SMALL BISON HERD UTILIZATION OF TALLGRASS PRAIRIE

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Abstract. The utilization of a tallgrass prairie remnant by a small bison (*Bison bison*) herd is described. Three bulls and six cows were introduced to a 257 ha section of Prairie State Park, Liberal, Missouri in 1985. Between 1985 and March 1988, ten calves were born; four cows and a bull were introduced to the herd in 1988. Since March 1986, the behavior of the herd has been observed three times per week, year-round. The portion of the herd using mowed fire breaks or burned or unburned portions was determined at ten-minute intervals; for 3,249 observations over 213 days. In addition, the daily location of the herd within the 257 ha was noted. The herd used fescue (*Festuca* spp.) areas during winter and native grass areas during summer. Individuals spent more time on mowed fire breaks than other areas, possibly because those areas have the most new shoots. Burned areas were also preferred, perhaps because fire reduced brambles (*Rubus* spp.) and ticks. The herd cut a few trails traversing ridges and created about 25 wallowing sites in areas adjacent to rubbing features. These had been sparsely vegetated before. At this time, there has been little noticeable effect of the herd on the prairie.

Key Words. bison, tallgrass prairie, burning, mowing, foraging, Missouri

INTRODUCTION

Since the Great Plains once supported millions of wild grazing animals, Larsen (1940) has suggested that the prairie ecosystem can only be understood by studying areas that are experiencing grazing pressure. Regrowth of burned prairie grasses is attractive to grazing livestock (Hobbs and Spowart 1984, Coppock and Detling 1986). However, few systematic studies have been conducted on how large native herbivores utilize prairie remnants (Glenn-Lewin and Landers 1978). In addition, McNaughton *et al.* (1982) cautioned against separating the plant-herbivore components and identified fire as an important interacting force. Edwards (1976) argued that knowledge of the effects of bison (*Bison bison*) on tallgrass prairie was limited by a lack of direct investigations. Data from domestic cattle, and from bison on shortgrass prairie, have led to conclusions that are misleading in a tallgrass context. Although bison are similar to cattle, cattle exhibit more selective foraging habits (Wentz 1978) and different social behavior (McHugh 1958, Shult 1972) which may affect area utilization. The data reported in this study were collected to describe the effect of burning and mowing treatments on the foraging patterns of bison on a prairie remnant at Prairie State Park and to help develop management strategies for this and other prairie remnants with bison herds.

METHODS

Study Site and Herd

Prairie State Park is a tallgrass prairie remnant near Liberal in the southwest corner of Missouri. The entire park is about 1,036 ha in size, divided by electric fences into three sections. The data reported here were collected while the bison were confined to one 257-ha section. The management plan of the park includes controlled burns at intervals of three years or less and mowing fence lines and fire breaks annually from July to November. A herd of six cows and three bulls was introduced to the park in 1985 from the U.S. Fish and Wildlife Service's Wichita Mountain herd. During 1985, 1986, and 1987, ten calves were born; during the winter of 1987-1988, four cows and one bull were brought from the Wichita Mountain herd. Ten calves were born in 1988, for a current total of 34 bison.

Data Collection

Since February 1986, the behavior of the herd has been observed three times per week, year-round. All of the data collection methods and some of the preliminary results were reported by Murdock and Larson (1986). The observations reported here were taken on 213 days between 1 April 1986 and 31 March 1988. Among the data recorded were the three management treatments (burned, mowed, or unburned and unmowed) on which individual herd members were located. These data were collected at 10-minute intervals and consisted of 3,249 samples whenever all herd members were visible. An area was classified as "burned" if it had been burned since the vernal equinox, in September.

RESULTS

Monthly Utilization

Table 1 shows a comparison of the management treatments and the difference between proportions of those utilized and available to the bison for each month of the two-year period. A highly significant difference occurred between the number of observations of the bison using the treatments compared to the number that would be expected given their availability $\chi^2 = 6154.4$, df = 46, $p < 0.005$, Chi Square Goodness of Fit Test). During July 1986 and June and July 1987, the bison used the burned treatment in greater proportion than it was available. The herd used the mowed treatment in greater proportion than its availability at all times, except during June and July 1987. The peak of mowed treatment use occurred during August in both 1986 and 1987. At that time of year, the mowed portions are usually freshly mowed. Both years, the herd used the unmowed and unburned treatment most between October and February.

Two-year Utilization

The data for the two-year period accounted for changes in the number of individuals in the herd and variation in numbers of observations taken each month. The proportion of burned, mowed, and unburned and unmowed area available at all times was also averaged over the entire two year period. The observed average proportion of each treatment used by the herd, and the estimated average proportion of each treatment that existed for its use are shown in Figure 1. If the herd did not have specific preferences for particular categories, it would be expected to use the category in proportion to its availability. Little difference occurs between the observed use of burned grass and its expected use. However, the herd used the unburned and unmowed grass much less than expected, and the mowed grass much more than expected (Figure 1).

The bison used unmowed and unburned areas most from October to February of both years of the study. During these periods, they preferred the one area with a mixture of fescue (*Festuca* spp.) and native grasses.

Table 1. Monthly differences between proportions of management treatments utilized and available to bison. Positive values indicate utilized proportion > available proportion. Negative values indicate utilized proportion < available proportion. Zero indicates that there was no proportion available.

Month and Year	*Treatment*		
	Burned	*Unburned-Unmowed*	*Mowed*
1986			
April	.144	-.342	.198
May	.129	-.176	.047
June	-.052	.012	.040
July	.344	-.393	.049
August	-.321	-.274	.595
September	.113	-.270	.157
October	0	.300	.252
November	0	-.265	.265
December	0	-.104	.134
1987			
January	0	-.020	.050
February	0	-.007	.023
March	-.320	-.060	.380
April	-.056	-.149	.205
May	.246	-.252	.006
June	.555	-.524	-.031
July	.536	-.503	-.033
August	-.235	-.320	.555
September	-.269	-.177	.446
October	-.435	.017	.418
November	0	-.221	.221
December	0	-.397	.397
1988			
January	-.143	.061	.082
February	-.218	.183	.035
March	-.062	-.065	.127

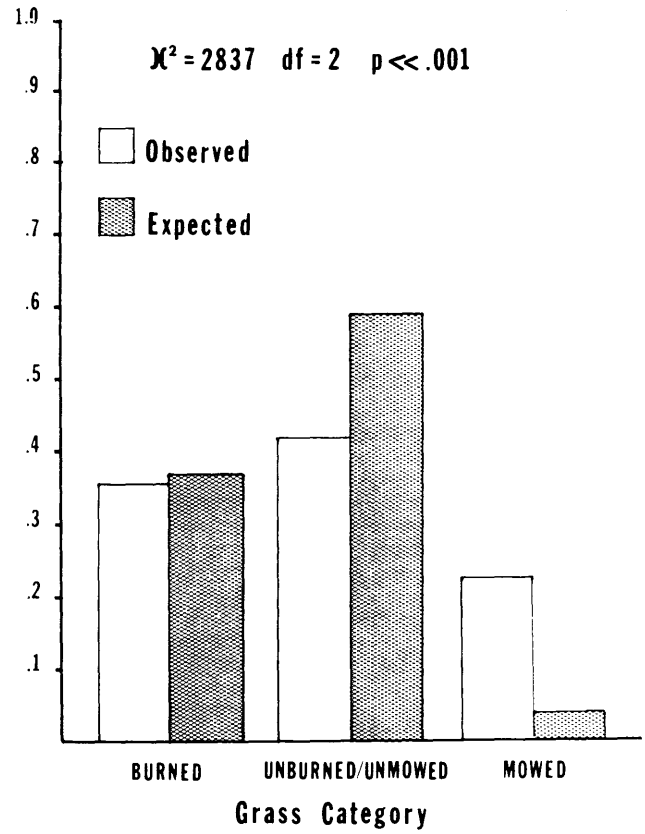

FIG. 1. Overall proportions of burned, mowed, and unburned and unmowed treatments utilized of that available to bison.

DISCUSSION

The bison definitely preferred to graze on new, fresh shoots, as also reported by Coppock and Detling (1986). This probably accounts for their preference for burned areas in early summer and mowed areas all year. After rain, fresh shoots appear in the mowed areas almost year-round. As a cool-season species, fescue is more likely than the native warm-season grasses to have fresh shoots at this time. Burned areas are relatively free of brambles (*Rubus* spp.) and dried grass from the previous year. This probably accounts for the herd's preference for these areas in early summer. But, after July of each year, the grass in the large burned areas probably grew too quickly and became too rank for the bison to select for grazing.

In May 1988, the herd was moved into another section of the park, all of which had been burned in the previous month. This allowed observation on the short-term use of the bison on a new section and to observe the old section's recovery from bison use. The impact of bison wallows has been investigated for example, by Polley and Collins (1984). They found that plants in old wallows were primarily mesic prairie species which are adapted to extremes of desiccation and moisture. In 1988, Prairie State Park was particularly dry during the month of June. The old wallows did have grass coming up consistently all over the wallow, although the grass was taller at the edges. The herd created several wallowing sites in the new section, the largest around the salt block.

Bison did use trees and smaller saplings on which to rub but, contrary to Edwards (1976), individuals only occasionally browsed on woody vegetation. However, as noted by Edwards (1976) the bison at Prairie State Park selected certain vegetation types (i.e. grass species) over others and showed seasonal variation in their use of vegetation.

In the first two months, the herd cut several distinct trails, of which two led from a salt block or a pond. In the section to which the herd had previously been confined, trails tended to traverse the ridges.

It is clear that by controlling the location of mowed and burned areas and areas with stands of fescue mixed with native species, the location of bison herds could be controlled to meet additional management concerns. In parks where the public and bison share space, there could thus be greater control over their interactions.

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