



Habitat use and distribution of bison in Theodore Roosevelt National Park
by Jack Eugene Norland

A thesis submitted in partial fulfillment of the requirements for the degree Master of Science in Range Science

Montana State University

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Abstract:

This study described the habitat use and distribution of bison in Theodore Roosevelt National Park. Data was collected by direct observation of bison herds and by use of fecal transects. Additional data was collected through the use of 4 marked bison cows. Both percent use from direct observation and the fecal transect index gave comparable estimates of habitat use. The close agreement meant that habitat use observed in 1982-83 was not different from the previous years, and absence of mature bulls in the direct observations did not effect use patterns. Flat grasslands were preferred with use higher than availability would indicate. Areas of rugged terrain or dominated by trees and shrubs were avoided with use lower than availability. Habitat use changed over time with levels of use varying widely in some habitats.

Home ranges of individuals and the overall distribution were very similar. Virtually the whole park was used by bison, with few areas avoided. Restricted distribution was found during certain parts of the year. Herds were uniformly distributed during a 15 day period in the immediate area of use. Grazing activity was significantly different over the habitat types in the park, but not over a more generalized land classification scheme. Resting and other activities were significantly different over the habitats. Grazing and other activities had significantly different levels over time. Daily activities had a crepuscular pattern with grazing being the deterministic factor. Bison -moved 1.65 kilometers per day which did not significantly differ over time. Bison daily changed sites of use and habitats. The second and third weeks after initial location the distances moved by bison individuals from the initial location were in a random pattern.

The combined results characterize the bison as a nomadic animal which had preferences for habitats and localities. Bison are very similar to other large, herding bovids which inhabit grasslands.

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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

This study described the habitat use and distribution of bison in Theodore Roosevelt National Park. Data was collected by direct observation of bison herds and by use of fecal transects. Additional data was collected through the use of 4 marked bison cows. Both percent use from direct observation and the fecal transect index gave comparable estimates of habitat use. The close agreement meant that habitat use observed in 1982-83 was not different from the previous years, and absence of mature bulls in the direct observations did not effect use patterns. Flat grasslands were preferred with use higher than availability would indicate. Areas of rugged terrain or dominated by trees and shrubs were avoided with use lower than availability. Habitat use changed over time with levels of use varying widely in some habitats.

Home ranges of individuals and the overall distribution were very similar. Virtually the whole park was used by bison, with few areas avoided. Restricted distribution was found during certain parts of the year. Herds were uniformly distributed during a 15 day period in the immediate area of use. Grazing activity was significantly different over the habitat types in the park, but not over a more generalized land classification scheme. Resting and other activities were significantly different over the habitats. Grazing and other activities had significantly different levels over time. Daily activities had a crepuscular pattern with grazing being the deterministic factor. Bison moved 1.65 kilometers per day which did not significantly differ over time. Bison daily changed sites of use and habitats. The second and third weeks after initial location the distances moved by bison individuals from the initial location were in a random pattern.

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INTRODUCTION

Knowledge of the habitat use and distribution of an animal is essential to understanding its ecology and management. Because the American bison has declined from millions of animals freely roaming the grasslands of North America to small populations restricted to a fraction of their former range, much of the historical information does not apply to the bison's current situation (Reynolds et al. 1982). New studies are needed to redefine how bison use their present habitats.

This study specifically looked at a population of bison in Theodore Roosevelt National Park (TRNP), North Dakota. The objectives were to describe the habitat use and distribution of bison in the park, in order to define the spatial and temporal use of the available resources in the park. This study was done in conjunction with a larger study meant to determine carrying capacities of bison in the park (Marlow et al. 1984).

LITERATURE REVIEW

The American bison (Bison bison) has been present on the North American continent since its evolution 4,000-5,000 before present (McDonald 1981). The bison is believed to have originated on the Northern Great Plains and from there radiated to other provinces. At the time of contact with western man, bison were distributed from the foothills of the Appalachian Mountains to the Great Basin and from the boreal forests of northwest Canada south to northern Mexico. The original environment of the bison was characterized by wide open spaces covered by large grasslands. Eventually, the bison did adapt to habitats dominated by forests and shrublands.

Before the changes brought by western civilization bison were characterized as highly mobile animals utilizing large land areas during the year (Garretson 1938, Larson 1940, Roe 1970, and Dary 1974). Bison preferred grasslands, and their diets were made up mostly of graminoid species. How the bison influenced its environment has been debated for years. Weaver and Clements (1938) stated that the plant communities in the grasslands were influenced primarily by climate and soils, and bison affected only short term changes. Larson (1940) and Malin (1956) felt that bison were a major influence keeping the grassland in a disclimax.

The bison's environment has undergone many changes since the coming of western civilization. The vast original grasslands have been fragmented leaving only small tracts of grassland in which the bison can live. Since the great slaughter of the herds almost all

bison have been managed as captive animals with only Yellowstone National Park and Wood Buffalo National Park having herds descended from and resembling wild animals (Reynolds et al. 1982).

Several recent studies have investigated the bison in their present situation. Popp (1981), working in Wind Cave National Park, reported that bison chose grasslands for the majority of use, and forested areas were only used as travel corridors. Sites dominated by cool season grasses tended to be preferred in the spring and early summer by the cow herds while warm season grass sites were preferred in the mid and late summer. The cool season sites were again preferred in the fall. Bull groups had different usage patterns with the warm season sites being preferred throughout the year. Also, forest openings were used more often by the bull groups. Prairie dog towns received heavy use during the rut (midsummer to early fall). The largest herds found in the park were on the prairie dog towns during the rut.

Coppock et al. (1983), working in Wind Cave, reported specifically on bison use of prairie dog towns. They found a definite selection for prairie dog towns during midsummer. Herds would use the most recently colonized areas for grazing while the older portions of the towns were used for other activities. This usage pattern was related to differences in vegetation structure and forage quality brought about by the herbivory of the prairie dogs.

In Utah Van Vuren (1979 and 1983), working with an isolated population of bison in the Henry Mountains, reported that bison differed from cattle in several respects. Bison tended to use habitats

farther away from water sources, steeper landforms, and higher elevations. Bison used habitats which were dominated by their preferred forage, grass and grasslike plants. Cattle avoided the same sites because of the distance from water, steepness, and elevation.

Van Vuren (1979 and 1983) additionally reported that bison were a highly mobile animal staying an average of 1.9 days at a site but rarely longer than 3 days. The changes in bison distribution during the study were attributed to seasonal and yearly differences in forage and weather patterns. The home ranges of several bison cows overlapped with the average size being 52 square kilometers (km^2). Herds tended to include 15 individuals or fewer, but the size of herds was positively correlated with the size of forest openings. Social structure of the herds and the association of individuals was described as fluid.

Lott and Minta (1983) reported on group stability and individual associations of bison cows on Santa Catalina Island, California. They reported that mature cows associated in a random pattern, and the only close association reported was between cows and calves. The cow-calf association eventually became random after calves reached ages of 8-19 months. Herd size did not follow a random pattern but was influenced by environmental factors. Some of the environmental factors mentioned were watering locations, topography, forage quality and phenology, and social interactions such as the rut. Home ranges for cows averaged 56.1 km^2 with portions of all home ranges overlapping. Movement of individuals in a straight line averaged 2.8 kilometer (km) per day. This did not change significantly over the seasons but did increase

somewhat during the rut. The authors characterized the bison as a highly mobile animal, with similar home ranges, and being driven individually by environmental rather than social factors.

Several authors have described habitat use by bison in Wood Buffalo (Soper 1941, Reynolds et al. 1982) and Yellowstone National Parks (McHugh 1958, Meagher 1973). Both parks are dominated by forests although bison almost exclusively choose areas dominated by graminoids. The distribution of the grasslands limited the range of bison in the parks. Although other habitats and locations were chosen during the year, this was thought to be related to snow depths and local climatic conditions.

McHugh (1958) investigated the behavior of bison herds in Yellowstone National Park and several other locations. He reported that the home range for Yellowstone National Park bison was approximately 31 km² in the summer and 93 km² in the winter. Movement of bison in the Wichita Mountains National Wildlife Refuge averaged 3.4 km per day and this daily movement was common to all the herds. He observed bison going to water only once a day.

Peden et al. (1974), working with cattle and bison in northeast Colorado, reported that bison used uplands more than cattle. Cattle were found more often in the drainageways. Schwartz and Ellis(1983), working in the same area, reported that bison were selecting for the most abundant forage the dominant grasses. They theorized that bison, because of their large size and energy needs, would have to select for the most available forage in an area.

From the literature review it appears that the bison of today: 1) prefer grasslands, 2) will change habitat preference during the year, 3) have differences in habitat preferences between the sexes, 4) have large home ranges, 5) will utilize most all of the available habitat, 6) move constantly from site to site; and 7) have a fluid social structure with no long term associations. Differences in the home range sizes were related to the different sizes of available preferred habitat.

STUDY SITE

The entire study was conducted in Theodore Roosevelt National Park. The Park was created in 1978, but had previously been Theodore Roosevelt Memorial Park established in 1947. The Park is composed of two units, the North Unit (NU) and South Unit (SU) (Figures 1 and 2). The SU is 18,756 hectares in size and the NU 9,741 hectares in size. Both units are located in western North Dakota, the SU near Medora, North Dakota and the NU 80 kilometers (km) directly north. Bison were reintroduced into the Park in 1956.

The dominant features in both units are the Little Missouri River and the valley and badlands that it has formed. During the most recent glaciation the mouth of the Little Missouri River was lowered which accelerated the erosional forces in the soft sedimentary rock producing the badland formations found in the Park (Hansen et al. 1980). The past and ongoing erosion has produced a varied topography which results in a variety of vegetational communities in the Park.

Two different schemes were used to describe the land in the Park. One scheme involved dividing the units into physiographic/vegetational classes (from now on referred to as classes) based on appearance, landform origin, and the gross structure of the associated vegetation (trees, grasslands, shrubs, etc.). A total of 14 different physiographic/vegetational classes were identified. Seven classes were unique to one or the other units, while the others were present in both units (Table 1). Figures 3 and 4 indicate where in the units each class is found. A general description of each class follows:

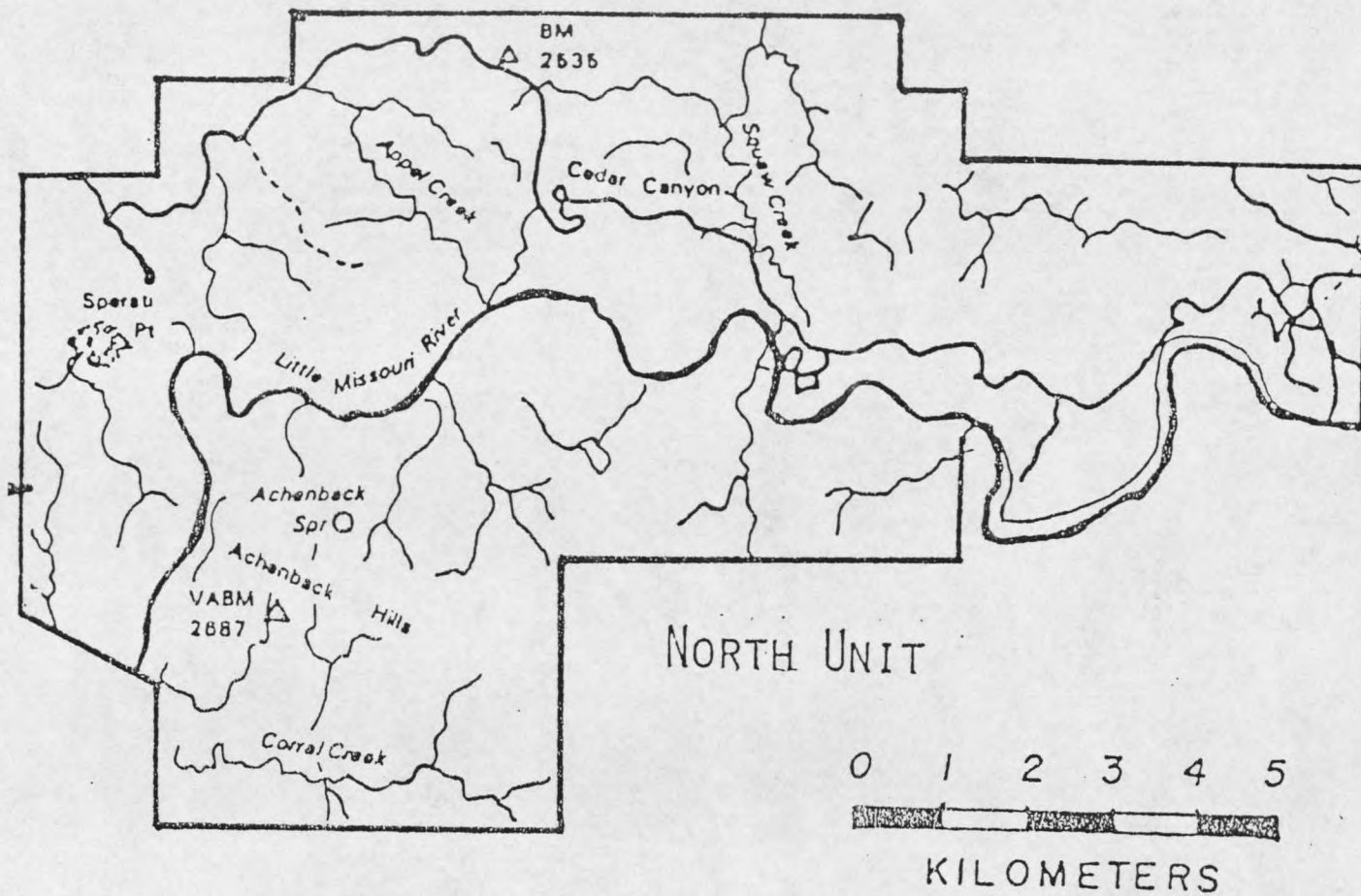


Figure 1. Map of North Unit, Theodore Roosevelt National Park.

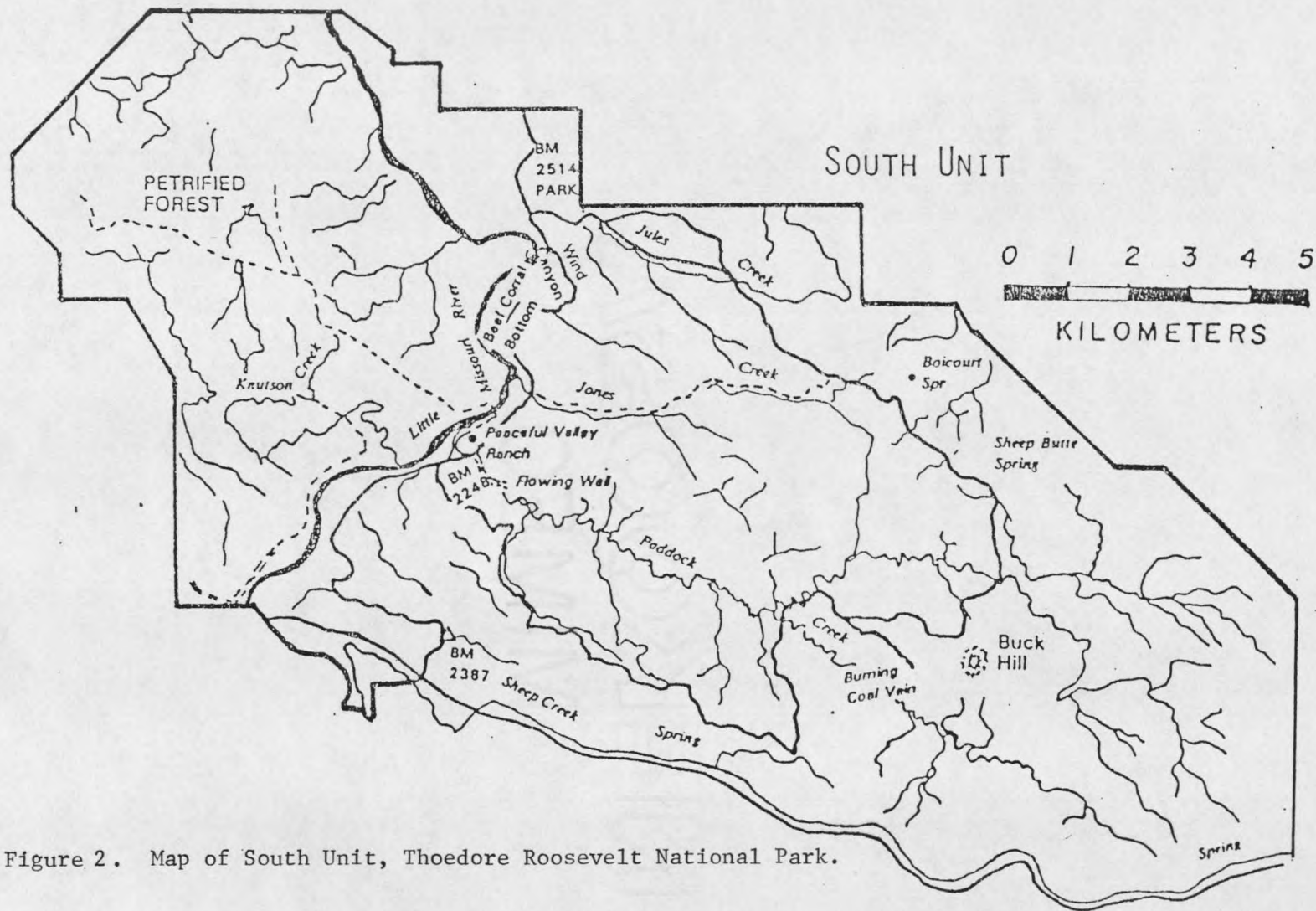


Figure 2. Map of South Unit, Theodore Roosevelt National Park.

