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David Terrall
Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, SD, USA

Jonathan Jenks
Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, SD, USA

Arthur Smith
South Dakota Department of Game, Fish and Parks, Pierre, SD, USA

USE OF NATURAL VEGETATIVE BARRIERS TO LIMIT EXPANSION OF BLACK-TAILED PRAIRIE DOG TOWNS.

DAVID F. TERRALL, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, SD, USA
JONATHAN A. JENKS, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, SD, USA
ARTHUR E. SMITH, South Dakota Department of Game, Fish and Parks, Pierre, SD, USA

***Abstract*:** Prairie dog (*Cynomys ludovicianus*) control has historically consisted of lethal methods to maintain, reduce, or eliminate populations in South Dakota and throughout the species range. Non-lethal methods of control are desired to meet changing management objectives for the black-tailed prairie dog. The use of naturally occurring buffer strips as vegetative barriers may be effective in limiting prairie dog town expansion. The objectives of this study were: 1) to evaluate effective width of vegetative barriers in limiting prairie dog towns expansion in western South Dakota; and 2) to document effect native vegetation height on expansion of prairie dog towns in western South Dakota. Five study sites were established in western South Dakota on rangelands containing prairie dog towns of adequate size. Electric fences were constructed for the purpose of excluding cattle and creating buffer strips of native grasses and shrubs. Prairie dogs were poisoned to create a prairie dog free buffer zone adjacent to active prairie dog towns. Grazing was allowed on both sides of the buffer strip. When grazing pressure was not sufficient, mowing was used to simulate grazing. Buffer strips were 100 meters long and 10, 25, and 40 meters in width. A zero meter control was included on all study sites. Quadrats (25) were randomly distributed throughout the buffer strips. Evaluation of study sites included visual obstruction, vegetation cover, vegetation frequency, vegetation height, and vegetation identification. Barrier penetration was evaluated by the presence of new active burrows behind vegetative barriers. Significant relationships were documented for both VOR and vegetation height. No significant difference was found between frequency of breakthroughs and buffer widths.

Key words: *Cynomys ludovicianus*, grazing, prairie dog, vegetative barriers

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INTRODUCTION

In 2000, the U. S. Fish and Wildlife Service designated the black-tailed prairie dog (*Cynomys ludovicianus*) a candidate species for listing as threatened (U. S. Fish and Wildlife Service 2000). This designation prompted South Dakota as well as other states and agencies to modify prairie dog management plans (Cooper and Gabriel 2005).

Prairie dog control has historically consisted of lethal methods to maintain, reduce, or eliminate populations in South Dakota and throughout the range of the species (Schenbeck 1982, Boddicker 1983, Uresk et al. 1987, Knowles 1988, Hanson 1988, 1993). Non-lethal methods of control are needed to meet changing management objectives for the black-tailed prairie dog. These objectives include long-term, self-sustaining populations of prairie dogs while reducing landowner conflicts (Cooper and Gabriel 2005). Development of non-lethal control methods is increasingly necessary for areas such as preserves and national parks were lethal methods are not allowed or limited in use.

Anecdotal observations indicate the use of native vegetation buffer strips barriers may be effective in limiting prairie dog expansion. However, no information exists on use and success rate of this technique. The objectives of this study were: 1) to evaluate effective width of vegetative barriers in limiting prairie dog towns expansion in western South Dakota; 2) to document effect of height of native vegetation on expansion of prairie dog towns in western South Dakota. Knowledge gained in this study will supplement existing non-lethal methods for managing prairie dogs.

METHODS

Five study sites were selected in western South Dakota on rangelands containing prairie dog towns ≥ 10-ha. Electric fences were constructed for the purpose of excluding cattle and creating buffer strips of native grasses and shrubs. At the beginning of the study, prairie dogs were poisoned to create a prairie dog free buffer zone adjacent to active prairie dog towns. Grazing was allowed on both sides of the buffer strips. This created strips of naturally occurring vegetation between an area that contained both grazing and prairie dogs and an area with grazing only (Figure 1). Buffer strips were 100 meters long and 10, 25, and 40 meters in width. A zero meter control was included on all study sites.

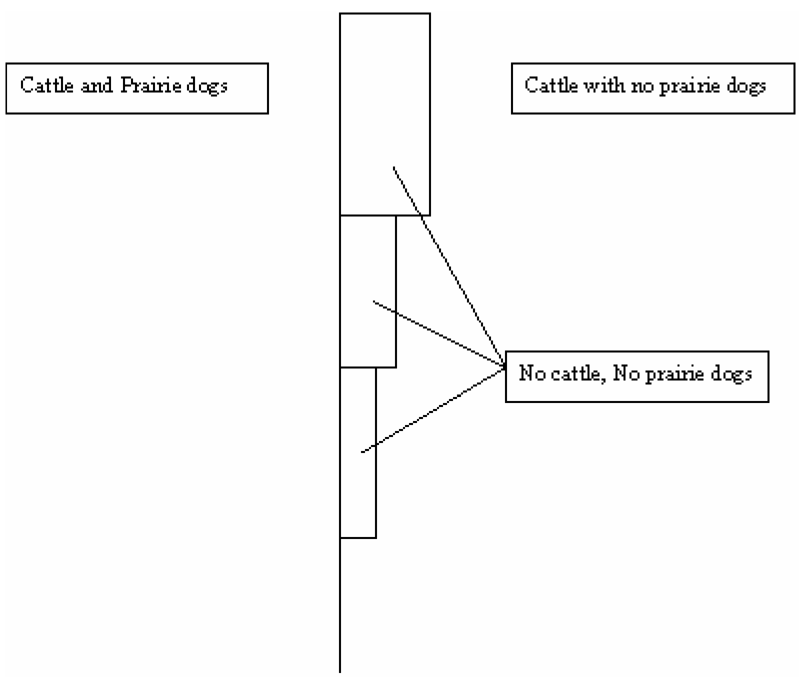

Figure 1. Schematic of buffer strips used to reduce prairie dog town expansion for five study sites in western South Dakota.

Initial poisoning efforts took place in the spring prior to the first emergence of young prairie dogs. Aluminum phosphide (Weevel-cide, United Phosphorus Inc., Trenton, NJ) fumigant tablets (60% concentration) were used for the initial spring application. The treatment was applied by placing two to three tablets into all open burrow entrances, then sealing the burrows with sod or dirt. Fumigants, such as aluminum phosphide are the only poisoning methods approved for controlling prairie dogs in South Dakota during spring. Follow-up applications were conducted to establish a prairie dog free buffer.

Evaluation of vegetation on study sites included visual obstruction (0.2 dm), vegetation cover (%), vegetation frequency, vegetation height (cm), and vegetation identification. Twenty-five quadrats were randomly distributed throughout buffer strips. Three transect lines were established to facilitate the random distribution of quadrats. Transects extended the length of the buffer strip and were equally spaced at the 25, 50, and 75% positions across the width of buffer strips. Transects were separated into 1-m increments to establish possible quadrat locations. End points of transects were eliminated to reduce the effect of the buffer edge. Twenty-five non-consecutive points along the total length of transects were randomly chosen for evaluation. Visual obstruction was measured at each quadrat site using a modified Robel pole method (Robel et al. 1970). An observer records the length vegetation obscures the ple to the nearest 20cm. Measurements were taken from the four cardinal directions at a distance of 4 m and a height of 1 m with the average of the four observations recorded (Robel et al. 1970). Cover and frequency measurements for grasses, forbs, bare ground, and litter were estimated at sampling points as described by Daubenmire (1959). Quadrat size was 30 cm wide and 75 cm long. Modified cover classes were 0 (none present), 1 (trace-5%), 2 (5-25%), 3 (25-50%), 4 (50-75%), 5 (75-95%), and 6 (95-100%). Vegetation height was obtained for each of the sampling points using a clear 30-cm disc lowered until the bottom side of the disc was first touched by leafy vegetation (Higgins and Barker 1982). Vegetation identification followed that of Johnson and Larson (1999). Barrier penetration was evaluated documenting frequency of new active burrows behind vegetative buffers. Non-linear regression models and ANOVA were used to analyze vegetation characteristics. Chi-square analysis was used to analyze the characteristics of buffer strip widths.

RESULTS

The relationship between prairie dog breakthroughs and VOR and vegetation height were modeled using negative binomial models. Significant relationships were documented for both VOR (Figure 2) and vegetation height (Figure 3). The predictive model for VOR was Breakthrough = $e^{(4.289 - 0.596*VOR)}$ with a mean corrected r-square of 0.72 and standard error of 0.103. The predictive model for vegetation height was Breakthrough = $e^{(4.921 - 0.128*vegetation\ height)}$ with a mean corrected r-square of 0.68 and a standard error of 0.022. No significant difference (X^2=5.394, p=0.145) was found between frequency of breakthroughs and buffer widths (Table 1). Further, no difference was detected in grass cover (F=0.310, p=0.818), forb cover (F=0.226, p=0.877), litter cover (F=0.040, p=0.989), or bare ground (F=2.668, p=0.083) relative to buffer treatments (Table 1). Rainfall totals were derived from weather stations within 25 kilometers from study sites (Table 2).

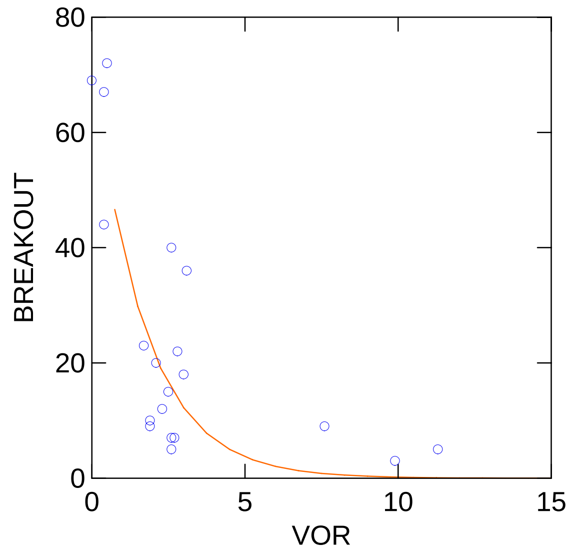

Figure 2. Non-linear model of Breakthroughs (Breakout) versus visual obstruction (VOR, [cm]) for five study sites in western South Dakota during August 2004.

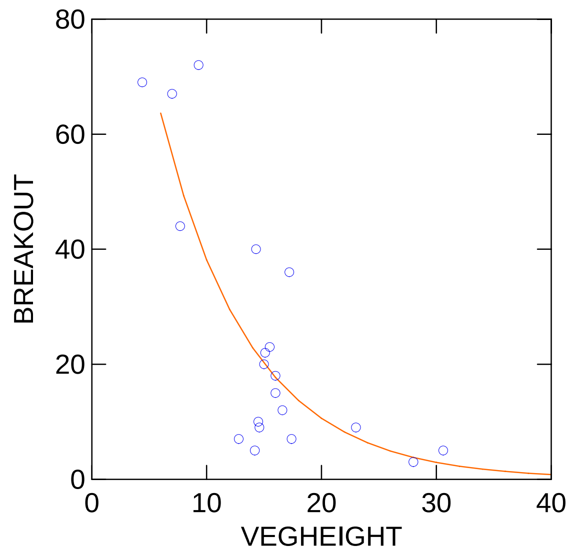

Figure 3. Non-linear model of breakthroughs (BREAKOUT) versus vegetation height (VEGHEIGHT, [cm]) for five study sites in western South Dakota during August 2004.

Table 1. Mean (SE) of vegetation characteristics measured from five study sites in western South Dakota, August 2004.

	Control	10m	25m	40m
Break through	28.6 (11.57)	23.4 (12.6)	25.0 (10.9)	21.6 (7.69)
VOR (cm)	1.78 (0.47)	3.42 (1.67)	3.1 (1.2)	4.1 (1.87)
Vegetation Height (cm)	12.76 (2.11)	17.36 (3.02)	14.58 (2.57)	17.1 (3.74)
Grass cover (%)	36.48 (11.72)	51.34 (10.99)	49.2 (14.48)	51.5 (14.04)
Forb cover (%)	11.66 (6.04)	6.62 (2.42)	9.8 (5.69)	12.1 (5.97)
Liter cover (%)	21.14 (6.70)	26.3 (12.70)	24.0 (13.07)	22.1 (12.16)
Bare ground (%)	30.68 (6.76)	15.76 (2.94)	17.0 (4.29)	14.26 (3.67)

Table 2. Total rainfall as registered by the nearest weather station within 25 kilometers of study site for growing season starting 1 April 2004 and ending 31 August 2004.

	Rainfall Total (cm)
Bad River Rd	22.04
Fort Pierre	23.34
Winner	32.99
Custer Cty	24.31
Fall River Cty	14.07

DISCUSSION

Breakthrough was minimized with 40-cm vegetation height and 10-cm VOR. Additional vegetation characteristics such as grass cover, forb cover, litter cover, and bare ground did not add significantly to models. Vegetation height had a lower mean corrected r-square, but also had a lower standard error. Vegetation height is easier and faster to measure than VOR in the field.

The U.S. Drought Monitor indicated extreme to severe drought conditions in western South Dakota during 2004. Drought in western South Dakota visibly reduced the vegetation productivity of the rangelands. Vegetation in these areas showed signs of reduced stature and drought stress, which may have contributed to the similarity in vegetative characteristics across buffer treatments. Patterns indicated a tendency towards a decrease in breakthroughs with increase in buffer width, but no significant differences were found. The 40-m buffer width was not adequate to stop prairie dog breakthroughs with the low VOR and vegetation height brought on by drought conditions in 2004.

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