

Effects of Fire and Mowing on Expansion of Reestablished Black-Tailed Prairie Dog Colonies in Chihuahuan Desert Grassland¹

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Introduction

Black-tailed prairie dogs (*Cynomys ludovicianus*) once ranged from Canada to Mexico throughout the Great Plains and west to Arizona. During the last 100 years, public and private control programs, plague, and habitat loss have reduced the distribution of black-tailed prairie dog populations by 98 percent, causing localized extinctions. This species is now considered uncommon or extirpated in many areas of its former range. Black-tailed prairie dogs significantly alter grassland ecosystems and are considered a “keystone” species that require active conservation efforts (Kotliar and others 1999). Conservation measures for this species, including reintroduction, are underway in a number of areas.

The best practical indicator of habitat suitability for reintroduction is visible evidence of previous prairie dog occupancy (Jacquart and others 1986, Ackers 1992, Truett and Savage 1998, Truett and others 2001a). Due to vegetation changes following the absence of prairie dogs from a site, vegetation manipulation is often required to provide reintroduced prairie dogs with suitable habitat (Truett and others 2001a). Woody plants (McDonald 1993) or tall grasses (Osborn and Allan 1949) that encumber vigilance behaviors for predators may require remedial actions to remove shrubs or reduce vegetation height (Player and Urness 1982, Truett and Savage 1998, Truett and others 2001a). Prairie dog colonies will not expand into areas where ocular vigilance is hampered. Dense vegetation greater than about 15 cm tall must be reduced in height so newly established colonies can survive and expand. Where mid- and tall grasses prevail, prairie dogs thrive mainly where fire, bison or cattle shorten the grasses by burning, or grazing and trampling (Truett and others 2001a).

Prior to the late 1800s, bison (*Bison bison*) coexisted with and helped sustain a diverse assemblage of animal and plant communities in grasslands, including black-tailed prairie dog colonies and associated species (Truett and others 2001b). Bison grazing historically reduced grass stature around prairie dog colonies. However, the system under which prairie dog-bison coevolved is largely absent. Under current

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conditions the grazing intensity is insufficient to remove mature vegetation (*fig. 1*). Grass mowing to simulate the effects of grazing has been used to facilitate expansion of reintroduced prairie dog colonies, but large-scale mowing is generally not cost-effective. Another alternative to grazing and mowing is prescribed fire. Fire is a natural disturbance that regulates ecological processes in southwestern grasslands (Ford 2000). Fire reduces the height of vegetation and attracts foraging bison for at least the first few years post burn (Shaw and Carter 1990, Vinton and others 1993, Hartnett and others 1996, Knapp and others 1999, Truett and others 2001b). Use of fire best simulates the system in which these species evolved and may provide a more cost-effective method to promote the expansion and vigor of reintroduced black-tailed prairie dog colonies.

We report on the preliminary results of an experimental study evaluating fire vs. mowing for facilitating expansion of reintroduced prairie dog colonies in the northern Chihuahuan Desert. Our objectives were to 1) find a cost-efficient management tool for enhancing habitats for prairie dog reintroduction, and 2) to understand the use of fire as a tool for managing colony expansion of black-tailed prairie dogs in Chihuahuan Desert grasslands. Our long-term goal is to use fire as a catalyst to help sustain a long-term dynamic between bison and prairie dogs. There is a documented pattern of bison grazing following fire. If this occurs, bison can be expected to concentrate on the burned areas for 3 to 4 years following fire. Once prairie dogs expand into the burned areas, they can, with the help of bison grazing, maintain their habitat at low stature (less than 15 cm tall) by trimming and eating the vegetation.



Figure 1—Black-tailed prairie dog, bison, and Chihuahuan Desert grassland, Armendaris Ranch, southern New Mexico.

Study Area

Our study was conducted on the Armendaris Land Grant located at the northern extent of the Chihuahuan Desert in southern New Mexico. The Armendaris Land Grant was purchased by Turner Enterprises, Inc., with the primary objective of producing bison (introduced in 1995), and promoting wildlife biodiversity. Efforts to restore black-tailed prairie dogs to previously occupied habitat on the ranch commenced in 1995. The site is located on deep mixed alluvium formed at the base of alluvial fans and adjacent flood plain. Soils are characterized as a Mimbres silt loam. Average annual precipitation ranges between 200 to 250 mm (SCS 1984) with most precipitation resulting from convectional storms during the summer growing season. Vegetation is dominated by a *Sporobolus/Pleuraphis/Scleropogon* grassland association.

Methods

Three experimental sites were established at the margins of three re-established prairie dog colonies on the Armendaris Ranch. These colonies, S-Curve (2 ha), Red Lake (8 ha), and Deep Well (1.27 ha), were established in 1998-1999. We established six to eight 50 x 50 m experimental plots (20 total) at the periphery of each colony. Burn or mowing treatments were randomly assigned to each plot, with treatments being conducted in early July 2001 just prior to the summer growing season. All burrows in each colony were georeferenced using Trimble®XXX geographical positioning system immediately preceding and four months after treatment with differentially corrected data mapped using ArcGis 3.2 software. Vegetation cover was sampled using five 20 m line intercept transects per plot before (June 2001) and after (October 2001) treatments were established.

Prior to establishing treatments prairie dogs were trapped at each colony. Each captured prairie dog was sexed and classified as juvenile or adult, morphometric measurements obtained, and examined for presence or absence of fleas. Further, each adult prairie dog was classified as breeding or non-breeding, based on the presence of descended testes in males and on evidence of lactation in females. Burrow data, vegetation data, and trapping data were analyzed using contingency table analyses, and Wilcoxon signed-rank and Chi-square tests. Because spatial coordinates were not recorded for prairie dog captures, these data could not be examined in relation to the treatments, but instead were analyzed with regard to possible differences in population structure among the three colonies.

Results

Numbers of newly established burrows in each treatment type within each of the three colonies were used as a measure of habitat suitability. Results indicate no significant difference ($P=0.59$) in the number of new burrows among treatments: burned (48 new burrows at Deep Well, 25 new burrows at Red Lake, 22 new burrows at S-Curve) vs. mowed (33 new burrows at Deep Well, 41 new burrows at Red Lake, 31 new burrows at S-Curve). However, there were strong differences among colonies in the total number of new burrows ($\chi^2=7.70$, D.F.=2, $P=0.021$): Deep Well 81, Red Lake 66, S-Curve 53.

There were statistically significant post-treatment increases in bare ground, litter and prairie dog feces for both burned and mowed plots (overall $\chi^2=5990.6$, D.F.=19, $P<0.001$). This pattern persisted when the three colonies were analyzed separately.

Table 1—Number of trapped prairie dogs classified by sex and breeding status (adults only) for each colony.

	Breeding		Non-breeding	
	females	males	females	males
Deep Well	15	11	4	3
Red Lake	5	7	5	2
S-Curve	16	8	4	10

Analysis of the number of trapped prairie dogs classified by sex and breeding status for each colony were not conclusive ($\chi^2=10.01$, D.F.=7, $P=0.188$). However, there were slightly more active-breeding females than males, active breeding individuals outnumbered non-breeders by about two to one, and the overall sex ratio

of trapped animals was slightly female-biased (*table 1*). There were differences in age and sex structure among the prairie dogs trapped at the three colonies ($\chi^2=18.49$, D.F.=6, $P=0.005$) (*table 2*); but these differences may be an artifact of our trapping protocol. Although we trapped intensively, we were not able to capture all colony members.

Table 2—Number of trapped prairie dogs classified by age (adult vs. juvenile) and sex, ignoring breeding status.

	Females		Males	
	Adult	Juvenile	Adult	Juvenile
Deep Well	19	14	14	23
Red Lake	11	6	9	8
S-Curve	20	0	18	7

Conclusion

In the short-term, fire and mowing appear to be equally effective in promoting colony expansion by black-tailed prairie dogs in Chihuahuan Desert grasslands. Based on our knowledge of the grazing behavior of large generalist herbivores, fire treated areas appeared more favorable to bison grazing than mowed areas. Fire may catalyze a self-sustaining interaction between bison and prairie dogs. Preferential bison grazing on burned areas may help to maintain post-fire reduced grass stature longer than mowing, thereby providing the potential for further colony expansion. However, persistence of these treatments and interaction will depend on prairie dog population dynamics and impact of treatments on the foraging dynamics of associated large ungulates.

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