Effects of Controlling Black-tailed Prairie Dogs on Plant Production

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Abstract

Plant production of 43 plant species was evaluated for three treatments after poisoning black-tailed prairie dogs *(Cynomys ludovicianus)* on rangelands in western South Dakota. The three pre-poison treatments were ungrazed (no cattle or prairie dogs), prairie dogs only, and cattle plus prairie dogs. Western wheatgrass *(Agropyron smithii)* had lower production on the prairie dog, and cattle-prairie dog treatments 4 years after prairie dog control, when compared with no grazing. Buffalograss *(Buchloe dactyloides)* showed a decrease in production on the cattle plus prairie dog grazing treatment, when compared to no grazing. Production of needleleaf sedge *(Carex eleocharis)* was lower on the cattle-prairie dog treatment, when compared to the prairie dog treatment. No other significant differences were observed over the 4-year period among the three treatments for all other species, including grass and forb categories. Prairie dog control did not increase plant production over a 4-year period. Additional time with reduced livestock grazing may be required to increase forage production.

The black-tailed prairie dog *(Cynomys ludovicianus)* has been considered a "pest" since the late 1800's, because of alleged competition for forage with cattle (Merriam 1902). Control of the black-tailed prairie dog has been considered necessary to increase forage production on rangelands. Although competition for forage between prairie dogs and cattle has not been fully assessed, Hansen and Gold (1977) reported a similarity index of 0.64 between diets of these two herbivores. Kelso (1939) stated that 76% of the plants consumed by prairie dogs were used by livestock as forage. Other dietary studies indicated that black-tailed prairie dogs ate mainly grasses, followed by forbs and shrubs (Tileston and Lechleitner 1966, Summers and Linder 1978, Fagerstone et al. 1981, Uresk 1984).

O'Meilia et al. (1982) found no differences in forb production between steers only or steer plus prairie dog treatments. However, less blue grama *(Bouteloua gracilis)*, and sand dropseed *(Sporobolus cryptandrus)* were available on the prairie dog pastures. Aboveground production of other grass species also were significantly reduced on pastures with prairie dogs. Other studies (Koford 1958, Taylor and Loftfield 1924, Osborn and Allan 1949, Bonham and Lerwick 1976, Potter 1980, and Coppock et al. 1983) have examined standing crop of plants or canopy cover on prairie dog towns being grazed by prairie dogs or prairie dogs with another large herbivore, or have examined plants on abandoned prairie dog towns. Little information is presently available for vegetation response on grazed areas after prairie dog poisoning on western rangelands. The purpose of this study was to determine if plant production under cages increased after removal of black-tailed prairie dogs on areas grazed by prairie dogs only, cattle plus prairie dogs, and an ungrazed treatment.

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Study Area and Methods

The study was conducted in Conata Basin, approximately 29 km south of Wall, S. Dak. over a 5-year period. The climate is semiarid-continental and is characterized by cold winters and warm summers. The mean temperature is 10°C, ranging from -5°C in January to 26°C in July. Average annual precipitation is 39.7 cm, based on 20 years of climatological information from Badlands National Park, Cedar Pass Visitor Center weather station, 21 km from the study area. Most of the precipitation falls as rain during the growing season (April–September). Yearly effective precipitation (October 1 to September 30) for the 5 study years (1978–1983) was 38.3, 27.7, 42.9, 58.6, and 46.3 cm, respectively.

The dominant grasses in Conata Basin are blue grama, buffalograss *(Buchloe dactyloides)*, needleleaf sedge *(Carex eleocharis)*, and western wheatgrass *(Agropyron smithii)*. Dominant forbs are scarlet globemallow *(Sphaeralcea coccinea)*, prostrate vervain *(Verbena bracteata)*, buckhorn *(Plantago spinulosa)*, and dogweed *(Dyssodia papposa)*.

The rangeland in Conata Basin was grazed by both cattle and black-tailed prairie dogs before this study. Cattle grazed the area from mid-May to the end of October of each year. Stocking levels varied depending upon moisture and available forage. Three treatments were established in 1974 (on areas previously grazed by both cattle and prairie dogs): (1) ungrazed (no prairie dogs or cattle), (2) prairie dogs grazing only, and (3) cattle - prairie dogs grazing (Uresk and Bjugstad 1983). These treatments were operating from the beginning of the grazing season in 1975 until prairie dog poisoning in 1979. Prairie dogs were poisoned in September 1979 with zinc phosphide-treated oats (Schenbeck 1982). After 1979, there was no grazing by prairie dogs on the treatments, but cattle continued to graze (treatment 3) during this period.

A set of 3 treatment plots were established on 3 different sites on an area approximately 1700 ha. Each treatment plot was 0.4 ha and located adjacent to the other plots. Sites were spaced about 1.6 km apart. Five cages 1.2 × 2.4 m were randomly established on each treatment plot to obtain production data. All cages were moved to

Table 1. Treatment differences in production (kg/ha) of important plant species. Data were adjusted for pre-treatment measurements (1979). Pretreatment data were subtracted from 1980 (1st year) and 1983 (4th year) for individual replicates to obtain differences associated with treatments.

Plant	Time since poisoning	Production $\bar{x} \pm SE$		
		No grazing	Prairie dogs[1]	Cattle-prairie dogs[1]
Western wheatgrass	1	−14 ± 22	−27 ± 19	−69 ± 49
(Agropyron smithii)	4	67 ± 20[a2]	−28 ± 45[b]	−73 ± 63[b]
Buffalograss	1	−14 ± 117	−148 ± 119	−196 ± 170
(Buchloe dactyloides)	4	316 ± 32[a]	742 ± 767[ab]	−19 ± 29[b]
Needleleaf sedge	1	−59 ± 15	−47 ± 24	−54 ± 12
(Carex eleocharis)	4	−102 ± 32[ab]	−68 ± 7[a]	−87 ± 5[b]

[1]Prairie dogs were poisoned on these treatments during September 1979.
[2]Means followed by the same letter superscript were not significantly different ($P>0.20$) by row. See text for actual probability values.

a new location at random each spring, before plant growth began; plots were clipped during late July and early August. Plants were harvested at ground level from two quadrats of 31 × 61 cm randomly located under each cage. All plants were oven dried at 60° C for 48 hours and were weighed to the nearest 0.1 gram. Weights for each treatment were expressed as mean kg/ha by replicate for analyses. Vegetation was sampled in 1979 (before poisoning), 1980 and 1983.

Profile analysis was used to estimate the significance of change due to treatment (Morrison 1967). In this analysis, significant treatment effects are indicated if treatment profiles (i.e., change from 1 year to another) are not parallel. Analysis does not assume equal response levels in pre-treatment year (1979), but does assume amount of change is not effected by differential pre-treatment conditions. Because of large annual variability, separate analyses were computed for the two post-treatment measurement years, 1980 and 1983. The treatment profiles were estimated by subtracting each of the post treatment years, 1980 and 1983, from pretreatment year 1979, and parallelism of profiles was tested using a one-way analysis of variance (Hull and Nie 1981). If differences among treatment profiles were indicated by the analysis of variance, the F-protected LSD was used to compare pairs of profile (Carmer and Swanson 1973). Type I error level at $\alpha = 0.20$ was adapted for all tests.

Results

Three plant species showed a significant response in production over the 4-year period after control of black-tailed prairie dogs (Table 1). Western wheatgrass did not show any differences among the treatments during the first year after prairie dog control. Production of western wheatgrass was lower ($P<0.20$) after 4 years on the prairie dog treatment and cattle-prairie dog treatment ($P<0.08$), when compared with no grazing. No grazing had the greatest positive change in production of western wheatgrass during the fourth year, while the other treatments had less. However, there were no differences in production between prairie dogs and cattle-prairie dog treatment.

Buffalograss showed no response among treatments during the first year after prairie dog control (Table 1). Production on the cattle-prairie dog grazing treatment decreased, compared to no grazing during the fourth year ($P<0.02$). No differences with buffalograss production were found between the prairie dog treatment and no grazing, or between prairie dog and cattle-prairie dog treatments.

Production estimates for needleleaf sedge showed no effects due to prairie dog removal during the first year (Table 1). However, by the fourth year, production was lower on the cattle-prairie dog treatment, compared to the prairie dog only treatment ($P<0.07$). Production estimates were similar on the no grazing and prairie dog grazing treatments ($P>0.20$), and between no grazing and cattle-prairie dog treatments.

A total of 40 other plant species (10 grasses and 30 forbs) was analyzed, among treatments with no significant effects ($P>0.20$). Other grasses and forbs were also examined; but no differences were found over the 4-year period ($P>0.20$) among treatments. The minor plant species were highly variable, showing no effects due to treatments.

Discussion

Controlling black-tailed prairie dogs on rangelands in western South Dakota did not result in a positive increase in forage production after 4 years. Western wheatgrass production was the same on both prairie dog and cattle-prairie dog treatments, indicating that control of prairie dogs without cattle and with cattle grazing did not affect production of this species over a 4-year period. Buffalograss showed a decrease in production when cattle were allowed to graze the area after prairie dogs were removed. Needleleaf sedge was lower in production estimates on the cattle-prairie dog treatment from the prairie dog only, indicating that response is slower when grazed by cattle when prairie dogs are removed. All other plants on the treatments did not show a response to poisoning of prairie dogs. Other grasses and forbs, as groups, did not show a response over the 4-year period.

No grazing had higher production for western wheatgrass and buffalograss, indicating that total exclusion from herbivores for 9 years or more may be required to increase forage production for all treatments when the range is in a low condition class (Uresk and Bjugstad 1983). In general, controlling prairie dogs did not increase forage produced, whether or not cattle were allowed to graze. The results indicated that more than 4 years of reduced prairie dog densities may be required to obtain an increase in forage production.

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