# WALL RANGER DISTRICT
# BOUNDARY MANAGEMENT ZONE
# 2007 MONITORING REPORT

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## INTRODUCTION

The 2005 Boundary Management Zone (BMZ) prairie dog amendment (USDA, Forest Service 2005) was developed in response to unwanted prairie dog expansion onto private lands from adjoining National Grasslands. As part of the decision, BMZs were established at ≤ ½ mile adjacent to private land on Buffalo Gap National Grassland. The amendment makes it clear that an adaptive management approach will be taken to reduce unwanted colonization onto private lands. Some of the tools the Forest Service can use to address BMZ complaint issues consist of expanded rodenticide use, vegetation management through livestock grazing adjustments and visual/physical barriers to slow down prairie dog expansion. One key aspect to adaptive management is monitoring. In order to guide current and future management, one needs to know whether the current practice is working, failing or simply needs a slight adjustment to get better results. The Wall Ranger District uses a number of management tools to address BMZ issues. In this report, the District provides a detailed analysis of past and current BMZ management actions including rodenticide treatments, fencing and vegetative response to different grazing and rodenticide treatments.

## RODENTICIDE TREATMENT

Rodenticide treatment within the Wall Ranger District BMZ has taken place since fall of 2004. The Wall Ranger District uses a simple decision-tree to verify each complaint, and determine if it meets the criteria of whether or not prairie dog encroachment is imminent within 1-2 years (Figure 1). The treatment process is as follows: (1) Private landowner files an official complaint with the State of South Dakota that they are being encroached upon from Forest Service land, (2) District personnel then visit each site to verify complaint, (3) If complaint is valid, District personnel GPS colony to be treated, (4) District creates map of colonies to be treated and associated acres of each colony, coordinate with the poisoning contractor and sets-up treatment schedule, (5) District personnel then accompany contractor through the treatment process.

This year we treated a total of 5,015 acres on the District, which is 2,825 acres less than last year (Table 1). The main reason for the decline is that the colonies within the BMZ that have been repeatedly treated over the last four years have either declined in size or completely disappeared. Additionally, we received fewer complaints this year than in the past. Within the BMZ, colonies that are isolated and completely fall within the ½ mile zone are at very low densities and small in size, or in some cases, have been totally eliminated from past poisoning (i.e. ~5 colonies). The primary management challenge is with those colonies in which only a portion of the colony falls within the BMZ, and thus, there is a nearby prairie dog source that can move back into the treated area. Post-treatment surveys conducted this winter indicated a significant difference between colonies partially treated vs. those completely treated in terms of prairie dogs observed. The mean number of prairie dogs observed post-treatment in partially treated colonies was 5.2 (n = 23, SD = 4.6) compared to a mean of 0.4 (n = 56, SD = 0.9) in completely treated colonies ($t_{77}$ = -7.5, $P < 0.0001$). However, even these partially treated sites are showing low prairie dog density and higher vegetative structure (refer to the vegetation monitoring section) compared to non-treated areas. These sites typically have small pockets (i.e., 2-8 active burrows) of prairie dogs scattered about and intermixed with taller vegetation again when compared to the rest of the non-poisoned prairie dog colony (Figure 2).

Although minor, there are a few distinct locations where it could be argued that prairie dogs are actually encroaching into the BMZ from private land, especially where vegetation management through fencing and rest from cattle grazing is taking place. It is highly unlikely prairie dogs are moving almost a ½ mile through tall vegetation in the BMZ and establishing themselves when right across the fence on the private side there are also prairie dogs on more desirable habitat (i.e., short-structure grass and active cattle grazing) (Figure 3). The prairie dogs on the private side of the fence are being treated, but zinc phosphide is not 100% effective and kill-rate can vary according to who applies it and time of year, which are outside our control and knowledge.

**Figure 1.** Wall Ranger District decision matrix for BMZ prairie dog colony rodenticide treatment.

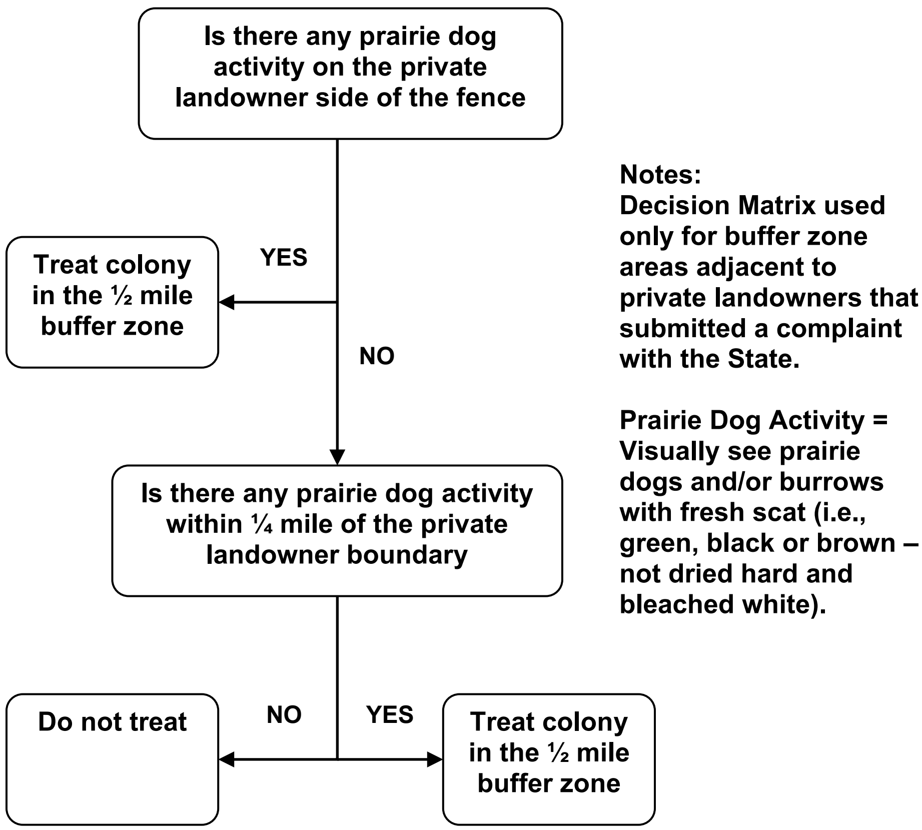
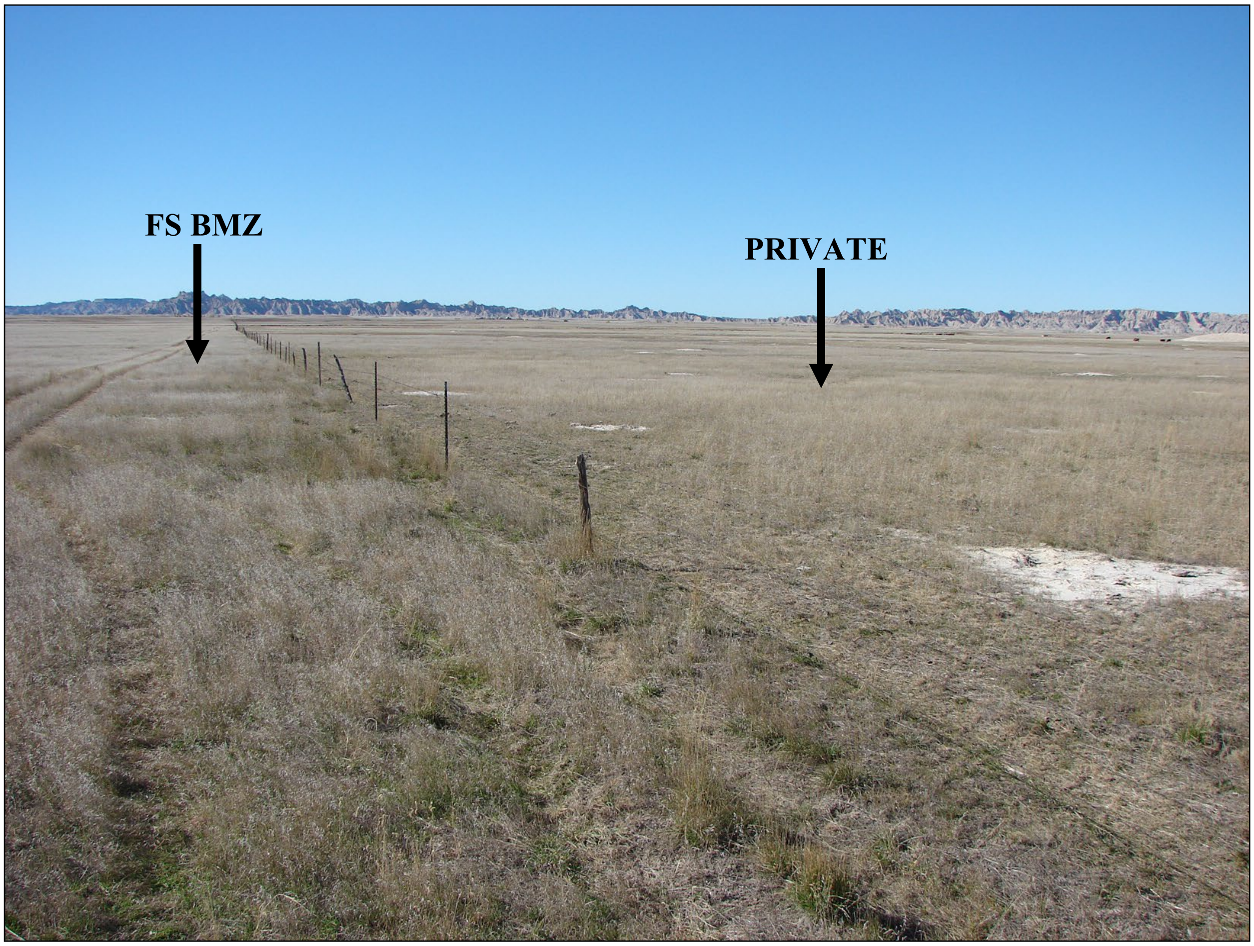



**Table 1.** Prairie Dog control on the Wall Ranger District by Geographic Area (GA) in the fall and winter of 2004-2007.

| Geographic Area | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Wall North | 60 | 497 | 940 | 466 |
| Wall SE | 237 | 950 | 1370 | 908 |
| Wall SW | 0 | 0 | 279 | 36 |
| Wall SW: Conata Basin MA 3.63 | 3196 | 2184 | 5251 | 3605 |
| **TOTAL** | 3493 | 3631 | 7840 | 5015 |

**Figure 2.** Example of prairie dog activity in treated Conata Basin BMZ. These particular areas are part of a larger colony in which only a portion gets treated. The rest of the colony is located outside the ½ mile buffer zone.

**Figure 3.** Prairie dog activity on private land and an adjacent Forest Service BMZ treated site in the Conata Basin.




**FENCING**

Temporary electric fence was built on a number of BMZ sites on the Wall Ranger District in 2007 (Figure 4). The goal of the fencing was to keep cattle from grazing in the ½ mile buffer zone and to subsequently increase vegetative structure to deter prairie dog encroachment. A total of 10 fences were built totaling 13.23 miles. Additionally, two other existing barbed wire fences were simply used to keep cattle from grazing those particular BMZ sites. Thus, there were 12 distinct BMZ sites deferred from grazing in 2007 totaling 3,765 acres; the majority of this acreage was located in the Conata Basin (N = 9, acres = 2,787).

**Figure 4.** Electric fence in the BMZ

This is a significant increase over the two electric fences built and 1,161 acres deferred in 2006.

## VEGETATION MONITORING

The goal for vegetation monitoring in the BMZ was to look at the vegetative response in regards to structure and percent canopy cover by major vegetative group. We compared three treatment groups: (1) **Controlled and Fenced (CF)** – these sites have been treated with rodenticide the last 3-4 years and were fenced-off from grazing this year, (2) **Controlled and Not Fenced (CNF)** – these sites were treated with rodenticide the last 3-4 years but were not fenced, cattle grazing did occur this year, and (3) **No Control and No Fence (NCNF)** – these sites are just outside the BMZ and have not been poisoned or fenced-off, grazing did occur this year. We sampled from three different areas in the Conata Basin: Upper Sage, Lower Sage and Agate East. Thus, each area contained all three treatment types and there were two transects per treatment for a total of 18 transects. All prairie dog colonies within the treatment sites were part of a larger complex that contained adjacent non-poisoned prairie dogs.

### Transect Location and Sampling

Since we thought there may be a spatial influence in regards to prairie dog movement within the treated sites (i.e., the area closer to the boundary of the untreated portion of the prairie dog colony may experience greater encroachment than the area further away) two transect were established in each site, one 250 m and one 500 m away from the BMZ boundary. Each transect was run parallel to the boundary. Likewise, for the non-treated portion, we set-up two transects 250 m and 500 m from the edge of the BMZ for consistency. Transect start points were randomly located by the use of a GIS layer and the direction of each transect depended-on where the start point was located in terms of the site. For example, if the start point was closer to the east side of the prairie dog town then the transect would be run in a westerly direction adjacent to the BMZ boundary. Transects were 200 m long and 20 measurement stations were taken along each transect (one measurement every 10 m). Transects were sampled from 22-25 October 2007 to incorporate late season vegetation and all cattle were off the grazed-sites. Range condition class was determined for each transect through GIS: 9 were excellent, 6 were good and 3 were fair. However, visual obstruction reading (VOR) results were similar by treatment and thus, range condition was not included as a categorical variable for our data analysis.

### VORs

The Robel pole was used to measure vegetation structure along each transect (Robel et al 1970). The pole consisted of one-inch bands of alternating gray and white color going-up the pole. Bands were sequentially numbered, beginning with the number 1 on the bottom-most band and increasing upward. VORs were measured from a distance of 4 m and at a height of 1 m. The VOR was measured by the observer as the last visible band seen through the vegetation. If the first band could be read, it was given a VOR of 1. At each measurement station, 4 readings were recorded, 1 for each cardinal direction to get a mean reading for each stop along the transect. The 20 stations per transect were sufficient to be within ± a half-band at an 80% confidence level (Benkobi et al. 2000).

#### *Results*

VOR readings were nearly the same for the 250 m and 500 m transects; further analysis was conducted to determine if these transects could be combined to give one reading per treatment. In all three treatments, there was no significant difference in VOR readings between the two spatially located transects (Table 2) and thus, data was combined for each treatment site.

**Table 2.** Results comparing VORs between 250 m and 500 m transects for each treatment.

| Treatment | N | Mean | SD | *t-value* | *P* |
|---|---|---|---|---|---|
| CF: 250 m | 3 | 1.48 | 0.12 | -0.03 | 0.98 |
| CF: 500 m | 3 | 1.48 | 0.17 | | |
| CNF: 250 m | 3 | 1.35 | 0.20 | -0.32 | 0.77 |
| CNF: 500 m | 3 | 1.40 | 0.21 | | |
| NCNF: 250 m | 3 | 1.01 | 0.02 | -0.64 | 0.56 |
| NCNF: 500 m | 3 | 1.03 | 0.05 | | |

When measuring VORs, it's not just the height of vegetation that is important but also the density of the vegetation that plays a role in how much forage or cover there is available. Not surprisingly, the highest VOR readings were located in the CF treatment followed by CNF and then NCNF (Figure 5). Although the NCNF VOR reading was 1.03, in reality, there was little to no visual obstruction at any measurement station and the entire Robel pole could be seen; it was simply assigned a value of 1 according to the protocol. Figure 6, provides an example of what a typical Robel pole reading looked like in each treatment.

**Figure 5.** Mean VOR reading per treatment.

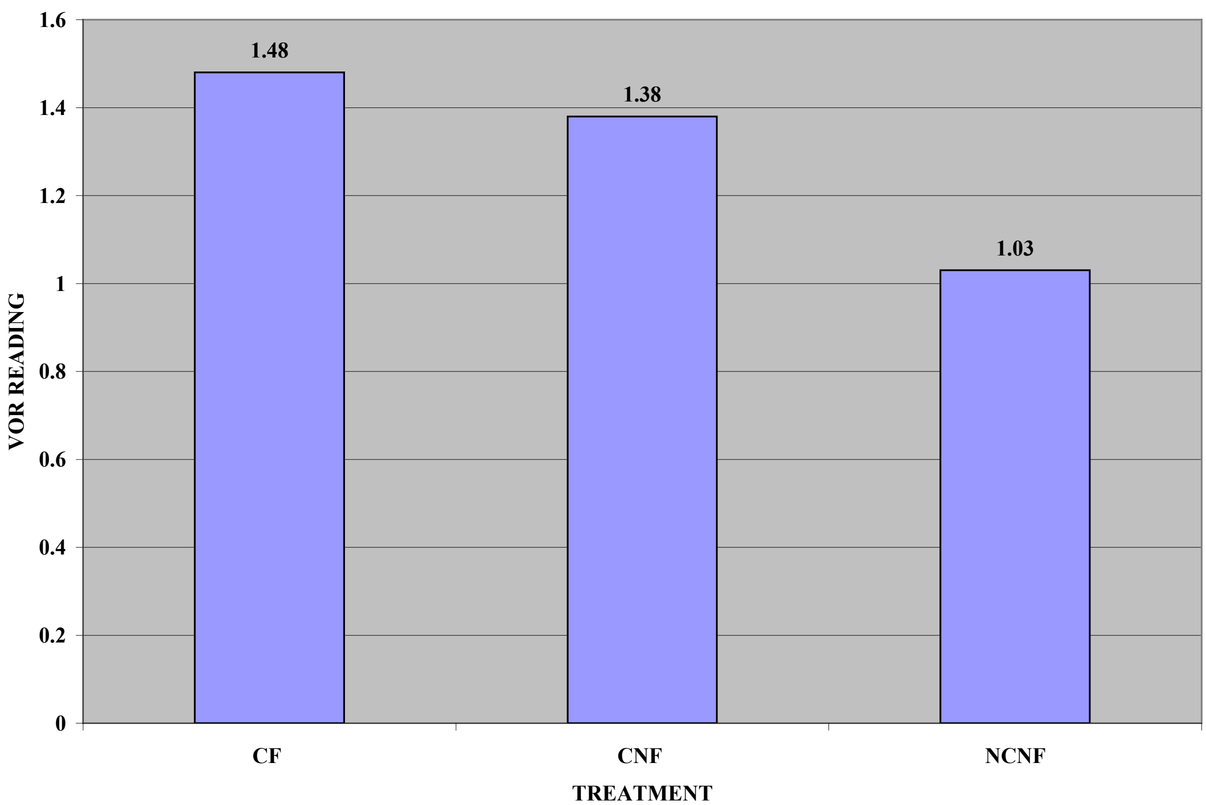
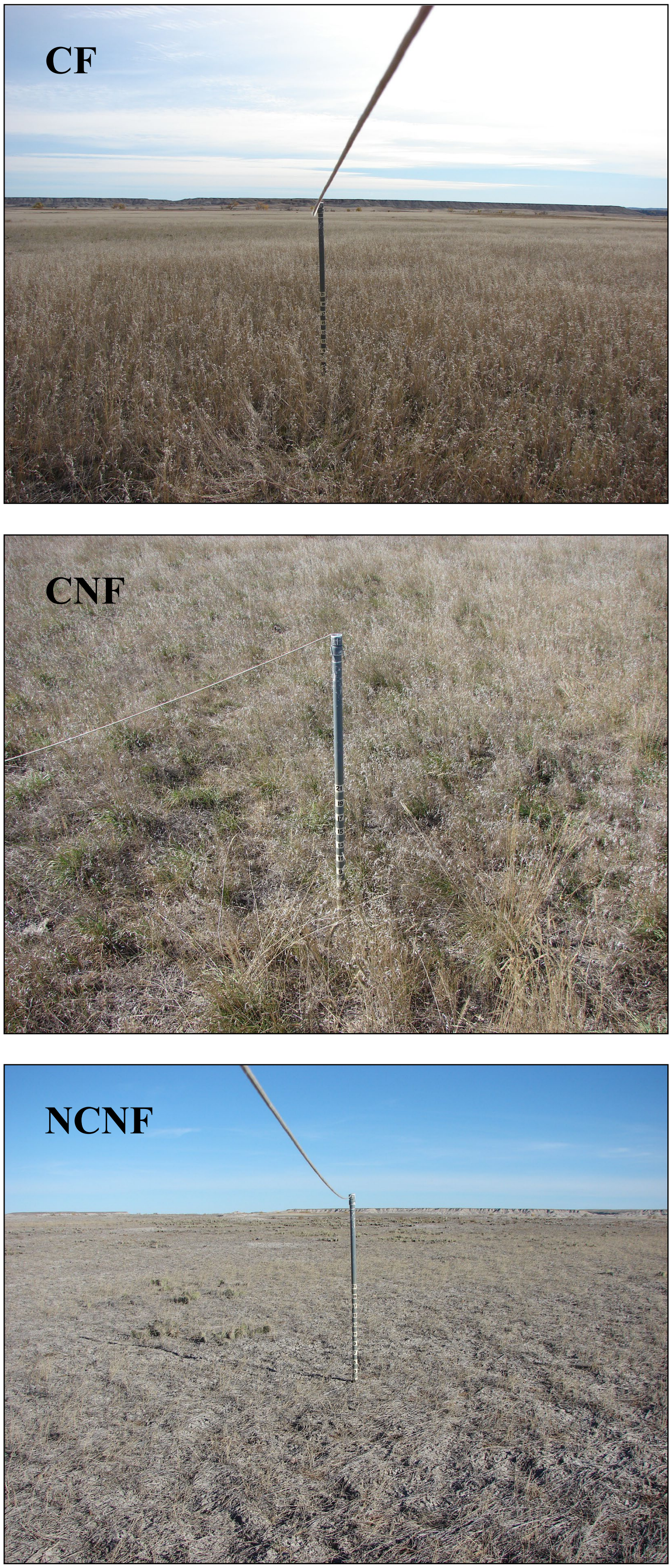


**Figure 6.** Typical Robel pole measuring station in each type of treatment.



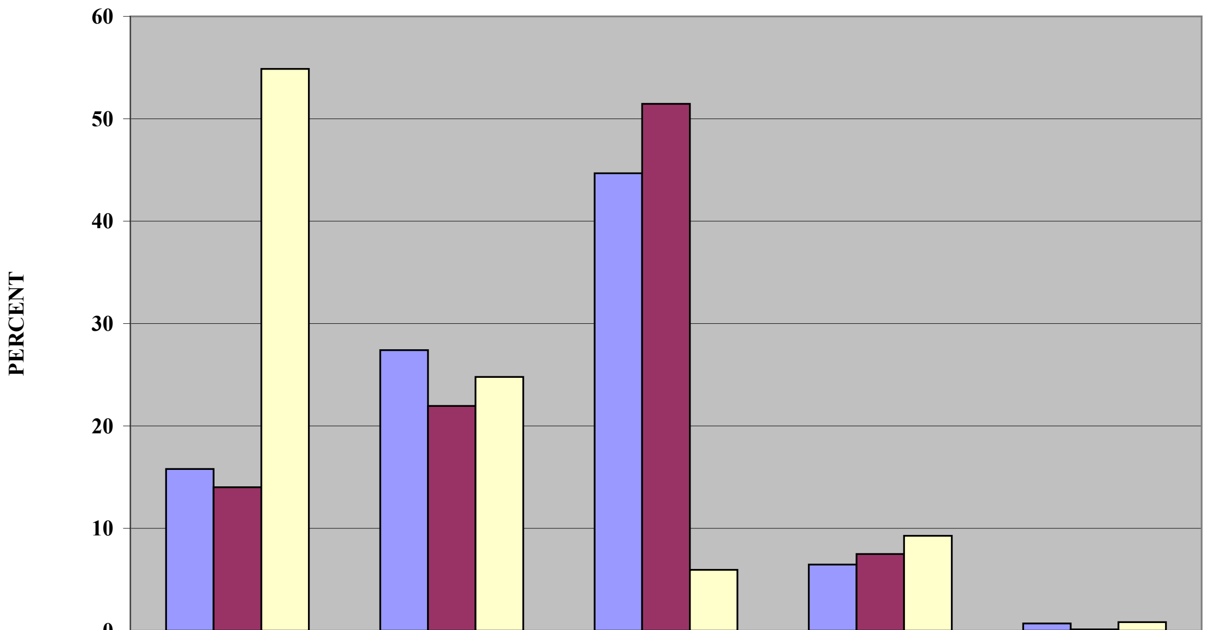
**Plant Canopy Cover and Height of Tallest Vegetation**

Although VORs provide a relative measure for vegetative structure, it doesn't always explain what is happening in terms of vegetative composition and how management practices are influencing those changes. Prairie dog colonies typically contain a greater percentage of forbs, lower percentage of litter and shorter maximum plant heights when compared to nearby uncolonized sites (Agnew 1986). The goal of analyzing the percent canopy cover and vegetative height was to get a better understanding of how the three different treatments varied in regards to the following variables: bare ground, litter accumulation, grass/sedge, forb, cactus and height of tallest vegetation. The cover class for each of the variables (except vegetative height) was estimated in a 20 x 50 cm plot placed at 10 m intervals along the same transect lines used for VOR readings (Daubenmire 1959). The height of the tallest plant in each plot was measured to the nearest centimeter. Sampling was conducted the same time as the VORs.

***Results***

Similar to the VOR results between the two spatially located transects per treatment (i.e., 250 m vs. 500 m), none of the variables were significantly different between transect locations so data was combined and analyzed at the treatment-level. Percent canopy cover was similar for all variables between CF and CNF treatments; however, there was a very large difference between CF/CNF and NCNF treatments for percent bare ground and grass (Figure 7). Figure 8, provides an example of what a typical cover reading looked like in each treatment.

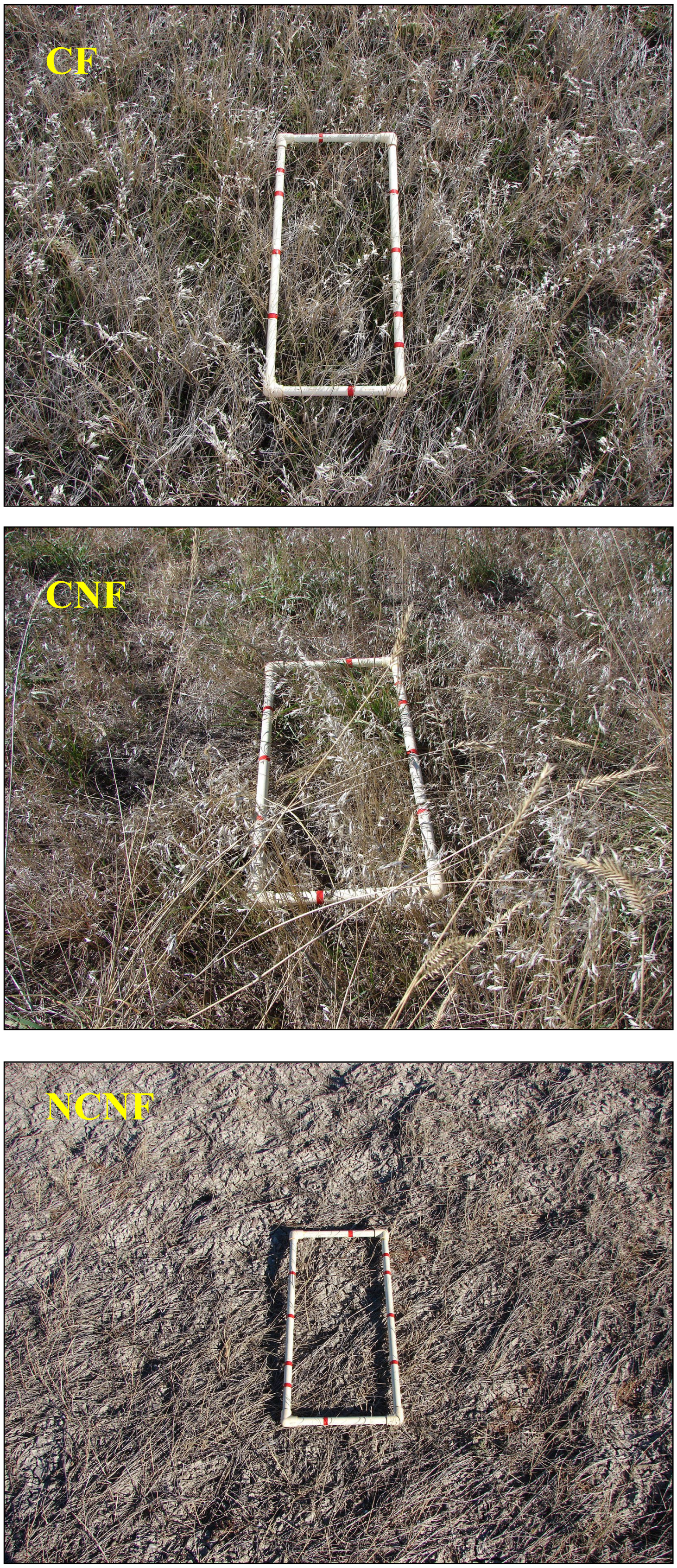
**Figure 7.** Percent cover for each variable per treatment.




| | Bare Ground | Litter | Grass | Forb | Cactus |
|---|---|---|---|---|---|
| CF | 15.8 | 27.41 | 44.67 | 6.46 | 0.71 |
| CNF | 14.01 | 21.96 | 51.46 | 7.5 | 0.13 |
| NCNF | 54.88 | 24.78 | 5.94 | 9.26 | 0.84 |

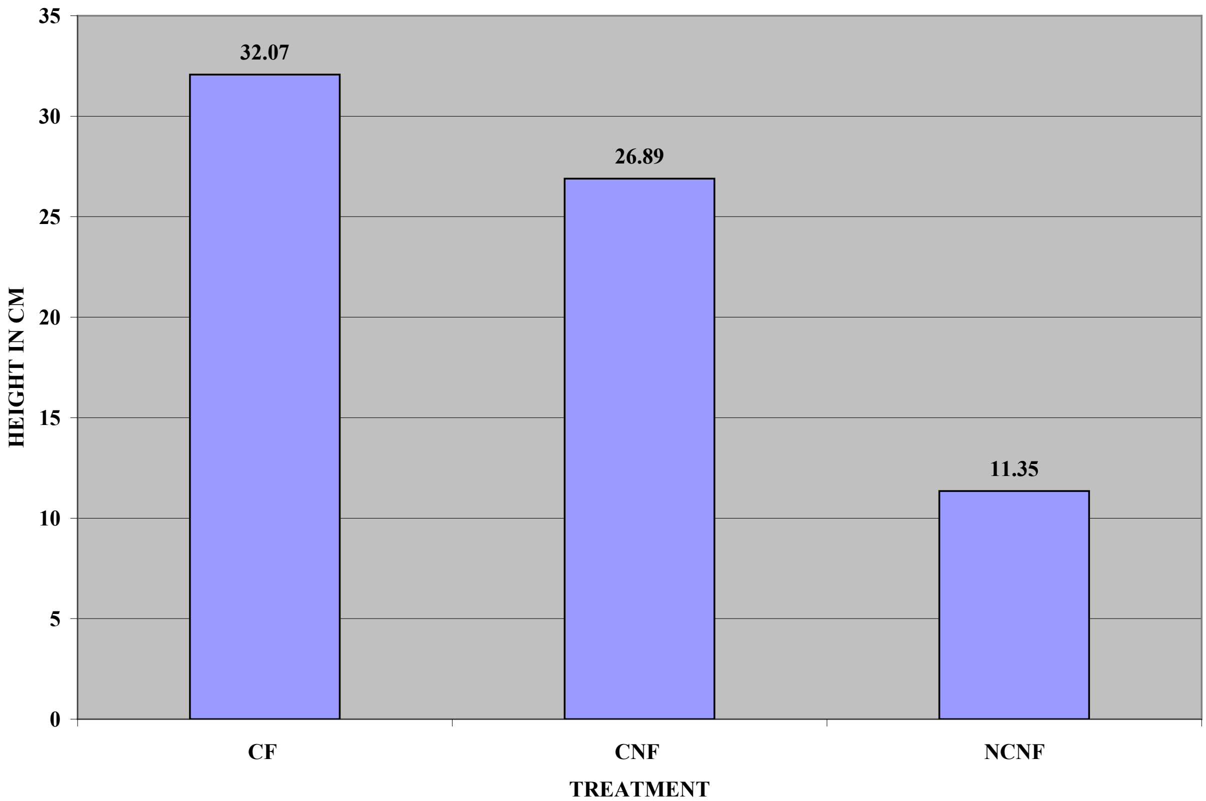
COVER CATEGORY

**Figure 8.** Typical canopy cover plot in each type of treatment.



Height of the tallest plant corresponded to VOR results with the highest in the CF treatment and the lowest in the NCNF treatment (Figure 9).

**Figure 9.** Mean height reading per treatment.




Several of the variables were correlated; two variables were considered correlated if the Pearson's Correlation Coefficient was ≥0.7 (Table 3). There is a strong negative correlation between VORs and percent bare ground as well as percent grass and height with bare ground. VORs are strongly positively correlated with percent grass cover and height of tallest plant.

**Table 3.** Correlation table of variables.

| | VOR | Bare Ground | Litter | Grass | Forb | Cactus | Height |
|---|---|---|---|---|---|---|---|
| **VOR** | 1.00 | | | | | | |
| **Bare Ground** | **-0.92** | 1.00 | | | | | |
| **Litter** | 0.06 | -0.13 | 1.00 | | | | |
| **Grass** | **0.90** | **-0.94** | -0.18 | 1.00 | | | |
| **Forb** | -0.48 | 0.61 | -0.51 | -0.50 | 1.00 | | |
| **Cactus** | -0.15 | 0.21 | 0.34 | -0.32 | -0.13 | 1.00 | |
| **Height** | **0.95** | **-0.88** | -0.06 | **0.90** | -0.48 | -0.18 | 1.00 |

**BOLD = Correlated.**

## Discussion

The Wall Ranger District currently utilizes a number of management practices to address BMZ issues and aggressively addresses private landowner complaints through the use of rodenticide and grazing management. Results from this year's vegetation monitoring are consistent with research conducted in western South Dakota that indicated natural vegetative barriers can limit prairie dog expansion (Terrall 2006). Terrall (2006) looked at a number of variables but found that visual obstruction and vegetation height were the most important factors limiting prairie dog expansion. His models showed a decreasing trend in prairie dog movement into buffer zones as visual obstruction and vegetation height increased. Additionally, when the model also included buffer width, the mean corrected $R^2$ value also increased. Expansion into the buffer zone was minimized when vegetation height reached 40 cm and VORs reached nearly 4 inches (Terrall 2006). He did note that only two of his eastern sites reached this level of height and VOR status during one year of his research when increased precipitation at these sites resulted in an increased vegetative response. Under drought conditions or situations that don't allow the vegetation to reach this minimum height and VOR, he recommends a buffer width of at least 100 m to deter expansion. Cincotta (1985) found that the primary factors influencing prairie dog colony expansion in Badlands National Park were population density on the colony edge as well as adjacent visibility in terms of vegetative obstruction.

BMZ vegetation in the Conata Basin did not reach the minimum level suggested by Terrall (2006) to completely halt encroachment at the treatment boundary; however, our buffer width of ½ mile is approximately eight times greater than what is recommended and we are seeing results. Additionally, there were individual measurement stations that did have VORs of 4 inches and vegetation heights >40 cm, especially in the CF treatments. An increase in rainfall and continuation of deferred cattle grazing may push those numbers to the minimum threshold identified by Terrall (2006). Since we did not see a significant difference in VORs, vegetation height and canopy cover between the transects located 250 m away from the boundary vs. those located farther (i.e., 500 m), the 100 m buffer width suggested by Terrall (2006) may in fact be slowing encroachment from the non-poisoned part of the prairie dog colony – basically, our transects were too deep into the buffer zone to find a difference. One thing this finding does show is that a ½ mile buffer may not be necessary and you can get similar results with smaller buffer zones.

Within the buffer zones that had been treated with rodenticide, there were usually small pockets of prairie dog activity scattered about and intermixed with taller vegetation (Figure 2). This is more than likely the result of a number of factors: (1) not getting a 100% kill in the buffer zone at time of treatment, (2) some low-level amount of colonization from adjacent non-poisoned areas, and (3) some encroachment actually coming-off private land. To expect absolutely zero prairie dogs within the entire BMZ is not feasible, especially when only a portion of that colony falls within the BMZ and a larger portion of it is not treated. However, prairie dog re-colonization can be slowed down considerably. Both vegetation height and visual obstruction are the keys to controlling prairie dog movement into the BMZ after treatment. Results from our monitoring show that both height and visual obstruction are greater in areas not grazed but even in the CNF treatments there is promise if the vegetation is not overgrazed and allowed to increase in height and density. Future prairie dog encroachments into these partially treated BMZs will more than likely decrease if cattle grazing continues to be deferred, vegetation recovers, and precipitation increases.

## CONCLUSION

In 2007, the Wall Ranger District treated 5,015 acres, built 13.23 miles of temporary electric fence, and deferred 3,765 acres from cattle grazing in the BMZ. Vegetation monitoring indicated that these sites are recovering and slowing-down prairie dog encroachment. Both vegetative height and density are greatest in areas treated with rodenticide and deferred from grazing; both variables are important in slowing-down prairie dog re-colonization. Although ½ mile buffers are the current, normal practice, smaller buffer widths may produce similar results. Boundary management areas that suffer from chronic problems should incorporate rodenticide treatment and fencing to defer grazing. The expectation that there should be "zero" prairie dogs in BMZ areas like the Conata Basin; which contain very large colonies adjacent to the treated sites is unrealistic. There is too much of a source pool and prairie dogs naturally expand and contract. The Forest Service should use all the tools available and the best tools available to slow this down as much as possible. The very low prairie dog densities observed in the fourth year of treatment, combined with vegetation management indicates that prairie dogs are finding it difficult to re-colonize at significant densities within the BMZ (Figures 10-11), even under drought conditions. We believe our protocol of keeping a Forest Service employee with the

**Figure 10.** Area not treated with rodenticide or deferred from grazing in Upper Sage Creek of the Conata Basin (NCNF Treatment).

rodenticide contractor has helped immensely. It alleviates confusion and provides the contractor with on-the-spot advice and guidance, especially where boundaries can be confusing. At the end of the day, we know the area was treated according to the standards outlined in the contract. The Wall Ranger District will continue monitoring in the future and adjust management practices accordingly.

**Figure 11.** Area treated with rodenticide and deferred from grazing in Upper Sage Creek of the Conata Basin (CF Treatment).

**ACKNOWLEDGEMENTS**

We would like to thank Defenders of Wildlife for the purchase and donation of 12.5 miles of electric fence at a cost of $18,656 for use in our Boundary Management Zones. Without their assistance, the total acreage dedicated to vegetation buffers within the BMZ would have been significantly less.

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