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LIVESTOCK GRAZING AND THE UTAH PRAIRIE DOG: IMPLICATIONS FOR MANAGING THE AWAPA

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Executive Summary

The Utah prairie dog (*Cynomys parvidens*) is a federally listed species that occurs only in southwestern Utah. The Awapa Plateau in south-central Utah is one of three Utah prairie dog recovery areas. The prairie dog population in this area is below recovery goals established in 1991 by the U.S. Fish and Wildlife Service (USFWS). In 2002, the USFWS approved three Utah prairie dog mitigation banks on the Awapa Plateau. Little information exists regarding how these mitigation banks should be managed to optimize benefits for the species. Past research has suggested that management actions to reduce shrub canopy cover results in increased grass and forb cover and may benefit Utah prairie dogs.

From 2002-2005, we evaluated the effects of 20-30%, 50-60%, and 80-90% forage (grass) utilization rates, using domestic cattle under a high-intensity/short duration grazing regime, on Utah prairie dog habitat use and foraging behavior on rangeland owned by Utah School and Institutional Trust Lands (SITLA) on Parker Mountain. Parker Mountain is included in the Awapa Plateau recovery area. We wanted to determine if high forage utilization by cattle over short periods could improve Utah prairie dog habitat by reducing shrub cover. Additionally, we wanted to determine what forage utilization rate would be most compatible with the management of prairie dogs. We found no evidence that any of the forage utilization levels tested affected Utah prairie dog densities or burrow density. However, Utah prairie dogs spent more time foraging and were less vigilant under high (80-90%) cattle forage utilization. Higher foraging rates by cattle coincided with reduced grass cover in the high utilization pastures. No change in plant composition, particularly shrub cover, was detected for the forage utilization rates implemented during this study.

Our results suggest that implementation of high forage utilization by cattle (80-90%) may negatively effect Utah prairie dogs if it results in increased predation risks or reduced energy intake. Currently, livestock grazing on the Awapa Plateau (SITLA lands) is managed to achieve a 50-60% forage utilization rate. Our research suggests this forage utilization level is compatible with Utah prairie dogs even though it coincided with peak prairie dog nutritional needs. However, because no reductions in shrub cover were detected even under the highest forage utilization level evaluated, we recommend that mechanical treatments be evaluated for use on the Awapa Plateau to improve Utah prairie dog habitat in areas where shrub cover exceeds recommended guidelines. We recommend that the use of livestock, particularly sheep, be implemented and evaluated to maintain treated areas. In summary, we did not detect any evidence that current grazing regimes as implemented by SITLA lands on the Awapa Plateau are detrimental to Utah prairie dogs.

Introduction

The Utah prairie dog was listed as an endangered species in 1973 pursuant to the Endangered Species Act (ESA) of 1969. The species was down-listed to threatened in 1984 after substantial numbers were found on private lands in parts of Utah. The U.S. Fish and Wildlife Service (USFWS) completed a species recovery plan in 1991. The focus of the plan was to recover populations on federal lands in three areas (USFWS 1991). The areas identified included the West Desert of Utah, the Paunsaugunt Plateau, and the Awapa Plateau (which includes Parker Mountain).

Grazing by domestic livestock continues to be the dominant land use activity across most of the range of the Utah prairie dog. Previous studies suggest that grazing may not only be compatible with the Utah prairie dog, but can be used as a management tool. Prior to implementing this management strategy, more information is needed to understand the potential impacts that high intensity/short duration grazing might have on the plant community and consequently on Utah prairie dog populations.

Player and Urness (1982) speculated that many sites previously inhabited by Utah prairie dogs are no longer suitable because of changes in plant composition and structure. Elmore and Workman (1976) determined that sagebrush height and density was the restricting factor on most historic colony sites. Other research has found that reduction of shrub height and density increased success rates of Utah prairie dog reintroductions (Player and Urness 1982). Therefore, periodic brush management to reduce canopy cover in areas inhabited by the species may facilitate recovery.

While shrub reductions and increased grass and forb composition achieved by grazing may be beneficial to Utah prairie dogs in the long-term, existing colonies could be negatively affected in the short-term by reduced forage during the treatment. At high elevation sites with short growing seasons, any reduction in weight of Utah prairie dogs may have costs in terms of over-winter survival.

In 2002, the USFWS approved three Utah prairie dog mitigation banks on the Awapa Plateau recovery area. The banks are operated by Utah School and Institutional Trust Lands Administration (SITLA) to provide mitigation credits to assist local communities affected by the ESA regulation regarding take permits. Little information is available regarding how the banks should be managed to optimize benefits to the species in the banks. One of the three mitigation banks was mechanically treated to reduce shrub canopy cover and reseeded with a grass and forb mixture in 2002. Utah prairie dogs have recently re-colonized this site after a 20-year absence (T. Messmer, Utah State University, personal observation). However, mechanical treatments are costly to implement large-scale. Livestock grazing may be more cost effective if it achieves a similar vegetation response. However, more information is needed prior to wide scale application.

Many areas of the Awapa Plateau do not achieve the cover guidelines recommended for Utah prairie dogs. We evaluated if high intensity (up to 90% forage utilization) cattle grazing could reduce shrub canopy cover within a short time frame (3 years). Although the 80-90% forage utilization has limited wide-scale applicability to rangeland management, it may have potential in site-specific situations to manage vegetation for Utah prairie dogs. We also evaluated the effect of different cattle forage utilization rates to determine the most appropriate level for Utah prairie dogs. Specifically, we wanted to determine the effect of three grazing intensities on Utah prairie dog behavior and habitat use in a high elevation (> 2,300 m. elevation) shrub-steppe community, and if cattle grazing can be used to improve Utah prairie dog habitat in this vegetation community.

Study Area

The Parker Mountain resource area consists of approximately 380,000 acres and is located in Garfield, Piute, Sevier, and Wayne counties in south central Utah on the Awapa Plateau (Figure 1). It is bounded to the north by Fish Lake Mountain, to the west by Grass Valley, to the east by Boulder Mountain, and to the south by the Aquarius Plateau. The area is largely managed by Bureau of Land Management (33%), U.S. Forest Service (31%), SITLA (31%), private landowners (5%), and the UDWR (< 1%).

This experiment was conducted on SITLA property near the junction of Garfield, Piute, and Wayne counties, and is commonly known as the “Tanks” area. It is located in the “South” pasture of the SITLA land block and will be referred to as the South Butte mitigation bank. There are several Utah prairie dog colonies in the vicinity of the South Butte mitigation bank (within several miles). A large colony is located to the south of the treatment site. Additionally, prairie dogs inhabit the entire study site at much lower densities, although densities increased substantially during the study period. Historic mounds are found throughout the site.

Methods

Grazing Treatments

Nine pastures, 20 acres each, were constructed in a drainage located in the South Butte mitigation bank of Parker Mountain. Three treatment levels implemented were low (20-30%), moderate or current (50-60%), and high forage utilization (80-90%). Each of the experimental pastures had a treatment level randomly assigned but stratified by elevation. The randomization specified that each treatment must be represented in both site types to control for slope position.

Stocking rate was determined based on SITLA forage measurements for that area (150 lbs/acre). All cattle grazing was conducted over a period of approximately 3 weeks. Based on the knowledge that cattle typically consume 2% of their body weight daily (Holecheck 1988) and that the cattle used would weigh approximately 800 lbs each, stocking rate was set at 4 cows/pasture (low forage utilization), 8 cows/pasture (moderate

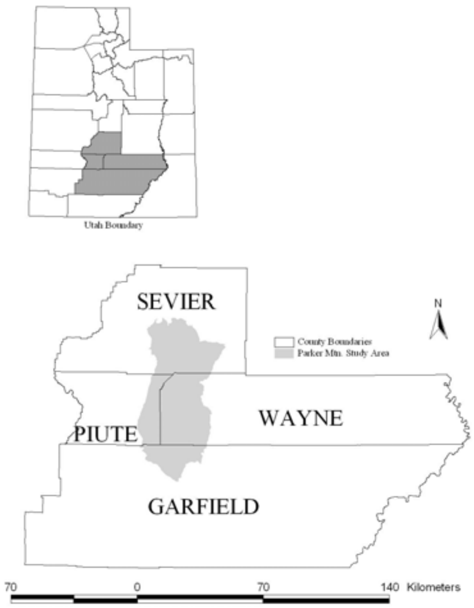

Figure 1. Location of study area, Parker Mountain, Utah.

or current forage utilization), and 11 cows/pasture (high forage utilization). This was adjusted by increasing cattle numbers by one animal for each pasture in 2004 and 2005 to reach forage utilization objectives within the allotted time. Cattle were placed on the pastures simultaneously in early June (varied with year, based on site readiness) and removed when the assigned forage utilization levels were met for each pasture. Forage utilization of grasses was determined by ocular estimation after training had occurred (BLM 1984), because of the sparse grass cover and the lack of one predominant forage. Cattle (heifers) were loaned to us by Mr. Gary Hallows, president of the Parker Mountain Grazing Association. Mr. Hallows also transported the cattle to and from the pastures when needed.

Prairie Dog Monitoring

Burrows. At the beginning of the study, we recorded the locations of any historic prairie dog mounds and burrows within the experimental pastures using global positioning system (GPS) technology. During the study, any new burrow construction or occupation of historic mounds was noted and the locations recorded. Because of the close proximity of the experimental pastures, all were considered within the range of dispersal of prairie dogs from surrounding colonies or from mounds currently occupied within the experimental pastures (Mackey 1988).

Prairie Dog Censuses. We conducted a weekly census of Utah prairie dogs throughout the summers of 2002-2005. We also surveyed a control colony located to the south of the experimental pastures to document normal fluctuations in prairie dog numbers that correspond to juvenile emergence and subadult dispersal.

Foraging. To monitor Utah prairie dog foraging activity, we constructed observation blinds in pastures exhibiting the highest and most equal prairie dog densities (one for each treatment level). We recorded activity at 15 minute intervals between 0900-1200 hrs. Each pasture was sampled weekly on a common day from early June until late July. All visible prairie dogs within the pasture under observation were counted, activity type noted, and adults were distinguished from juveniles. Although only foraging and alert activities were included in the final analysis, activities recorded included: alertness, foraging, moving, conflict, playing, and resting.

Vegetation

To sample the vegetation we divided each pasture into four equal quadrants. Within each quadrant, three transects 25 m in length were randomly placed for each vegetation sampling period. Therefore each pasture had 12 transects for each sampling period. This was done to ensure that all portions of a pasture were equally sampled. The beginning point and the direction of transects were randomly determined. Vegetation measurements were taken at 5-m intervals along transects. At each interval a Daubenmire frame was used to evaluate species present, percentage of ground occupied by each species, and average species height (Daubenmire 1959). Additionally, a modified 10-m line intercept transect was utilized to evaluate shrub abundance and height along the transects (Canfield 1941). However, during preliminary data analysis, we determined that because of the low stature and small canopy cover of individual shrub plants, the Daubenmire results more precisely represented shrub composition on the landscape. Therefore, line intercept data were not used in the final analysis. Because the dominant shrub (in terms of cover and height) on the landscape was sagebrush, and due to drastic palatability differences between it and other shrubs present, only sagebrush (*Artemisia spp*.) was included in the final analysis. Vegetation measurements were taken immediately before treatment, immediately after treatment, and in late summer for three field seasons. Two exclosures (each 2.5 x 2.5 m) were constructed in each pasture so that forage utilization could be monitored. The exclosures also allowed for comparison of grazing regimes to an ungrazed plot across time. Each exclosure had a paired unexclosed plot.

Results

Burrows

Utah prairie dog burrow distribution and density varied by year. In general, the number of active burrows increased within each pasture over the 3 years (Figures 2 and 3). The range of increase in active burrows was between 17% and 245% from 2003-2005. Our analysis suggested that forage utilization levels did not influence the change in active burrows over time. Thus changes were more related to annual weather fluctuations.

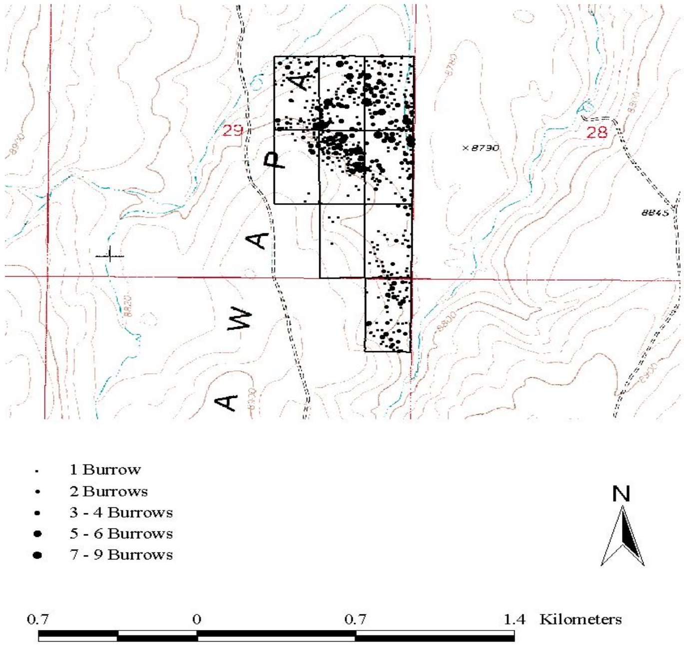

Figure 2. Distribution of prairie dog burrows in experimental treatment pastures on Parker Mountain, Utah, 2003.

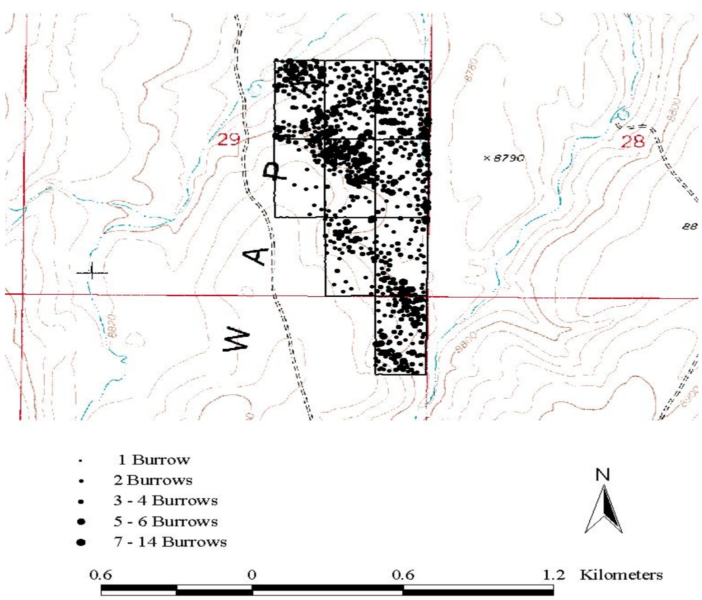

Figure 3. Distribution of prairie dog burrows in experimental treatment pastures on Parker Mountain, Utah, 2005.

Prairie Dog Censuses

Generally, the number of Utah prairie dogs surveyed was lower prior to juvenile emergence (Figures 4, 5, and 6). The number of prairie dogs quickly peaked in early June, and began a slow decline by late summer as subadults dispersed. Forage utilization rates were not related to prairie dog numbers. Utah prairie dog count data were more affected by juvenile emergence and annual fluctuations.

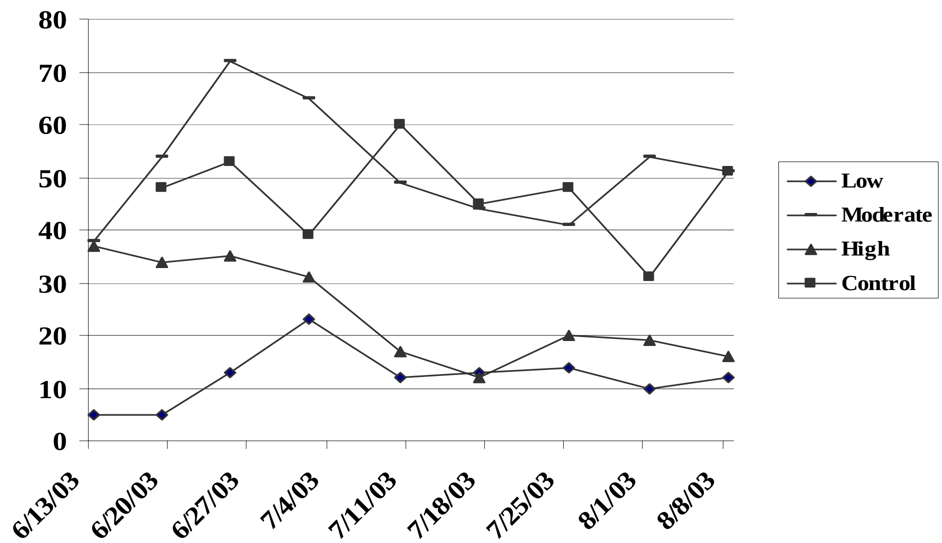

Figure 4. Utah prairie dogs counted in experimental pastures under low, moderate, and high forage utilization levels compared to control area, Parker Mountain, 2003.

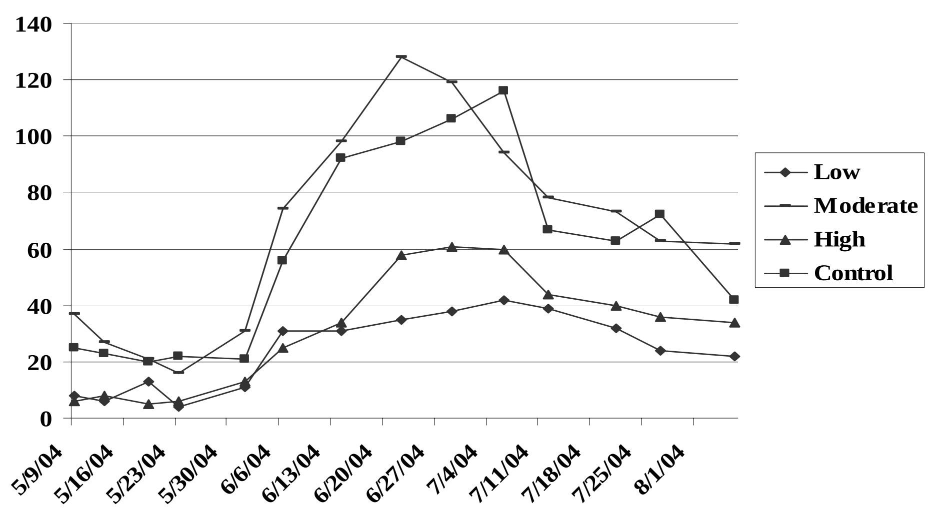

Figure 5. Utah prairie dogs counted in experimental pastures under low, moderate, and high forage utilization levels compared to control area, Parker Mountain, 2004.

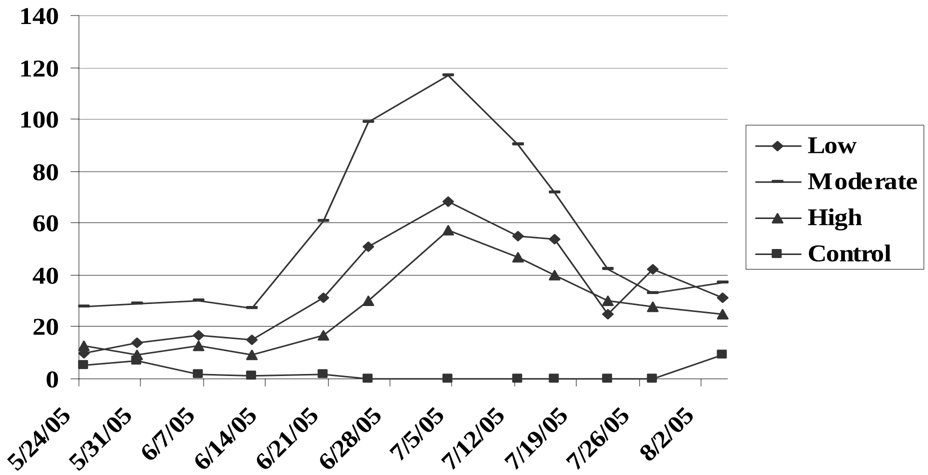

Figure 6. Utah prairie dogs counted in experimental pastures under low, moderate, and high forage utilization levels compared to control area, Parker Mountain, 2005. (Note: The control area experienced a plague outbreak during 2005.)

Foraging

The Utah prairie dog foraging activity varied among treatments across time. In general, adult Utah prairie dogs increased foraging time in the high forage utilization pasture in both 2004 and 2005 (Figures 7 and 8). The low forage utilization pasture showed the same increasing trend as did the high forage utilization pasture in 2005.

Juvenile prairie dogs increased foraging effort over time in all treatment levels. This observation would be expected as they wean and begin foraging above ground. However, juvenile foraging time was highest in the high forage utilization pasture in both 2004 and 2005 (Figures 9 and 10). The low forage utilization pasture had the lowest forage time for juveniles in both years. As would be expected as Utah prairie dogs spent more time foraging, alert time (vigilance) declined. Therefore, alert times were lower in the high forage utilization pasture than in the moderate treatment level. Utah prairie dogs in the low treatment level pasture had the highest alert time for 2004 and the lowest time in 2005.

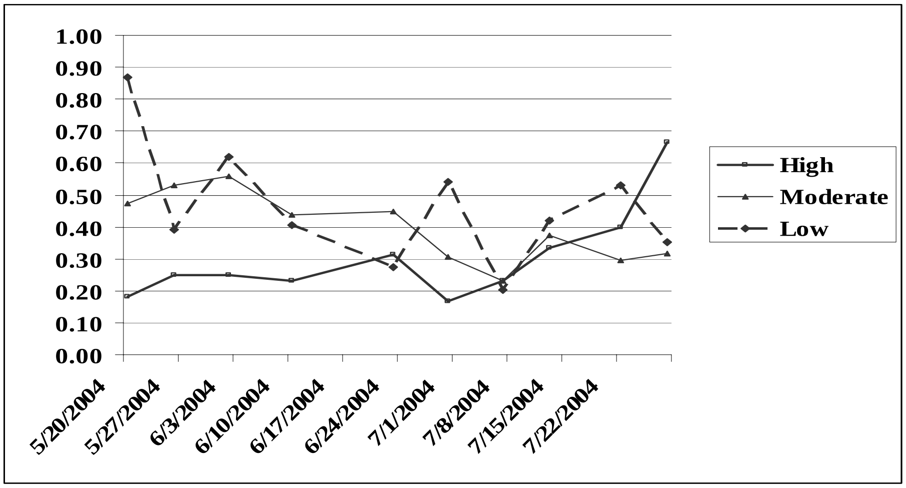

Figure 7. Proportion of total adult Utah prairie dogs observed by treatment level in selected pastures that were observed foraging, Parker Mountain, 2004. (Note: Grazing period was 5/27/2004 until 6/15/2004.)

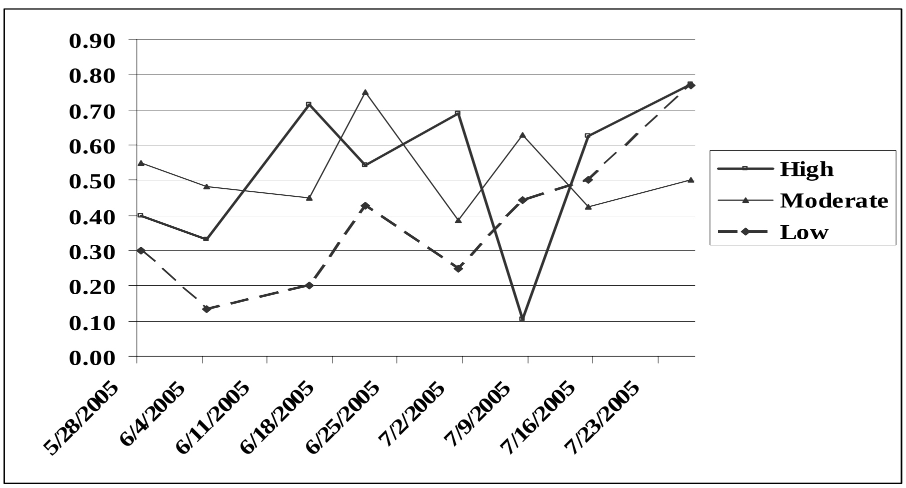

Figure 8. Proportion of total adult Utah prairie dogs observed by treatment level in selected pastures that were observed foraging, Parker Mountain, 2005. (Note: Grazing period was 6/7/2005 until 6/27/2005.)

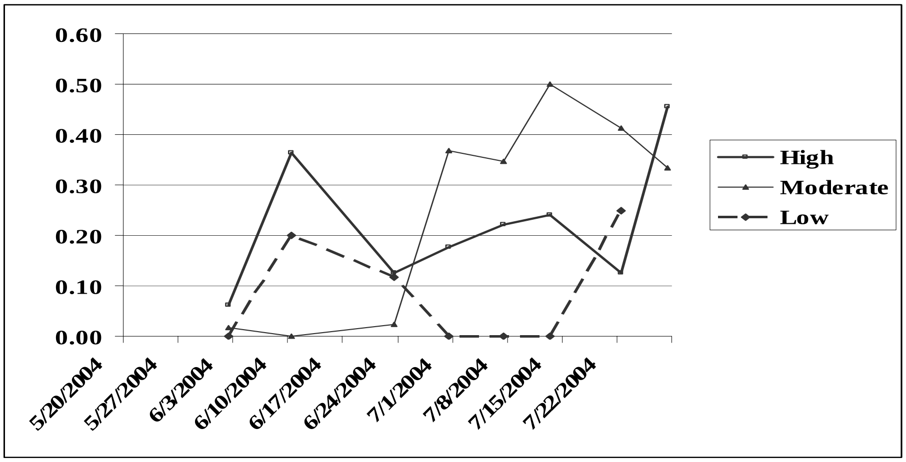

Figure 9. Proportion of total juvenile Utah prairie dogs observed by treatment level in selected pastures that were observed foraging, Parker Mountain, 2004. (Note: Grazing period was 5/27/2004 until 6/15/2004.)

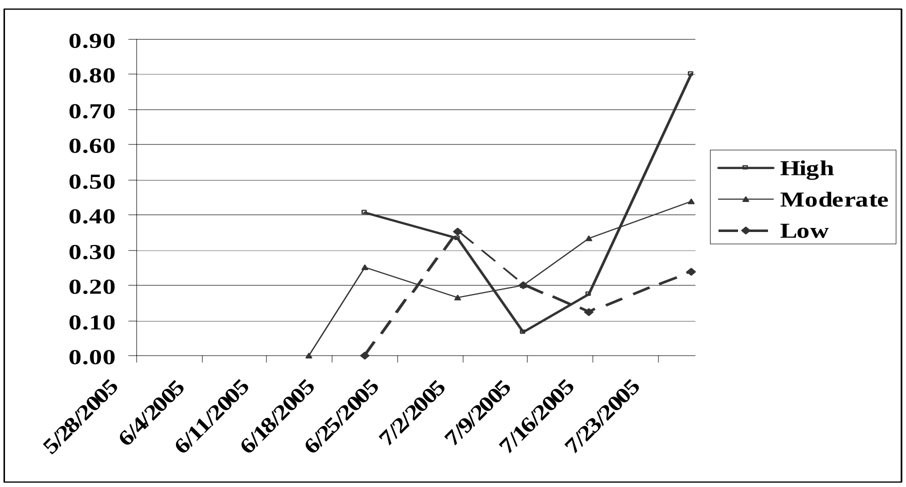

Figure 10. Proportion of total juvenile Utah prairie dogs observed by treatment level in selected pastures that were observed foraging, Parker Mountain, 2005. (Note: Grazing period was 6/7/2005 until 6/27/2005.)

Grass Cover

The average percent grass cover for the experimental pastures was 11.2%. Cool season grasses comprised <1% of the total cover. There was no treatment effect for grass cover. However, there was a year effect and a period effect as would be expected due to annual precipitation and plant phenology.

For grass height there was both a treatment/period and a year/period interaction. Both the high and moderate treatment levels differed between periods, while the low treatment level did not differ between treatments. This is related to the increased rates of forage utilization in those treatments. Additionally, the post-period and last-period differed between treatment level, while the pre-period did not differ between treatments. Pre-period, post-period, and last-period also differed between years. Periods within years differed for 2003 and for 2004, but not for 2005.

Forb

Forb cover for the experimental pastures was 7.5%. There was no treatment effect or period effect for forb cover. There was a year effect likely explained by precipitation differences.

Neither treatment nor period effects were significant for forb height. Year/period interaction was significant. Once again the post-period and last-period differed between years, while the pre- period did not differ between years. Periods within years did not differ for 2003 and for 2004, but did differ for 2005.

Shrub

Shrub cover for the experimental pastures was 25.8%. Treatment forage utilization rates did not affect shrub cover. Both year and period effects were significant reflecting precipitation and plant phenology.

Average shrub height for the experimental pastures was 4.3 inches. The utilization rates used did not affect average shrub height. However, there was a year/period interaction. The post-period differed between years, while the pre-period and last-period did not differ between years. Periods differed during 2003, but not during 2004 or 2005.

Discussion

Our observations support previous findings that reduction in amount of available forage increases forage time and decreases vigilance time of Utah prairie dogs (Ritchie 1998, Cheng and Ritchie 2005). While we were not able to determine survivorship of individual prairie dogs over time, other research has found that at higher forage utilization levels by cattle, not only did Utah prairie dog foraging time increase but survivorship decreased (Ritchie 1998 and Cheng and Ritchie 2005). However, our census data and burrow distribution data do not support this hypothesis. There are several plausible explanations to explain this difference.

First, we believe dispersal of sub-adults from surrounding areas may have masked any losses of prairie dogs in the high utilization pastures that may have occurred because of low survival rates. Secondly, while foraging time did increase under high forage utilization, prairie dogs in these areas, through selective grazing, may still have been able to obtain adequate energy reserves to survive hibernation. Both of these explanations would be more likely during a wet cycle where food availability was higher. In 2004, precipitation was 126% above normal at a nearby weather station. In 2005, precipitation was 205% above normal by July for that same station. Cheng and Ritchie (2005) noted that their study coincided with a drought which likely exacerbated negative effects.

Another consideration is the density of the prairie dogs in the experimental pastures. Pastures with similar (but not equal) prairie dog numbers were chosen to examine forage time. However, the moderate treatment level pasture had the highest initial counts and peak counts in both 2004 and 2005. Therefore, the difference in foraging time cannot be explained only by prairie dog density. Density of prairie dogs may have affected prairie dog response to high forage utilization by cattle, however. Examination of prairie dog surveys by individual pastures revealed that one of the three high utilization pastures had declining prairie dog counts across time. Initially, this pasture had some of the highest prairie dogs densities of any of the pastures. The remaining two high utilization pastures had increasing prairie dog numbers across time. Both of these pastures had few if any prairie dogs at the beginning of the study. Thus, differences in initial prairie dog density may have masked any treatment effects. All of these concerns should provide caution in using survey data or burrow numbers as indicators of colony health. While foraging time may be more indicative of treatment effects, these data still do not provide essential survivorship data.

We noted that juvenile prairie dog foraging time in particular increased under high utilization grazing. Because the Awapa Plateau recovery area receives much of its annual rainfall in late summer as monsoon rain, this may have helped mitigate any juvenile over-winter mortality. As juveniles enter hibernation later in the year, the increased availability of warm-season grasses after cattle were removed may partially explain the lack of difference in prairie dog counts or burrow establishment among grazing intensity levels. This warm-season grass response was noted by an approximately 1% grass cover increase and a slight increase in grass height (< 1 inch) between the end of the grazing period and late summer for the high forage utilization pastures.

In general, the literature suggests that competition can be expected when plant productivity is low or animal density is high (Heske and Campbell 1991, Keesing 1998). With forage production estimated at 150 lbs/acre and a frost free season of less than 80 days, our study site can be considered to have low productivity. Additionally, cattle densities were high on the high utilization pastures, albeit for a short period of time. By placing cattle at such density, diet selectivity would be expected to decrease (Savory 1999). Therefore, we would expect that conditions were in place to create competition. Our Utah prairie dog forage observation data supports this argument.

An important question yet to be answered is whether this actually affected survival of Utah prairie dogs. Results from previous studies suggest this is likely, particularly during drought and on low plant diversity sites (Ritchie 1998 and Cheng and Ritchie 2005). Ritchie (1998) and Cheng and Ritchie (2005) found profound survival differences related to forage utilization levels.

During the 3 year study period, we did not detect any reduction in shrub canopy cover or change in plant class composition. One purpose of this study was to evaluate if high intensity/short duration grazing (utilizing cattle during the growing-season) would result in a reduction in shrub canopy cover and an increase in palatable grass and forb cover. The vegetation cover differences detected reflected seasonal and annual variation, but not treatment effects. Height did differ between treatments, but for grass only, reflecting higher levels of forage utilization by cattle.

Shrub height did not appear to be above Utah prairie dog guidelines for the South Butte mitigation bank. However, other areas on the Awapa Plateau may have shrub cover above the recommended 12 inches (e.g., Tanks mitigation bank). Grass cover was < 50% recommended and warm season grass cover was < 20% recommended. If the current recommendations for vegetation for Utah prairie dogs are to be followed, then further methods of vegetation treatments should be evaluated on the Awapa Plateau. Based on the fact that we did not detect any reductions in shrub cover and subsequent increase in grass cover, and the potential negative effects that higher cattle forage utilization rates may create for Utah prairie dogs, we do not recommend growing-season high-intensity grazing by domestic cattle as a shrub reduction method for the Utah prairie dog on the Awapa Plateau. This in no way implies that moderate cattle grazing is not a compatible use in areas occupied by the Utah prairie dog.

Mechanical means of shrub reduction may be more appropriate on the Awapa Plateau. Another potential shrub reduction technique may be fall grazing with domestic sheep. It is likely that some type of biological control (such as domestic grazing) will be necessary to reduce undesirable shrub response (rabbitbrush) and to reduce sagebrush reestablishment following any mechanical treatments. Therefore, a combination of mechanical and biological control may be most appropriate. While combining treatments would increase total cost of shrub reduction, the desired effect would be achieved in a shorter time period.

Management Recommendations

Grazing by domestic livestock has been speculated to be a cost-effective management tool compared to mechanical methods such as harrowing or disking. However, consideration must be given to the continued cost of administration of the ESA for the Utah prairie dog, private landowner implications of the ESA, and time and logistical considerations of implementing a landscape level high-intensity/short duration grazing regime. With all of these factors taken into account, mechanical control appears more acceptable to achieve shrub cover guidelines recommended for areas inhabited by the Utah prairie dog.

We recommend that high-intensity/short duration grazing of cattle that exceeds 60% forage utilization not be implemented during the growing season in areas currently occupied by Utah prairie dogs as a method of shrub canopy reduction. Instead, mechanical treatments (such as harrowing of brush hogging) should be evaluated on the Awapa recovery area to examine the hypothesis that Utah prairie dog numbers will increase as shrub levels are reduced and that Utah prairie dogs will increase dispersal rates into newly treated areas. The Tanks mitigation bank and the South Butte mitigation bank both have shrub cover above and grass cover below the recommendations for Utah prairie dogs. Mechanical and/or fall sheep grazing treatments could be evaluated on either site. Regardless of the method of shrub reduction, quantified data on Utah prairie dog survival should be collected prior to and after treatment implementation. Large-scale shrub reductions should not be applied with the sole purpose of Utah prairie dog management on the Awapa Plateau until definitive evidence is obtained regarding its efficacy.

In areas where mechanical treatment is not feasible (such as rocky areas or areas with significant archaeological significance) then fall grazing alone (preferably by sheep) should be considered and evaluated as an option to reduce shrub cover. While this method may be cheaper, it will likely take longer to achieve the desired results and in some years, early snowfall may prohibit its use at these high elevation sites. Additionally, supplements may be necessary to increase shrub consumption by livestock. Biological maintenance in the form of sheep and cattle will likely be necessary to control unwanted shrubs post treatment. Specifically, rabbitbrush encroachment may be a significant problem on the Awapa (R. Torgerson, SITLA, personal communication). It has been noted that rabbitbrush in this area is highly palatable to livestock, and thus could be controlled with livestock grazing.

Herbicide treatments are not recommended except in very low-statured stands of black sagebrush where residual brush will not obstruct prairie dog vision (< 12 inches). Herbicide treatment is generally an economical method to increase forage production in sagebrush steppe (Holecheck and Hess 1994). Unfortunately, the woody debris left from herbicide treatment would need to be mechanically removed if the height exceeded that recommended for Utah prairie dogs, thereby increasing cost. This would preclude its use on many areas on the Awapa. Additionally, specific herbicides should be approved for use on rodents if occupied Utah prairie dog colonies are to be treated.

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