Animal Use of Black-Tailed Prairie Dog Burrows: Preliminary Findings

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ABSTRACT: Black-tailed prairie dogs are considered an important "keystone" species of the prairies, on one hand, and a nuisance rodent causing considerable damage on the other. To effectively manage prairie dog colonies, a better understanding is needed of the effects of management practices on prairie dogs, their burrow systems, and other species that may use those burrow systems. For example, when fumigants are used to control prairie dog populations, to what extent may other species be affected? We used a burrow-probe camera system to observe animal use of 777 burrow openings. These included colonies both in urban/suburban and natural prairie settings as well as active versus inactive colonies. Burrows were usually probed to a depth of about 2 m, requiring only a few minutes each. Relatively few animals were seen and most were invertebrates. More animals were observed in urban/suburban burrow systems versus prairie burrow systems. Somewhat more animals were observed in active versus abandoned burrow systems. The vertebrates observed were prairie dogs, rabbits, ground squirrels, snakes, a mouse, and a salamander. The implications and possible short-comings of this study are discussed.

KEY WORDS: burrow, *Cynomys ludovicianus*, keystone species, prairie dog, rodent ecology

Proc. 22nd Vertebr. Pest Conf. (R. M. Timm and J. M. O'Brien, Eds.)
Published at Univ. of Calif., Davis. 2006. Pp. 195-197.

INTRODUCTION

Even though black-tailed prairie dog (*Cynomys ludovicianus*) numbers and occupied range have declined dramatically since the arrival of Europeans in North America, they are considered by some ecologists to be a "keystone" species (Kotliar *et al*. 2006). A keystone species' activities enhance conditions for many associated species and help maintain high levels of biodiversity (Kotliar *et al.* 2006). Over 100 species of vertebrates have been observed on prairie dog colonies. Some rare or endangered species occur principally on prairie dog colonies, including burrowing owls (*Speotyto cunicularia*), mountain plovers (*Eupoda montana*), and the highly endangered black-footed ferret (*Mustela nigripes*; Kotliar *et al*. 2006). In the urban-suburban setting, the occurrence of prairie dog colonies also provides opportunities for wildlife viewing and environmental education. Prairie dogs are being given greater protection by many states and have been considered for federal protection by the U.S. Fish and Wildlife Service (Hoogland 2006).

Unfortunately, prairie dogs can also come into conflict with humans, especially in the urban-suburban setting, where they cause vegetation and property damage (Witmer *et al*. 2003), and pose a health threat attributable to periodic plague outbreaks (Witmer 2004). Efforts to reduce conflicts can involve colony relocation or management so the prairie dog population and occupied area do not increase. Options include lethal or non-lethal removal, construction of physical barriers around the colony, and enhancement of natural predation (Witmer *et al*. 2003).

To effectively manage prairie dog colonies, a better understanding is needed of the effects of management practices on prairie dogs, their burrow systems, and the many other species of animals that may use those burrow systems. It is important that we have a better understanding of animal use of prairie dog colonies because of 1) biodiversity and conservation issues, 2) the potential for toxicants, especially fumigants, to harm non-target animals that may be in those burrows, and 3) the need to better understand the hosts and transmission routes of plague.

Most of what we know of the use of prairie dog burrows by other animals has come from indirect methods: day and night direct observation of animals on the surface, observing animal "sign" (tracks, droppings) on the surface, and trapping animals on colonies (e.g., Lomolino and Smith 2003). In one case, black-tailed prairie dog burrows were excavated to learn more of the burrow physical structure and dimensions (Sheets *et al*. 1971). Our objective was to use a camera system inserted within prairie dog burrows to directly observe animals in those burrows. We included both urban/suburban and natural prairie dog colonies as well as active versus inactive colonies. Active colonies had prairie dogs present, whereas inactive colonies had no prairie dogs because they had been removed or had been killed by plague. We report the preliminary results in this paper; more detailed analyses of our finding are underway and will be published at a later date.

METHODS

We used a remote, infra-red camera system (Peep-A-Roo Video Probe, Sandpiper Technologies, Inc., Manteca, CA) to observe animals in burrow systems. The system was described in detail by VerCauteren *et al*. (2002). A 3-m cable was "snaked" into the burrow system, although roots, rocks, branching of the burrow, and deterioration of the burrow often limited penetration. Direct, real-time observation within the burrow system was made possible by video display goggles worn by the observer. Additionally, the system was wired to a video recorder so that pictures could be taken of animals. We obtained permission to use our camera system to examine a large number of burrow systems on the USDA Pawnee National Grasslands (natural prairie colonies) and within

the boundaries of the City of Fort Collins and Boulder County (urban/suburban colonies). In each setting, both active and inactive colonies were examined. At each burrow, we recorded the date, location of the colony, its nature (natural prairie or urban/suburban setting), its status (active or inactive), the maximum distance probed (m), the time spent probing (seconds), and any animals observed. Observed animals included both vertebrates and invertebrates.

RESULTS

We probed 777 burrows with our camera system. This total included 460 active burrows: 200 on natural prairie colonies and 260 on urban/suburban colonies. We also probed 317 inactive burrows: 167 on natural prairie colonies and 150 on urban/suburban colonies. On average, we could probe the burrows to about 2 m. Field crews endeavored to work quickly and quietly so as to minimize disturbance to animals. Once experienced, field crews required about 1.5 - 2 minutes to probe a burrow.

Animals were observed in 97 (12.5%) of the 777 burrows. Animals were observed somewhat more often in active burrows (52) than in inactive burrows (45). Also, animals were observed somewhat more often in urban/suburban burrows (57) than in natural prairie burrows (40).

Most of the animals observed (84.5%) were invertebrates: mainly crickets and beetles, but also a few sow bugs and spiders. Fleas were observed in a few burrows, but could not be accurately counted. The vertebrates observed were prairie dogs (10), rabbits (8), ground squirrels (2), snakes (2), a mouse (1), and a salamander (1). Additionally, based on odor, one burrow was, or had been, occupied by a skunk. In terms of total animal numbers, more animals were observed in urban/suburban burrows (97) versus prairie burrows (58). Also, somewhat more animals were observed in active (82) versus abandoned burrows (73).

Forty-two burrows were collapsed or plugged (presumably by prairie dogs) a short distance inside. We encountered substantial vegetation while probing 24 burrows, which may have represented food materials or nest sites of prairie dogs or other animals. Five burrow openings had been enlarged, perhaps by a coyote, fox, or dog.

DISCUSSION

Prairie dog burrow systems, although not particularly elaborate relative to some other rodent burrow systems, are important to the well-being of their occupants by providing shelter from inclement weather and predators, a place to feed and store food, and a place to raise young (Hoogland 2006, Kinlaw 1999). The value of this resource is evident in the rapid re-invasion rates by other animals once a burrow system is vacated. The burrow systems, including their construction and maintenance, also provide some important ecosystem functions in terms of soil aeration, soil mixing, nutrient cycling, and sites of seed germination (Kinlaw 1999).

We found very little published literature on animal use of prairie dog burrows aside from surface observations. Sheets *et al*. (1971) excavated 18 black-tailed prairie dog burrow systems in South Dakota, during the course of a black-footed ferret study. These burrow systems were not particularly complex. They usually had 2 openings, were about 12 m in length, reached maximum depths of about 2-3 m, and were about 10-15 cm in diameter. A few enlarged chambers appeared to have been nest chambers. There were a few side tunnels or pockets, some of which contained food materials. The floor of the burrows commonly contained compacted fecal pellets. Chunks of cattle manure were found; often they had been broken apart, perhaps in search of seeds or insects. Insects and their remains were commonly found in the burrows. Sheets *et al*. (1971) found little evidence of vertebrates: some bones of prairie dogs and mice were found, along with some fecal material of black-footed ferrets. It was common to find sections of the burrow that had been plugged by the prairie dogs.

We were not able to examine as much of our burrow systems as did Sheets *et al*. (1971) with their total burrow excavations. However, like Sheets *et al*. (1971), we observed relatively little vertebrate use of the burrow systems other than by prairie dogs. We observed relatively large numbers of invertebrates, which is consistent with the findings of Sheet *et al*. (1971). We also encountered collapsed or plugged portions of burrows on a relatively regular basis.

Given that the burrow system is a valuable resource to the prairie dog occupants and requires substantial effort to build and maintain, one might question why the occupants would share it with other animals. Perhaps the prairie dogs are rather indifferent to the invertebrates that access the system, or perhaps these tiny animals serve as a possible food source for the prairie dogs. But why would prairie dogs welcome or tolerate use of their burrow system by potential competitors (e.g., rabbits) or potential predators (e.g., snakes)? Hansen and Gold (1977) reported substantial overlap in the diets of prairie dogs and desert cottontail rabbits. Bull snakes (*Pituophis sayi*) and rattlesnakes prey on prairie dogs (Hoogland 2006). Perhaps the main problem prairie dogs have in this regard is in fending off competitors or predators. Several studies, however, have documented the aggressive behaviors of prairie dogs (especially males) towards snakes that approach their burrow openings, including a case of burying a snake that had entered the burrow (Halpin 1983, Loughry 1988). Prairie dogs have evolved rather complex behaviors and activities to reduce the risk of predation (Hoogland 2006). The use of artificial perches by raptors in prairie dog colonies in the Fort Collins, Colorado, area indicated substantial use by a wide array of raptors (G. Witmer, unpubl. data). Additionally, examination of the regurgitated pellets of raptors from under those perches indicated that prairie dogs were the second most common prey item (percent frequency of occurrence), second only to voles (*Microtus* spp.).

Based on our study, we conclude that prairie dog burrows are not heavily used by other animals, although it is not entirely clear how prairie dogs prevent this. VerCauteren *et al*. (2002) also observed little use of California ground squirrel burrow systems by other

wildlife. It is possible, however, that the camera system we used (the same as that used by VerCauteren *et al*. 2002) had some limitations that bias the data set: we can not probe beyond about 3 m into the burrow, and animals may be frightened by our activity and therefore retreat deeper into the burrow, beyond our viewing range. Future improvements in this technology may help overcome these limitations.

From the many surveys by other researchers, it is clear that many species of vertebrates make use of prairie dog colonies. For at least one species, the black-footed ferret, prairie dogs and their burrows are essential to the species' survival. We suspect, however, that the ferret is the exception to the rule. Nonetheless, animals usually take advantage of a good situation and we suspect that many animals will readily make use of a prairie dog burrow system once it has been vacated. Indeed, Kinlaw (1999) suggested that burrow systems go through a faunal succession of invasion and colonization.

ACKNOWLEDGEMENTS

We acknowledge Donna Dees, City of Fort Collins, Mark Brennan, Boulder County, and Mark Ball, USFS Pawnee National Grasslands, for providing us with access to prairie dog colonies for this study. This study was conducted under a study protocol approved by the USDA National Wildlife Research Center's Institutional Animal Care and Use Committee. We also thank Susan Jojola for a thoughtful review of this manuscript.

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