

MONITORING OF PRAIRIE DOGS ON BOULDER COUNTY OPEN SPACE.

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Introduction

The pressures of development along the Front Range in Colorado have led to numerous efforts to remove black-tailed prairie dogs (*Cynomys ludovicianus*) from certain areas. In an attempt to conserve these animals, great efforts have been made to relocate them to Open Space properties. These efforts are well intended, especially in light of the fact that prairie dogs have been reduced to one percent of their historic range, and The Wildlife Federation has petitioned the U.S. Fish and Wildlife Service to have the species listed. However, data are lacking on the success of these relocation efforts. For the time and expense applied to relocations, it would be useful to see have some measure of success. Much of the existing long-term research on prairie dogs has been conducted on undisturbed populations, far from urban centers. There is a real gap in our knowledge on prairie dog populations in a mixed urban/agricultural landscape with the combination of pressures that ensue.

The purpose of this monitoring project is to work hand-in-hand with the County's prairie dog relocation efforts to provide some indication of the success of these efforts.

The general research questions relate to how visual count densities and behavior at translocation sites compare with control sites. Other factors include whether prairie dogs were held in confinement prior to release or released at the new site the day of capture; whether animals were released adjacent to existing colonies or more isolated; and how much dispersal occurs to adjacent colonies. Because relocation requests came in from the public and required quick response, it was not possible to have total control over experimental design parameters. Consequently, we tracked relocation efforts and made comparisons as best we could, given these constraints.

Methods

Black-tailed prairie dog populations are amenable to density estimation by visual counts due to their diurnal activity patterns, large size, propensity to live in relatively well-defined social colonies and habit of clipping vegetation within the colony. Visual counts are a



reliable and relatively rapid means of assessing density of prairie dog populations (Biggins et al. 1993; Fagerstone and Biggins 1986; Menkens et al 1990; Powell et al 1994; Dave Seery, personal communication) and are less labor intensive than mark-recapture techniques or counting plugged and reopened burrows. However, because they are fossorial and not all aboveground simultaneously, an index of density associated with actual abundance, rather than an absolute density, must be calculated (Caughley 1977). Fagerstone and Biggins (1986) found that visual counts and mark-recapture density estimates of white-tailed prairie dogs (*C. leucurus*) were significantly correlated ($r=0.95$) and Knowles (1982) found that maximum visual counts of prairie dogs corresponded well with actual counts.

Maximum counts of prairie dogs correspond well with population levels (Fagerstone and Biggins 1986, Knowles 1982). Analysis can be straightforward as long as the assumptions are met and counts are made of entire colonies rather than by sampling. The highest number of prairie dogs recorded during the three-day count period is the number to be used. If there are several sections per colony, then the sum of the maximum counts is used to obtain a colony count (Fagerstone and Biggins 1986; Menkens et al. 1990; Seery, personal communication). The maximum count made during any count period yields a minimum population estimate for that colony since it is likely that not all animals are above ground at the same time. The highest count for each colony is divided by the area of the colony to determine an index of density for the colony (individuals/ha). These two figures (minimum population estimate and density index) can be used to compare populations between colonies and among years within a colony.

An initial visit was made to each site in order to place perimeter stakes to demarcate the perimeter of each site; the perimeter was also walked to code GPS points in order to develop area measurements. Area was determined using program Maptech Terrain Navigator (coverage of Colorado Northcentral). The entire site was counted from one observation post. Sites were scanned with binoculars. Counters (field crew, volunteers, and student interns) sat in the observation spot for 15 minutes before starting the count, to minimize the effects of human disturbance. The number of prairie dogs visible at each 15-minute point was tallied.

Each site was counted for three consecutive days of good weather (no rain, wind <10 mph, temperature between 10 and 27 degrees Centigrade and cloud cover <75%) (Fagerstone and Biggins 1986, Powell et al. 1994, Tileston et al. 1966). Visual counts started one-half hour after sunrise and continued until numbers began to decrease (approximately midmorning or 3.5 hours), or at the end of the day for 3.5 hours preceding sunset. Counts were taken at 15-minute intervals. Intervals between counts were used for behavioral observations. There were two observers, minimum, per site and a site consisted of one plot. There were approximately 10-12 counts made per daily count period (morning or evening). All sites except Mayhoffer North had one observation post with a view of the whole count area. At Mayhoffer North, two observation posts were used with mutually exclusive viewsheds. Counts for this site were summed. Baseline

counts were conducted in June, and translocation counts were conducted 4–6 weeks subsequent to translocations.

The behavioral observations were collected by scan sampling (Altmann 1974) during the 15 minutes in between visual counts. A bout of behavioral observations was conducted with each visual count; each such bout contained three or five observation scans, conducted about two minutes apart. The observation scan noted the specific behavior (from a list of possible behaviors, see Appendix) of five prairie dogs. Thus a bout of observations contained 15 (3 scans of 5 dogs each) or 25 (5 scans of 5 dogs each) behavioral observations, and a behavioral observation is simply the notation of a particular behavior being conducted by one prairie dog. Because we encouraged student interns and volunteers to join us, there was some variation in the number of observers, which affected the total number of behavioral observations. Behavioral observations were started at different locations (right side of site, left side of site, center, etc.) in order to collect data from as many different animals as possible. It is possible, however, that a particular individual would be tallied more than once.

Results and Discussion

A total of 664 prairie dogs were translocated to four release sites in Boulder County during summer and fall 2000. The release protocol (whether animals were maintained in captivity prior to release), dates of release, number of animals translocated, burrow type into which the animals were released, and presence of adjacent colonies is presented in Table 1. Prairie dogs were initially kept in captivity in an attempt to release entire coterries and colonies together. However, problems resulted when juveniles were easily captured but adults evaded capture for long periods of time causing some animals to remain in captivity for as long as a month (Table 1). For the last translocation, at Rabbit Mountain, animals were translocated on the day of capture and were not marked. Locations for release, in regard to proximity of adjacent colonies, were mostly a matter of availability of abandoned colonies (typically from previous plague outbreaks).

At Rabbit Mountain, dogs were released upon day of capture into existing abandoned burrows with an adjacent town within 200 m; at Coalton Trail (also called Mayhoffer South), dogs were held in captivity an average of 28 days and released into existing burrows, some of which had to be augured open, with an adjacent existing colony; at Mayhoffer Dead Cow, dogs were held in captivity an average of 19 days and released into existing burrows within 50 m of adjacent colonies; at Mayhoffer North, dogs were held in captivity an average of 16 days and released into abandoned burrows and artificial holes, with an adjacent town 50 m distant.

Counts

The mean density of prairie dogs on the control sites at Platte/Centennial was 6.9 animals/acre (17.0 animals/ha). This compares with much lower densities at the translocation sites of 4.1/acre, 2.8/acre, 3.5/acre, and 2.2/acre for Rabbit Mountain,

Coalton Trail, Mayhoffer Dead Cow, and Mayhoffer North, respectively (Table 2). These densities, from visual counts, represent the minimum number of animals present, as mentioned in the Methods section. The density for Mayhoffer Dead Cow is confounded because the area included in the counts contained the small translocation site at the northwest corner and a larger area with an existing colony. In sum, these data do indicate a lower density of prairie dogs at the relocation sites the fall succeeding translocation efforts.

Although represented only by a sample size of one, the release at Rabbit Mountain on the day of capture was associated with the highest count density (4.1 animals/acre) of all the release sites. These data, albeit preliminary, suggest that releasing animals on the day of capture may result in improved retention success.

At Rocky Mountain Arsenal, researchers found that releasing a minimum of 60 animals/site was recommended in order to increase the potential for success in relocation efforts (Robinette et al. 1995). All of the present relocations involved more than 60 animals per site. They further indicate that one year after release, the sites with 60 translocated animals were the only ones to have more survivors and progeny than original number of dogs released. Following this line of thinking, the success of translocation efforts may best be evaluated one year subsequent to the release, even in light of the exceedingly small numbers of marked animals observed. In New Mexico, success of translocations was improved by moving coterie together, using abandoned burrows, provisioning, and enclosing the site (Truett and Savage 1998). The present efforts did maintain coterie integrity and used abandoned burrows when possible. Food provisioning may be worthy of consideration in future efforts.

Temporal and geographic variation in disease, survival, and reproduction, even in undisturbed populations, are inherent in the system. Thus it must be recognized that these data are preliminary, and replicates over time and of additional sites will be necessary to draw substantive conclusions. Plague epizootics are well known in this region, and add an element of uncertainty to long-term plans.

Behavior

Behavioral data were collected for the purpose of assessing potential behavioral differences between resident (control sites) and translocated prairie dogs. The percent occurrence of 16 behaviors is shown in Tables 3, 4, and 5. The largest difference was seen in Play, which was 4%, 7%, and 1% at the control sites compared with 0%, 0%, 1%, and 0% at the relocation sites. This is likely due to the fact that the control site observations were conducted in June, whereas the relocation sites were sampled later in the season. The pups are probably most playful in June, before they move into adulthood. Translocated dogs showed a higher percentage of Alert and Call behaviors and lower percentages of Travel behavior. These data suggest that they are less settled and more cautious in their new surroundings. The vegetation is likely taller at translocation sites, which may increase predation risk and cause for an increase in alarm calls. In fact, many raptors were observed at the Coalton Site. The lower percent occurrence of Travel in

translocated dogs may be the result of the disruption and the fact that coterries may be smaller as they have not had as long to get settled and grow in their new environment. Prairie dogs at the control sites showed slightly higher percentages of Burrow Active; no immediate interpretation of this difference is apparent. Interestingly, the percent occurrence of calls at Mayhoffer Dead Cow were low, and comparable to the control sites; in fact, Mayhoffer Dead Cow as sampled was more equivalent to a control site (see Counts, above).

Another study found that translocated prairie dogs were more sensitive to human intruders, exhibiting nearly twice the distance sensitivity to intrusion (Farrar et al. 1998). This element was not an issue in the present study, as all colonies sampled were not near trails or other areas with human intruders.

Sample sizes for the behavioral data were good (6,384 and 3,887 behavioral observations for control and relocation sites, respectively). The behavioral differences appear to present a subtle effect of potential stresses on relocated animals, as measured here. Subsequent comparison of confidence intervals of the means may be useful. Although aggression may result when prairie dogs are translocated to the periphery of existing colonies (Hoogland 1979, 1995, 1996), we did not see an increased frequency of occurrence of Chase behaviors with translocated animals (Tables 3, 4, 5).

Marked Animals

Very few of the translocated prairie dogs were seen during visual counts or behavioral observations. No animals were marked at Rabbit Mountain (and thus none were seen), 5 were seen at Coalton Trail, 2 were seen at Mayhoffer Dead Cow, and none were seen at Mayhoffer North. Although these numbers are incredibly low in contrast to the number of animals released (Table 1), it may take at least one year before an evaluation should be made, as discussed above.

Adjacency and Dispersal

It was not possible to release dogs to an isolated site; all sites had existing dogs within 200 m. Nor was it immediately apparent to what extent prairie dogs dispersed to the adjacent colonies. It is clear that the vast majority of marked animals (424 out of 431) disappeared. Radio-telemetry would be an excellent technique to tease apart disappearance due to predation versus dispersal.

Summary

Visual counts and behavioral observation were conducted on three control and four relocation sites of prairie dogs in Boulder County during 2000. Of the 431 dogs marked and released at three relocation sites, only seven marked dogs were seen at two of the sites. The mean visual count density of prairie dogs on the control sites at Platte/Centennial was 6.9 animals/acre (17.0 animals/ha). This compares with much lower densities at the translocation sites of 4.1/acre, 2.8/acre, 3.5/acre, and 2.2/acre for Rabbit

these included neighboring colonies

Mountain, Coalton Trail, Mayhoffer Dead Cow, and Mayhoffer North, respectively. Dogs were probably lost to a combination of predation and dispersal to adjacent colonies. Although these results are discouraging in relation to the efforts extended to the relocation efforts, it may well take a year or more before meaningful evaluations can be established. Behavioral data suggest some subtle differences, suggesting that translocated dogs are more alert, call more frequently, and travel less than dogs in control colonies.

References

- Altmann, J. 1974. Observational study of behaviour: Sampling methods. *Behaviour*, 49:227-267.
- Biggins, D.E., B.J. Miller, L.R. Hanebury, B. Oakleaf, A.H. Farmer, R. Crete and A. Dood. 1993. A technique for evaluating black-footed ferret habitat. Pp. 73-88, *In* Management of Prairie Dog Complexes for the Reintroduction of the Black-footed Ferret. US Department of the Interior, Biological Report 13, July 1993.
- Caughley, G. 1977. *Analysis of Vertebrate Populations*. Wiley, New York.
- Fagerstone, K. and D.E. Biggins. 1986. Comparison of capture-recapture and visual count indices of prairie dog densities in black-footed ferret habitat. *Great Basin Naturalist Memoirs* #8. The Black-footed Ferret. Pp. 94-98.
- Farrar, J.P., K.L. Coleman, M. Bekoff, and E. Stone. 1998. Translocation effects on the behavior of black-tailed prairie dogs (*Cynomys ludovicianus*). *Anthrozoos*, 11(3):164-167.
- Hoogland, J.L. 1979. Aggression, ectoparasitism, and other possible costs of prairie dog (*Sciuridae: Cynomys* spp.) coloniality. *Behaviour*, 69:1-35.
- Hoogland, J.L. 1995. *The black-tailed prairie dog: social life of a burrowing mammal*. The University of Chicago Press, Chicago, Illinois. 557 pp.
- Hoogland J.L. 1996. *Cynomys ludovicianus*. *Mammalian Species*: 535:1-10.
- Knowles, C.J. 1982. Habitat affinity, populations and control of black-tailed prairie dogs on the Charles M. Russell National Wildlife Refuge. Unpublished dissertation. Univ. of Montana, Missoula. 171 pp.
- Menkens, G.E, D.E. Biggins and S.H. Anderson. 1990. Visual counts as an index of white-tailed prairie dog density. *Wildlife Society Bulletin*, 18(3), pp. 290-296.
- Powell, K.L., R.J. Robel, K.E. Kemp and M.D. Nellis. 1994. Above-ground counts of black-tailed prairie dogs: temporal nature and relationship to burrow entrance density. *Journal of Wildlife Manage.* 58(2), pp. 361-366.
- Robinette, K.W., W.F. Andelt, and K.P. Burnham. 1995. Effect of group size on survival of relocated prairie dogs. *Journal of Wildlife Management*, 59(4):867-874.
- Tileston, J.V. and R.R. Lechleitner. 1966. Some comparisons of the black-tailed and white-tailed prairie dogs in north-central Colorado. *The American Midland Naturalist*. 75(2), pp. 292-316.
- Truett, J.C. and T. Savage. 1998. Reintroducing prairie dogs into desert grasslands. *Restoration and Management Notes*, 16:189-195.

Table 1. Prairie dog release protocols and treatment details for four relocation sites, Boulder County, field season 2000.

SITE (Size)	Release Protocol and Dates	No. of Animals Translocated	Burrow Types	Presence of Adjacent Colonies	Comments
Rabbit Mountain (13.17 acres)	Released upon day of capture, not held in captivity. Releases from Colp up until 10/10; releases from Hillside 10/23 to 11/1. A couple of animals released during monitoring	233 (170 from Colp, 63 from Hillside Estates). Dogs not marked.	Existing abandoned burrows (approximately 60 available); some had collapsed and were opened with auger and hand tools.	Adjacent town approx. 200 m to the east. A handful of dogs had moved into burrows closer to the release site from the time of initial scouting in June until the week releases began.	Animals translocated up until day before counts were made. As of 11/29, prairie dogs had dug about 10 new burrows on west side of site. Late season translocations, no obvious badger predation.
Coalton Trail (6.10 acres)	Held in captivity an average of 28.4 days (range=5-48 days). First release 6/28, last release 7/24	127 All dogs marked.	Existing burrows used (approx. 60 at beginning of season); many augured back open; problems with keeping released dogs from occupying all remaining burrows planned for other releases. At west/southwest end of existing colony.	Adjacent to existing town. All burrows were at extreme west end, separated from main colony by 100 m. Releases had been done in existing town in 1999.	First release site, had relocated dogs on it the longest time this season. A badger preyed on released dogs within 24 hours in many instances.

Table 1 (cont.). Prairie dog release protocols and treatment details for relocation sites, Boulder County, field season 2000.

SITE (Size)	Release Protocol and Dates	Number of Animals Translocated	Burrow Types	Presence of Adjacent Colonies	Comments
Mayhoffer Dead Cow (28.09 acres)	Held in captivity an average of 19 days (range=6-77 days). First release 8/4, last release 8/16.	87 All dogs marked.	All existing burrows (approx. 20)	Within approximately 50 m of each of two colonies present in 1999.	Animals were released at upper end of slope where yucca and other vegetation obstructed visibility.
Mayhoffer North (8.31 acres)	Held in captivity an average of 16 days (range=2-29 days). First release 9/1, last release 10/15.	217 All dogs marked.	Initial releases were into approx. 30 abandoned burrows, mostly on west side of existing town, some towards southern edge. Remaining releases into artificial holes created with Ditch Witch and using wooden boxes and plastic tubing (approx. 70 holes dug, approx. 40 used to date).	Adjacent town 50 m east of release. This town present in 1999, and had dogs released on its edges. Most of releases in existing burrows were close (50 m), and releases to artificial burrows were further west (75-100 m).	There are prairie dogs about 20 m to the east of this site. Also, electric fence occurs at east end of this site, to exclude cattle. Badger got into some release boxes at end of releases.

Table 2. Visual high counts, area, and density of prairie dogs at seven sites on Boulder County Open Space, June – November, 2000.

Site	Dates of Counts (Release dates)	High Count And (Number of Animals Translocated)	Area in Acres And (Hectares)	Density Per Acre and (Per Hectare)
Platte Centennial South	6-8 June	124	12.97 (5.25 ha)	9.6/acre (23.6/ha)
Platte Centennial West	6-8 June	84	11.44 (4.63 ha)	7.3/acre (18.1/ha)
Platte Centennial Central	6-8 June	99	26.71 (10.81 ha)	3.7/acre (9.2/ha)
Rabbit Mountain	29 October- 2 November (October)	54 (233)	13.17 (5.33 ha)	4.1/acre (10.1/ha)
Coalton Trail	25-27 July (July)	17 (127)	6.10 (2.47 ha)	2.8/acre (6.9/ha)
Mayhoffer Dead Cow	30 September- 2 October (August)	98 (87)*	28.09 (11.37 ha)	3.5/acre (8.6/ha)
Mayhoffer North	20-22 November (Sept/Oct)	18 (217)	8.31 (3.36 ha)	2.2/acre (5.4/ha)

Note: The highest visual count (High Count) is considered a reasonable measure for the low end population estimate. Mean for Platte/Centennial = 6.9 animals/acre (17.0/ha).

* The 87 animals were released onto the northwest corner of the 28.09 acre (11.37 ha) count area. Thus the counts reflect the density of the whole count are, not just the smaller area onto which animals were translocated.

Table 3. Behavioral observations at the three control sites on Boulder County Open Space: Platte Centennial Properties (South, West, and Central).

Platte Centennial, South 1304 Observations June 2000		
Alert	183	14%
Vigilant	47	4%
Feeding	658	50%
Burrow Active	118	9%
Resting	29	2%
Traveling	85	7%
Running	28	2%
Greeting	24	2%
Playing	58	4%
Grooming	4	0
Calling	41	3%
Digging	1	0
Underground	9	0
Not Visible	5	0
Fight	0	0
Chase	11	1%

Platte Centennial, Central 1436 Observations June 2000		
Alert	270	19%
Vigilant	132	9%
Feeding	759	53%
Burrow Active	60	4%
Resting	12	1%
Traveling	122	8%
Running	14	1%
Greeting	12	1%
Playing	16	1%
Grooming	1	0
Calling	15	1%
Digging	1	0
Underground	6	0%
Not Visible	8	1%
Fight	0	0
Chase	8	1%

Platte Centennial, West 1077 Observations June 2000		
Alert	106	10%
Vigilant	115	11%
Feeding	472	44%
Burrow Active	91	8%
Resting	38	4%
Traveling	75	7%
Running	23	2%
Greeting	24	2%
Playing	71	7%
Grooming	5	0
Calling	31	3%
Digging	1	0
Underground	7	1%
Not Visible	0	0
Fight	6	1%
Chase	8	1%

Table 4. Behavioral observations at four experimental relocation sites on Boulder County Open Space: Rabbit Mountain, Coalton Trail, Mayhoffer Dead Cow, and Mayhoffer North.

Rabbit Mountain, 799 Obs. October-November 2000		
Alert	127	16%
Vigilant	71	9%
Feeding	425	53%
Burrow Active	23	3%
Resting	6	1%
Traveling	26	3%
Running	15	2%
Greeting	1	0
Playing	2	0
Grooming	1%	0
Calling	77	10%
Digging	3%	0
Underground	1	0
Not Visible	12	2%
Fight	0	0
Chase	5	1%

Mayhoffer Dead Cow 750 Obs., September-October		
Alert	179	24%
Vigilant	66	9%
Feeding	300	40%
Burrow Active	34	5%
Resting	32	4%
Traveling	40	5%
Running	28	4%
Greeting	4	0.50%
Playing	5	0.70%
Grooming	5	0.80%
Calling	10	1%
Digging	1	0.10%
Underground	7	0.90%
Not Visible	39	5%
Fight	0	0
Chase	0	0

Coalton Trail 2037 Observations, July 2000		
Alert	258	13
Vigilant	81	4%
Feeding	858	42%
Burrow Active	107	5%
Resting	57	3%
Traveling	42	2%
Running	30	1%
Greeting	10	0
Playing	4	0
Grooming	13	1%
Calling	178	9%
Digging	12	1%
Underground	35	2%
Not Visible	333	16%
Fight	0	0
Chase	18	1%

Mayhoffer North 301 observations, November		
Alert	50	17%
Vigilant	17	6%
Feeding	95	32%
Burrow Active	7	2%
Resting	2	1%
Traveling	7	2%
Running	9	3%
Greeting	2	1%
Playing	0	0
Grooming	1	0
Calling	17	6%
Digging	1	0
Underground	5	2%
Not Visible	87	29%
Fight	0	0
Chase	1	0

Table 5. Percent occurrence of select behaviors across control and relocation sites, Boulder County Open Space, June through November 2000.

	CONTROL SITES			RELOCATION SITES			
	Platte Centennial South	Platte Centennial West	Platte Centennial Central	Rabbit Mountain	Coalton Trail	Mayhoffer Dead Cow	Mayhoffer North
Number of Observations	3817	1077	1436	799	2037	750	301
Month	June	June	June	Oct/Nov	July	Sept/Oct	November
Behavior							
Alert	14	10	19	16	13	24	17
Vigilant	4	11	9	9	4	9	6
Feed	50	44	53	53	42	40	32
Burrow Active	9	8	4	3	5	5	2
Rest	2	4	1	1	3	4	1
Travel	7	7	8	3	2	5	2
Play	4	7	1	0	0	1	0
Call	3	3	1	10	9	1	6
Chase	1	1	1	1	1	0	0

APPENDIX

Description of Prairie Dog Behaviors

DESCRIPTION OF PRAIRIE DOG BEHAVIORS

ALERT Standing vertical, often on mound, front legs not touching ground

VIGILANT On all fours, but head up and observant

FEEDING/FORAGING Acquiring food; sometimes an animal might appear "ALERT", but is in fact feeding; sometimes an animal appears to be digging but it actually foraging for roots.

BURROW ACTIVE Mucking about at the burrow entrance

DIG Digging, typically for mound improvement/housekeeping.

RESTING Lying down with head on ground

TRAVELING Moving along, but not chasing, being chased, or playing

GREETING Greeting another animal, including "kissing"

PLAYING Typically seen only in young, interacting with another individual in a playful manner

GROOMING Grooming self or another individual

CALLING Vocalizing, including alarm calls

FIGHT Engaged in a fight with another animal

CHASE/RUNAWAY Engaged in a chasing bout with another animal; different from traveling in that intensity and speed are heightened

NOT VISIBLE This category would be used if you have fewer than 5 animals in your viewshed, and you don't know where the remaining animals are; includes animals that might be underground, but you didn't see them go under

UNDERGROUND Used only if you saw an animal go underground