

Assessment of Black-tailed Prairie Dog Colonies for Reintroduction of Black-footed Ferrets in Western Oklahoma

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We conducted a partial evaluation of black-tailed prairie dog (*Cynomys ludovicianus*) colonies and complexes in western Oklahoma as possible reintroduction sites for the endangered black-footed ferret (*Mustela nigripes*). We applied a standardized survey technique to Oklahoma's two largest complexes of black-tailed prairie dogs to estimate carrying capacities for the black-footed ferret. Complexes were delineated from topographic maps and their juxtapositions and areas measured. On four of the colonies, we ran 73 1-km × 3-m transects and tallied numbers of active (i.e., fresh feces present) and inactive (i.e., fresh feces absent) burrows. These data permitted calculation of prairie dog populations and estimation of the number of ferret families that could be supported within each complex. The complex on Oklahoma Land Commission property in northwestern Cimarron County was comprised of six colonies on 594 ha. The estimated 16,167 prairie dogs within the complex could support about 21 ferret family groups (i.e., 21 breeding females, their young of the year, and 10-11 males). The complex on Rita Blanca National Grassland in southwestern Cimarron County consisted of eight colonies on 365.5 ha. We estimated a prairie dog population of 6,503 for that complex, with a carrying capacity of about 8.5 ferret family groups. Sylvatic plague (*Yersinia pestis*) struck the largest colony on Oklahoma Land Commission property during fall 1991 and leasees reported seeing no prairie dogs there during the months that followed. The Rita Blanca National Grassland complex experienced a similar outbreak of plague in 1992. As a result, reintroduction of black-footed ferrets cannot be recommended.

INTRODUCTION

Black-footed ferrets once ranged throughout mixed grass and shortgrass regions of the plains from Texas to Canada. The species became endangered as a result of widespread eradication of prairie dogs, which deprived the ferret of food and shelter in burrow networks essential for its survival. Following the disappearance of the last known ferret population in 1974, a series of extensive surveys failed to produce evidence that the species still survived. By chance, a population was discovered near Meeteetse, Wyoming, in September 1981 (1). The population was estimated at 128 individuals and was studied until its demise from an outbreak of canine distemper in 1986. Eighteen surviving ferrets were captured and placed in a captive propagation program (2). The present captive population is descended from those founders.

In Oklahoma, the historic range of the ferret presumably lay within the mixed grass and shortgrass prairies and encompassed roughly the western half of the main body of the State plus the Panhandle (3-5). As prairie dogs were controlled or eradicated, ferrets declined in Oklahoma as elsewhere. A few ferrets may have occurred in the Oklahoma Panhandle as recently as the early 1970s; Lewis and Hassien (4) found plugged burrows, trenches, and other signs similar to those made by ferrets in South Dakota. In addition, they concluded that 63 sightings of ferrets reported by local residents may have been authentic.

Although black-tailed prairie dogs have declined statewide, they have increased in recent years in the western half of the Panhandle. A 1967 survey (9) revealed 3,809 ha of colonies throughout Oklahoma of which 42% occurred in the Panhandle. Colonies in Cimarron County expanded by 45% by 1971 and in Texas County by an estimated 332% by 1973 (3). By 1989, prairie dogs had increased over the 1967 levels by an estimated 705% in Cimarron County and 404% in Texas County (6). Colonies in the Panhandle showed some instability, how-

ever, because only 39% of those mapped in 1967 survived through 1989 (6).

As black-footed ferret numbers have increased in captivity, plans have been developed for reintroducing them into the wild in suitable prairie dog colonies. Biggins et al. (7) drafted detailed methodology for evaluating prairie dog colonies and complexes as potential reintroduction sites. The method generates an estimate of the densities of active burrows within colonies and allows for linking colonies into complexes within the known movement radius of black-footed ferrets. A curvilinear formula is then used to convert burrow density into an estimate of prairie dog numbers. This methodology was developed for white-tailed prairie dogs (*Cynomys leucurus*) in the Meeteetse complex, where the last known wild population of black-footed ferrets occurred. The regression formula was recently modified to permit calculation of densities of black-tailed prairie dogs (*D. Biggins, pers. commun.*).

Our objectives were to: 1) evaluate known black-tailed prairie dog colonies in western Oklahoma as possible reintroduction sites for black-footed ferrets using the guidelines established by the Black-footed Ferret Interstate Coordinating Committee, and 2) assess prairie dog colonies in the adjoining states of Texas, Colorado, and Kansas when such towns are within 7 km of those in Oklahoma.

STUDY AREA AND METHODS

Following a detailed, statewide survey of prairie dog colonies in 1987-89 (6), Shackford (8) recommended three portions of Cimarron County, Oklahoma, and adjacent political units as potential reintroduction sites for black-footed ferrets. We focused our work on three complexes: 1) a complex of colonies that extended from just east of Boise City through the southeastern portion of Cimarron County and into western Texas County, Oklahoma; 2) a complex of colonies on public lands administered by the Oklahoma Land Commission (OLC) located in northwestern Cimarron County and possibly extending into the Comanche National Grassland across the Colorado state line; and 3) a complex of colonies on Rita Blanca National Grassland (RBNG) in southwestern Cimarron County possibly extending across the Texas state line.

The OLC complex lies on shortgrass prairie interspersed with canyons and mesas. Shallow, rocky soils render most of the complex unsuitable for cultivation. Cattle are grazed under contract with the OLC. In terms of roads and amount of vehicular traffic, the OLC complex is the most remote of the three surveyed. The RBNG complex consists of shortgrass prairie administered by the U.S. Forest Service. Federal holdings are interspersed with private lands at about a 1:1 ratio; some of the private lands are under cultivation. The U.S. Forest Service permitted grazing of cattle under lease agreements. The complex in southeastern Cimarron County lies principally on private land, virtually all of which is either under cultivation or grazed.

Maps and descriptive data (6, 8) were used to locate prairie dog colonies. Individual colonies that we mapped retain the numbers originally assigned by Shackford (8). Boundaries of colonies were plotted on USGS topographic maps (1:24,000) using a combination of permanent features, compass bearings, odometer distances, and distances measured by Rolatapes (i.e., singlewheeled instruments that record distances traveled to the nearest meter). Dot grids were used to determine areas of colonies. Colonies were measured only if they were part of the same complex; i.e., if the distance between colonies was ≤ 7 km (7).

Burrow densities were measured along 1-km \times 3-m transects that were systematically placed at 60-m intervals. Rolatapes were used to measure length of survey lines and distances between them. A 3-m wide strip of conduit pipe attached across each Rolatape helped determine if a given burrow was inside or outside of the transect (7). Whenever a burrow lay on the edge of a transect, it was counted only when $> 50\%$ of its opening lay inside the line.

Although Shackford et al. (6) and others have used a combination of criteria to distinguish between active and inactive burrows, the sole criterion used in our investigation was the presence of fresh prairie-dog feces within 0.5 m of the burrows opening (7). If no fresh feces were found, or if only light-colored, dried feces were present, the burrow was tallied as inactive. "Good" habitat for ferrets within a black-tailed prairie

dog colony has ≥ 12 active burrows/ha (D. Biggins, pers. commun.). The ratio of active:inactive burrows is regarded as a reliable indicator of the health of a colony (7).

Conversion of active burrow densities to prairie dog densities was based on intensive field studies involving repeated observations of marked and unmarked animals (7). For white-tailed prairie dogs at Meeteetse, a curvilinear regression equation was used. More recent studies on black-tailed prairie dogs have revealed that a simple linear regression through the origin (i.e., $0.31625 \times$ active burrow density) best estimates the relationship between active burrow densities and actual densities of prairie dogs (D. Biggins, pers. commun.).

Carrying capacity for black-footed ferrets was derived from the energetic requirements of a ferret family group, which consisted of 1 breeding female, her young of the year, and 0.5 breeding males. These estimates take into account such factors as weights of prairie dogs, proportion of prairie dogs actually consumed, rates of production, rates of natural losses, and area requirements of ferrets. The model predicted that 763 prairie dogs were needed in the midsummer to sustain 1 ferret family group (7).

RESULTS

We investigated the complex in southeastern Cimarron County and western Texas County and determined that it was not suitable for further consideration. Aside from a few scattered holdings by the Oklahoma Land Commission, the complex occurs on private ranchlands. We surveyed Shackford's (8) colony #109, one of the largest in the complex, and found that it had been reduced to only half the area reported. The owner told us that he routinely poisoned prairie dogs - the most likely reason for the colony's decline. In addition, we were denied permission to survey colonies on the area's largest ranch, which suggested negative attitudes toward prairie dogs and presumably ferrets. Overall, we could locate only about half of the colonies surveyed by Shackford in 1988-89 within this complex, which indicated considerable instability, likely caused by poisoning and/or disease.

We measured 4 prairie dog colonies encompassing 676.1 ha in June and July, 1991. We selected the largest colonies at the OLC and RBNG complexes and sampled between 2.58 and 4.89% of their areas. Seventy-three 1-km \times 3-m transects were run to assess densities of prairie dogs. Colony #32 in the OLC complex covered 457.3 ha. Forty-four of 45 transect lines on Colony #32 contained densities of ≥ 12 active burrows/ha, which is considered "good" ferret habitat (7). Average density of active burrows was 95.9 ± 5.96 (95% C.I.) / ha for an estimate of 30.3 prairie dogs/ha. The total population for the colony was estimated at 13,550, or sufficient to support 17.8 ferret family groups (Table 1).

Colony #33 was located in the OLC complex and covered 67.5 ha. All 11 transects passed through "good" ferret habitat and densities of active burrows averaged 60.6 ± 18.59 (95% C.I.) / ha. Average density of prairie dogs was 19.2/ha, and the estimated population size for the colony was 1,296, or enough to support 1.7 ferret family groups (Table 1). The ratio of active:inactive burrows (1.18:1.00) on colony #33 was less than that on Colony #32 (4.37:1.00). Substantially higher counts of active burrows occurred along the north and east sides of Colony #33 (the 2 most NE transects averaged 36 active burrows each, or 120/ha; the 2 most SW transects averaged 15 active burrows, or 50/ha).

Prairie dogs were present on the smaller colonies in the OLC complex, but they were not censused. If their densities were

TABLE 1. Estimated densities of burrows and prairie dogs in Colonies #32 and #33, Oklahoma Land Commission Complex, Cimarron County, Oklahoma.

	#32	#33
Portion in 'good' habitat (%)	97.8	100
Area (ha)	457.3	67.5
Total transects (number)	45 ^a	11
Portion sampled (%)	2.95	4.89
Mean burrow density (active burrows/ha)	95.9	60.6
C.I. (95%) of burrow density	89.6-101.6	42.0-79.2
Ratio (active burrows: inactive burrows)	4.37:1.00	1.18:1.00
Estd. prairie dog density (average prairie dogs/ha)	30.3	19.2
Estd. prairie dog population	13,550	1,296
Ferret family-groups supportable (number)	17.8	1.7

^a Results from one transect were below the minimum acceptable density for good ferret habitat and were not included in subsequent calculations (7).

the same as on Colony #33 (a conservative estimate), the four colonies would have a population of 1,334. The total population estimate for the complex would then be 16,167, or enough to support 21 ferret family groups (Table 2). Officials of the U.S. Forest Service supplied a recent map of prairie dog colonies on the Comanche National Grassland, Colorado. Only one colony of about 10 ha was within 7 km of the OLC complex.

The complex at RBNG consisted of 7 colonies on 365.5 ha. On Colony #4, we tallied an average density of active burrows of 71.3 ± 17.49 (95% C.I.) / ha, or an average prairie dog density of 22.5/ha. The estimated population size for the colony was 1,308 (Table 3). The density of active burrows in Colony #20 was 73.7 ± 17.97 (95% C.I.) / ha, which was similar to that of Colony #4. The estimated population for the 81.5 ha colony was 1,375, or enough to support approximately 1.8 ferret family groups (Table 3).

Prairie dogs were observed but not censused on the other colonies within the RBNG complex. If their population densities were similar to those of colonies #4 and #20, the total prairie dog population for the complex would be 6,503, or sufficient to support 8.5 ferret family groups (Table 2). Officials of the U.S. Forest Service from RBNG indicated that a large colony had occurred on private land along a public road approximately 3-4 km south of #20 across the Texas state line. We were unable to locate the colony and concluded that it no longer existed. No other colonies were found on the Texas side of the state line within 7 km of the RBNG complex.

DISCUSSION

Our results using the standardized methods of Biggins et al. (7) yielded higher estimates of prairie dog populations than did the methods used by Shackford et al. (6). Although the two studies found generally similar densities of active burrows, Shackford et al. (6) used Tyler's (9) estimate of 9 prairie dogs/ha and employed the ratio of 9.8 burrows/prairie dog when determining densities of active burrows. The method that we used was based on mark-recapture studies (D. Biggins, unpubl. data) and relied on direct conversion of active burrows to prairie dogs by multiplying the former by 0.31625. Our estimate of the population size for colony #32 was 13,550 but the method of Shackford et al. (6) would estimate 4,116 from the area of Colony #32 or 4,461 from burrow counts.

The Black-footed Ferret Interstate Coordinating Committee provides guidelines to compare complexes relative to their suitability for reintroduction of ferrets (7), but some of the criteria are subjective (e.g., future resource conflicts) and for others, we lack specific data to make judgements (e.g., canine distemper potential, abundance of other predators). Therefore, we used three criteria to compare the OLC and RBNG complexes. The first criterion was the minimum guideline of 400 ha for the total of the areas occupied by colonies in a complex (7). The second was an estimate of the minimum size, 80, for a black-footed ferret population to have a 95% chance of persisting for 100 years (10). Under isolated conditions, small populations face high risks of extinction for demographic and/or genetic

TABLE 2. Comparison of prairie dog complexes in Cimarron County, Oklahoma.

	OLC ^a	RBNG ^a
Area of complex (ha)	2,946	5,992
Total area of colonies (ha)	594.3	365.5
Portion of complex in colonies (%)	20.2	6.0
No. of colonies	6	8
Estimated no. of prairie dogs	16,167	6,503
Ferret family-groups supportable		
on largest colony (number)	17.8	1.8
on entire complex (number)	21.2	8.5

^a OLC=Oklahoma Land Commission; RBNG=Rita Blanca National Grassland.

TABLE 3. Estimated densities of burrows and prairie dogs in colonies #4 and #20, Rita Blanca National Grassland, Cimarron County, Oklahoma.

	#4	#20
Portion in good habitat (%)	83.3	72.7
Area (ha)	69.8	81.5
Total transects (number)	6 ^a	11 ^b
Portion sampled (%)	2.58	4.05
Mean burrow density (active burrows/ha)	71.3	73.3
C.I. (95%) of burrow density	53.8-88.8	57.3-89.3
Ratio (active burrows: inactive burrows)	2.05:1.00	3.06:1.00
Estd. prairie dog density (average prairie dogs/ha)	22.5	23.2
Estd. prairie dog population	1,308	1,375
Ferret family-groups supportable (number)	1.7	1.8

^a One (^b Three) transect(s) yielded results below the minimum acceptable density for good ferret habitat and were not included in subsequent calculations (7).

reasons. Black-footed ferrets are especially susceptible to common infectious diseases, including rabies and canine distemper, which add to the risk of extinction in small, isolated populations. Our third criterion was based on changes in the areas occupied by colonies between Shackford's (8) surveys of 1988-89 and ours.

At 594.4 ha, the area of colonies in the OLC complex exceeds the 400 ha minimum recommended for ferret reintroduction (7). The estimated 21 ferret family groups at the OLC complex converts to about 84 animals [21 females plus litters totaling about 52.5 (2.5/female) and 10.5 males], which meets the minimum size for a reasonable chance of persistence. Between Shackford's 1988-89 survey and ours in 1991, the area occupied by the six colonies within the OLC has increased by 74% (Table 4).

The RBNG complex totaled 365.5 ha of colonies, or just less than the 400 ha recommended (7). The 400-ha minimum, however was developed for white-tailed prairie dogs: and black-tailed prairie dogs typically occur at higher population densities (D. Biggins, pers. commun.). Moreover, we did not inspect or include a 187-ha area (Colony #5) reported by Shackford (8) because it was on private land and was peripheral to the main complex. It did, however, lie within 7 km of the complex and, if it still exists, could increase the complex's potential. Excluding colony #5, the estimated carrying capacity for ferrets at RBNG (i.e., 8.5 family groups or approximately 34 animals) is less than half the minimum size recommended by Harris et al. (10). Between Shackford's survey and ours, the total area occupied by colonies within the RBNG complex declined by approximately 2% (Table 4). This decline appears largely due to a 32% loss of colony area on private lands within the complex, enough to offset the 20% gain in colony area on U.S. Forest Service holdings (Table 4).

MANAGEMENT SUGGESTIONS

Our survey results confirmed the rapid expansion of prairie dog populations in Cimarron County and with it, the region's increasing ability to support black-footed ferrets. The OLC complex in particular was promising at the time of our survey. Colony #32, the largest in Oklahoma, experienced an abrupt die-off of prairie dogs in fall 1991. Grazing leasees reported seeing no live prairie dogs on the colony in the months following the die-off (J. Clark, pers. commun.). By the following summer, similar losses of prairie dogs occurred on Colonies #9 and #20 within the RBNG complex (R. Gonzaby, pers. commun.). We presume that these die-offs occurred as a result of sylvatic plague. No flooding occurred, and there was no evidence of extensive poisoning. Moreover, the sudden, high level of mortality among the prairie dogs seemed to be consistent with predictions of 99+% rates induced by plague in black-tailed prairie dog colonies (A. Barnes, pers. commun.).

Thus, the suitability of either complex as a reintroduction site for the endangered black-footed ferret has been destroyed for at least the next few years. Even if populations of prairie dogs recover to their mid-1991 levels, the threat of a recurrence of plague will remain, as it does in any plague-endemic region (A. Barnes, pers. commun.).

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TABLE 4. Changes in area (ha) occupied by prairie dog colonies in the OLC and RBNG complexes between Shackford's surveys (8) and this study.

Complex ^a (owner)	Colony No.	1988-89 area/ha	1991 area/ha	Change %
OLC (OLC)	31	7.9	16.3	+106
OLC (OLC)	32	246.5	457.3	+ 86
OLC (OLC)	33	56.7	67.5	+ 19
OLC (OLC)	34	7.4	15.1	+104
OLC (OLC)	49	15.3	10.9	- 29
OLC (OLC)	51	8.7	27.2	+213
Total OLC		342.5	594.3	+ 74
RBNG (FS)	4 ^b	40.8	41.9	+ 3
RBNG (FS)	6	59.4	34.9	- 41
RBNG (FS)	9 ^b	44.8	83.8	+ 87
RBNG (FS)	18	28.6	18.6	- 35
RBNG (FS)	20	44.2	81.5	+ 84
St ^c RBNG(FS)		217.8	260.7	+ 20
RBNG (Pv)	7	56.5	30.3	- 46
RBNG (Pv)	16	30.7	4.7	- 85
RBNG (Pv)	19	67.2	69.8	+ 4
St ^c RBNG(Pv)		154.4	104.8	- 32
Total RBNG		372.2	365.5	- 2

^a OLC=Oklahoma Land Commission; RBNG=Rita Blanca National Grassland; FS=U.S. Forest Service; Pv=Private.

^b Reported as private by Shackford (8) but in 1991 found predominantly on USFS land.

^c St=subtotal

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