Annual Status Report

2005

Black-tailed Prairie Dog Monitoring at

Scotts Bluff National Monument

By:

J. Tyler Cribbs (Bio-tech)

Reviewed by:

David G. Peitz (Ecologist)

The Heartland I&M Network and Prairie Cluster Prototype Monitoring Program

National Park Service

Republic, Missouri 65738

November 4, 2005

1.0 INTRODUCTION

1.1 Background

Black-tailed prairie dogs (*Cynomys ludovicianus*, BTPD) historically occupied over 100 million acres of shortgrass and mixed-grass prairie in 11 western states (National Wildlife Federation 2000a). Currently, less than one percent of this habitat is believed to be occupied (700,000 to 800,000 acres). The dramatic decline in BTPD habitat and abundance is the result of changing land use patterns, habitat fragmentation, disease, shooting and poisoning (U.S. Fish and Wildlife Service 2000). Sylvatic plague (*Yersinia pestis*), introduced from Europe and first identified in prairie dog populations in the mid-1930's (Hubbard 1947), is capable of causing massive die-offs in prairie dog populations (Barnes 1993, Cully 1993). Widespread control of prairie dogs through shooting and poisoning is still practiced in most states. Most states at one time or another have required the eradication of the species on both private and public held lands at the expense of the landowner (Desmond et al. 2000). This requirement for eradication of BTPD was relaxed in many states when the Fish and Wildlife Services ruled the species warranted listing as threatened under the Endangered Species Act of 1973 (US Fish and Wildlife Service 2000). The BTPD has since been removed as a candidate for protection under the Endangered Species Act (U.S. Fish and Wildlife Service 2004). However, during the four and a half years that the BTPD warranted listing as a threatened species, considerable efforts and resources were invested by states, tribes, landowners and conservation organizations to better understand the status of the species and design and implement conservation strategies to reduce threats to the species.

Species dependent on the BTPD for food or the habitat they create include the burrowing owl (*Athene cunicularia*), mountain plover (*Charadrius montana*), kit fox (*Vulpes velox*) and ferruginous hawk (*Buteo regalis*) (National Wildlife Federation 2000b). These species are candidates or potential candidates for listing as threatened species under the Endangered Species Act. The most endangered mammal in the United States, the black-footed ferret (*Mustela nigripes*), is wholly dependent on the prairie dog for its survival (National Wildlife Federation 2000b).

Concerns for recovery of the BTPD to stable numbers on National Park Service (NPS) lands have prompted the NPS to identify parks and monuments within the historic range of the BTPD that still host populations of prairie dogs and to monitor these populations. Seven of the 29 parks or monuments within the historic range of the BTPD still maintain populations (Badland's National Park, SD; Bent's Old Fort National Historic Site, CO; Devil's Tower National Monument, WY; Fort Larned National Historic Site, KS; Scotts Bluff National Monument, NE; Theodore Roosevelt National Park, ND; and Wind Cave National Park, SD).

The colony of BTPD at Scotts Bluff National Monument, Nebraska (SCBL) was reestablished in 1981 from vagrant individuals moving onto the monument. BTPD had been exterminated from the monument in 1944. Colony size, population densities, and estimates of overall abundance of BTPD at SCBL from 1981-1994 are given in Table 1. The rapid and sustained decline in BTPD numbers between 1988 and 1995 could be the result of several factors including illegal shooting or poisoning, poor winter survival, predation, or Sylvatic plague (Knowles 1998).

For the period 1995-1999, BTPD were monitored through a joint effort of the Heartland I&M Network and Prairie Cluster Prototype Monitoring Program (HTLN)

formerly the Prairie Cluster Prototype Long-Term Ecological Monitoring Program (PC-LTEM) and the Biological Resources Division (BRD) of the U.S. Geological Survey. A peer-reviewed monitoring protocol is the result of this endeavor (Plumb et al. 2001). Park personnel and HTLN staff continue annual BTPD monitoring. This report describes monitoring results for 2005.

1.2 Objectives

The objectives of BTPD monitoring at SCBL are to: 1) estimate BTPD population abundance; 2) map annual size and location of the BTPD colonies; and 3) determine through observation if Sylvatic plague (*Yersinia pestis*) is present in BTPD colonies.

2.0 METHODS

2.1 Black-tailed Prairie Dog Density and Abundance

Plumb et al. (2001) detail the current monitoring methods used to estimate BTPD densities, abundance and colony sizes. The main BTPD colony at SCBL was observed from two observation stands again in 2005. Eight replicate counts, with 15-minute intervals between the start of each replicate were made from each stand. Counts were conducted on three consecutive days, July 19, 20, and 21. As a result of colony expansion, part of the colony was obscured from observers. This was taken into account when figuring density estimates. The obscured area was removed from the total colony area prior to estimating density. Using landscape features, a section of the colony was defined for observation from each of the stands in an effort to minimize counting individuals twice during a replicate. Prairie dogs on the eastern portion and part of the southern section of the colony were counted from a stand located on the eastern edge of the colony. Prairie dogs on the northern, western and extreme southern sections of the colony were counted from a stand located in the middle of the colony (Figure 1). Daily replicate counts from each stand were combined in order to calculate estimates of population density and size. Surveys were conducted between 6:45 – 8:45 am on mornings with little or no precipitation. Counts from each stand were synchronized so counts could be combined to produce a colony wide estimate. Additionally, BTPD populations were surveyed on a colony north of the main colony across an irrigation canal and one in the Saddle Rock Unit of the monument concurrently with that of the main colony.

Using the combined visual count data, two calculations were made to estimate annual BTPD density and abundance within the main colony at SCBL. Similar estimates were also calculated for the colony north of the canal and the one in the Saddle Rock Unit. Predicted density (P) is derived from the linear relationship described by Severson and Plumb (1998): Density (P) = [((Y / Sp) – 3.04) / 0.40], where Y is the maximum count of individuals in a replicate over the three day survey period and Sp is the total area sampled. Density is calculated from the maximum count of individuals in a replicate and colony size, adjusted for the probability of not observing all individuals during the count. The adjustment coefficient is based on mark-recapture data (Severson and Plumb 1998). The maximum count (out of 24) is used because it is significantly correlated with prairie dog abundance as determined by mark-recapture data. (See Morrison 2004 for an explanation regarding how density is estimated and how the equations were derived)

Abundance (T) = (Sc)(P), where Sc is the total colony size in hectares and P the estimated density per hectare.

A 95 % confidence interval was calculated for density and abundance using the following formulas:

Density lower limit, P = P – 1.96 [SE(P)]
Density upper limit, P = P + 1.96 [SE(P)]
Abundance lower limit, T = T – 1.96 [SE(T)]
Abundance upper limit, T = T + 1.96 [SE (T)]

where SE is the standard error for Density (P) and Abundance (T), respectively. Standard error (SE) is derived by first calculating Variance (P) = $66 + 0.025 (P – 18.4)^2$ for Density (P) or Variance (T) = $66 + 0.025 (T – 18.4)^2$ for Abundance (T) and then calculating SE (P or T) = √ Variance (P or T) (Plumb et. al. 2001). Means with overlapping confidence intervals are not significantly different.

2.2 Black-tailed Prairie Dog Colony Mapping

Boundaries of the BTPD colonies at SCBL were delineated using a Global Positioning System in conjunction with a PC-based Geographic Information System, ArcGIS v.9™. Colony boundaries were determined as the area within five meters of active burrows on the perimeter of each colony. Active clip lines were indistinguishable for the majority of each colony, therefore not mapped. Burrows were classified as active if burrow openings were > 7-cm in diameter and fresh scat was observed within 0.5-m of the opening. Burrows were not classified as active if there were spider webs across an opening or unclipped vegetation growing in or around the opening (Biggins et. al. 1993, Desmond et. al. 2000). Colored pin flags were used to mark the perimeter of each colony prior to GPS mapping. Boundaries were walked in their entirety in order to close each colony polygon.

A large section of the main colony, 9.659 ha was found to be obscured from observer view during surveys, thus it was not included in the calculation of population density. However it was included in the calculation for population size.

2.3 Sylvatic Plague Surveillance

Park personnel monitor Sylvatic plague presence within the BTPD colonies at SCBL throughout the year. Observation of a substantial die-off in the population during the year would alert park personnel to the potential of a Sylvatic plague outbreak. If a Sylvatic plague outbreak is suspected, appropriate authorities will be notified to verify the presence or absence of Sylvatic plague.

3.0 RESULTS

3.1 Black-tailed Prairie Dog Abundance and Density

Results of BTPD monitoring on the main colony at SCBL between 1995 and 2005 are given in Table 2 and Figures 2 and 3. The density of BTPD on the main colony in 2005 was 44.9 individuals/ha (an increase of 30.5 individuals/ha (212%) from 2004), and higher than the eleven-year average (1995-2005) of 25.1 individuals/ha (Figure 2). However, our estimated density falls within the confidence intervals of all annual estimated densities except

in year 2000. Density estimates for the colony north of the canal and the one in the Saddle Rock Unit were 80.97 individuals/ha and 108.7 individuals/ha, respectively (Table 3 and 4).

Population size in 2005 was estimated at 670.7 individuals, an increase of 140.7 individuals (26.5%) from 2004 levels (Figure 3). However, again based on overlapping confidence intervals, the increase in population size was not statistically significant. The estimate of BTPD population size (i.e. 670.7 individuals) was 379.44 individuals higher than the eleven year average (1995-2005) of 291.26 individuals / year, and was the second largest on record. The estimated populations for the colony north of the canal and the one in the Saddle Rock Unit were 77.7 and 30.4 individuals, respectively (Table 3 and 4).

3.2 Black-tailed Prairie Dog Colony Mapping

Maps showing changes in the location and extent of the main BTPD colony at SCBL between 1995 and 2005 are shown in Figure 1. The main colony area was 14.948 ha in 2005, representing a decrease in size of 21.8 ha (59.4%) from 2004 (Table 2). The shape of the main colony has remained somewhat similar to last years shape, crescent. However, the location of the colony has moved outward drastically. The BTPD have abandoned large areas in the center of the colony and retreated to small “islands” as opposed to one continuous area. Colony size was 1.9 ha larger then the eleven year average of 13.0 ha.

The two other BTPD colonies at SCBL where mapped again in 2005 (Figure 4). The colony north of the canal had an area of 2.1 ha in 2004. However, it decreased to 0.96 ha in 2005, a decrease of 1.14 ha (54.29%) (Table3). This colony borders private lands on its north and west side. There did not appear to be any individuals on the neighboring private land. The colony located in the Saddle Rock Unit had an area of 1.1 ha in 2004. However, it decreased in size to 0.28 ha in 2005, a decrease of 0.82 ha (74.5%) (Table 4).

3.3 Sylvatic Plague Surveillance

Sylvatic plague was not observed in the BTPD colonies at SCBL during 2005.

3.4 Other Observations

Coincidental counts of burrowing owls revealed two individuals on the main colony in 2005. Individuals were not recorded on the Saddle Rock Unit or the colony north of the canal. Sightings of burrowing owls will continue to be recorded and included in annual reports.

4.0 DISCUSSION

Plumb et al. (2001) recommend conducting visual counts on a single 200 x 200 m section of a colony. However, our main colony’s small size, unique crescent shape and variation in population densities across the colony have led us to sample the entire colony by dividing it into two sections for separate visual counts. In the future a third stand may need to be used to observe the colony’s expanding southern end. Originally we thought that it would be possible to continue monitoring the whole colony from two stands if the stand in the middle of the colony was moved southward. We attempted this in 2005 but soon found that the topography still prevented us from seeing all of the colony on the south end and the increased sighting distance to the north made it difficulty to count prairie dogs in that direction. If the colony maintains its current shape or expands further outward and a third

observation stand is not used during counts, two 200 x 200 m sections of the colony will be employed with an existing stands positioned on each section during counts.

Expansion of the main colony observed in recent years did not continue in 2005. Instead there was a large decrease in overall colony size (Table 2 and Figure 1). Below average precipitation (Figure 5, see figure 6 also; temperature) during the early part of 2005 may have reduced the availability of nutritious vegetation. This was the fifth year in a row that precipitation has been below average. Rain that did fall in 2005 came during the early part of the growing season making for some lush vegetation across the colony. However, much of this vegetation especially on the interior of the colony consisted of a monoculture of sweet clover. Sweet clover approaching 1.5-2.0 m in height during surveys partially blocked our view of sections of the colony. For predator avoidance reasons BTPD prefer areas with shorter vegetation. Therefore, much of the interior of the colony where visibility was reduced was avoid by BTPD thus uninhabited anyway.

The increase in density of BTPD on the main colony at SCBL in 2005 is not an unusual event. Annual densities for this colony have increased from values reported the previous year four times during our monitoring; years 1996, 2001, 2003 and 2005 (Figure 2). However, even with the increased BTPD density observed in 2005, estimates of individuals/ha was not significantly different than other years based on overlapping confidence intervals. A higher density of BTPD on the main colony contributed to a higher population estimate in 2005 than 2004. The 2005 population estimate was the second largest recorded for this colony (Figure 3). Based on overlapping confidence intervals, 2005 population estimates were not significantly different from the previous three years.

With foraging opportunities within the colony reduced, individuals foraged outward from the colony center or in small island patches within the colony. Thus, the colony was fragmented into many small areas separated by sections of uninhabited sweet clover patches. In order to limit foraging distances and exposure to predators, BTPD have established most of their burrows on the main colonies periphery away from sweet clover patches.

The north colony decreased in both size and number of individuals during the recent droughty conditions. The colony decreased in size from 2.1 ha in 2004 to 0.96 ha in 2005 (Table 3), resulting in a slightly higher density in the later year. The irrigation canal and rough terrain continue to limit BTPD expansion to the east. The irrigation canal separates the north colony from the main colony and inhibits individuals from returning to the main colony when flowing. Private properties north and west of the colony once utilized by the BTPD are no longer being used.

The colony in the Saddle Rock Unit showed a dramatic decrease in total area occupied but had an increase in estimated BTPD population size. The decrease in colony size resulted in a high density estimate of 108.7 individual/ha. The estimated population size more than doubled from the previous years estimate. It should be noted that colony size may be skewed slightly because mowing had recently taken place on a small section of the colony making clip lines impossible to delineate. However, all efforts were made to accurately map the colony based on evidence of recently used burrows.

Presently, the combined colonies occupy only a small portion of the monument (i.e. 2.3% of the monument's 698-ha of grassland). Monument staff should continue to monitor for new occurrences of BTPD colonies in other areas of the monument. Dispersal from colonies outside the monument (most likely the source of the Saddle Rock Unit colony) may produce new colonies at SCBL. Dispersal from colonies within the monument may also lead

to new colonies. Dispersal usually begins in late winter and is complete by the end of June (Garrett and Franklin 1988; Hoogland 1995). Black-tailed prairie dog monitoring at SCBL will continue as part of the NPS's effort to address concerns over population status on their lands. Annual monitoring of the colony at SCBL allows resource managers the opportunity to assess the impacts of colony expansion on the cultural and natural resources of the monument, and assess the status of BTPD at SCBL in comparison to other NPS lands. Sylvatic plague surveillance as well as surveillance for other mortality factors will continue to be a routine part of the monitoring of BTPD colonies at SCBL. Surveillance of mortality factors must be undertaken if a rapid decline in the BTPD population is observed to minimize the risk to human health without causing undo concerns. Findings from monitoring efforts on BTPD at SCBL should be incorporated with those from other NPS lands in order to help recover this element of the prairie ecosystem to sustainable numbers.

5.0 PLANS FOR 2006

Black-tailed prairie dog density, abundance and colony sizes at SCBL will continue to be monitored with methodologies outlined by Plumb et al. (2001). Two observation stands will be used to observe the main BTPD colony if its size and shape dictates they are needed. If it appears necessary, two 200 x 200 m sections on the main colony will be delineated and used for population monitoring. Monitoring on the two new colonies will continue if they persist and continue to grow.

6.0 REFERENCES

Barnes, A.M. 1993. A review of plague and its relevance to prairie dog populations and the black-footed ferret. Pages 28-37 in Oldemeyer, J.L., D.E. Biggins, and B.J. Miller, editors. Proceedings of the symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. Biological Report 13. United States Department of Interior, U.S. Fish and Wildlife Service, Washington, DC.

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. Pages 73-78 in Oldemeyer, J.L., D.E. Biggins, and B.J. Miller, editors. Proceedings of the symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. Biological Report 13. United States Department of Interior, U.S. Fish and Wildlife Service, Washington, DC.

Cully Jr., J.F. 1993. Plague, prairie dogs and black-footed ferrets: implications for management. Pages 38-49 in Oldemeyer, J.L., D.E. Biggins, and B.J. Miller, editors. Proceedings of the symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. Biological Report 13. United States Department of Interior, U.S. Fish and Wildlife Service, Washington, DC.

Cox, M.K. and W.L. Franklin. 1989. Prairie dog management recommendations for Scott's Bluff National Monument. A Report to the National Park Service, Omaha NE. 30 pp.

Desmond, M.J., J.A. Savidge, and K.M. Eskridge. 2000. Correlations between burrowing owl and black-tailed prairie dog declines: a 7-year analysis. The Journal of Wildlife Management 64:1067-1075.

Franklin, W.L. 1984. Status of black-tailed prairie dogs as Scott's Bluff National Monument and recommendations for management. Completion Report for the Department of the Interior, U.S. Fish and Wildlife Service, Washington DC. and the National Park Service, Omaha NE. 18 pp.

Garrett, M.G. and W.L. Franklin. 1988. Behavioral ecology of dispersal in the black-tailed prairie dog. Journal of Range Management 69:236-250.

Hoogland, J.L. 1995. The black-tailed prairie dog: social life of a burrowing mammal. The University of Chicago Press, Chicago IL. 557 pp.

Hubbard, C.A. 1947. Fleas of western North America. Iowa State College Press, Ames, IA. 533 pp.

Knowles, C.J. 1998. Status of the black-tailed prairie dog. Report for the U.S. Fish and Wildlife Service, Pierre SD. 12 pp.

Morrison, Lloyd W. 2004. Evaluation of survey methods for black-tailed prairie dog populations at Scott's Bluff National Monument. Heartland I&M Network and Prairie Cluster Prototype Monitoring Program, National Park Service.

National Wildlife Federation. 2000a. Black-tailed prairie dog state by state status. National Wildlife Federation Home Page (http://www.nwf.org/prairiedogs/dog_status.html).

National Wildlife Federation. 2000b. Question and answers about the black-tailed prairie dog's warranted but precluded status. National Wildlife Federation Home Page (http://www.nwf.org/prairiedogs/dog_q&a.html).

Plumb, G.E., G.D. Willson, K. Kalin, K. Shinn, and W.M. Rizzo. 2001. Black-tailed prairie dog monitoring protocol for seven prairie parks. U.S. Department of the Interior, U.S. Geological Survey, Biological Resources Division, Northern Prairie Wildlife Research Center, Missouri Field Station, Columbia. 26 pp.

Severson, K.E. and G.E. Plumb. 1998. Comparison of methods to estimate population densities of black-tailed prairie dogs. Wildlife Society Bulletin 26:859-866.

U.S. Fish and Wildlife Service. 2000. Twelve-month finding for a petition to list the black-tailed prairie dog as threatened. Federal Register 2/4/2000. 65(24):5476-5488.

U.S. Fish and Wildlife Service. 2004. Findings for the resubmitted petition to list the black-tailed prairie dog as threatened. Federal Register 8/18/2004. 69(159):51217-51226.

Table 1. Annual colony size, population density and number of individual black-tailed prairie dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska – Main Colony, between colony reestablishment and 1994. Sources of annual data are indicated.

Year	Area (ha)	Density (individuals/ha)	Population Size	Source
1981	Colony Reestablishment in Scott's Bluff National Monument			
1982	--	--	--	None
1983	0.98	76.5	75	Franklin 1984
1984	1.31	30.5	40	Franklin 1984
1985	--	--	107	Cox and Franklin 1989
1986	5.77	34.7	200	Cox and Franklin 1989
1987	5.14	58.9	303	Cox and Franklin 1989
1988	3.39	64.6	219	Cox and Franklin 1989
1989	--	--	62	Monument Personnel unpub.
1990	--	--	62	Monument Personnel unpub.
1991	--	--	27	Monument Personnel unpub.
1992	--	--	--	None
1993	--	--	45	Monument Personnel unpub.
1994	--	--	--	None

Table 2. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska - Main Colony, between 1995 and 2005.

Year	Area (ha)	Density (individuals/ha)	Population Size
1995	1.4	12 (-4.1-28.1)	17 (1.1-32.9)
1996	1.4	53 (33.9-72.3)	74 (50.5-97.5)
1997	2.6	28.9 (12.7-45.2)	75 (51.3-98.7)
1998	3.3	22.7 (6.7-38.7)	75 (51.3-98.7)
1999	10.5	16.7 (0.8-32.6)	175 (123.9-226.1)
2000	16.2	9.2 (-7.0-25.4)	149 (105.5-192.5)
2001	10.9	23.4 (7.4-39.4)	255 (179.7-329.6)
2002	20.0	19.0 (3.1-34.9)	381 (267.5-494.5)
2003	25.2	31.8 (15.4-48.3)	802 (558.7-1045.5)
2004	36.7	14.4 (-1.5-30.4)	530 (370.7-689.4)
2005	14.9	44.9 (26.9-62.8)	670.7(467.9-873.5)

Table 3. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska - North Colony, between 2003 and 2005.

Year	Area (ha)	Density (individuals\ha)	Population Size
2003	1.7	--	--
2004	2.1	76.9 (52.8-101.0)	163.0 (116.0-211.6)
2005	0.96	80.97 (55.8-106.1)	77.7 (53.4-102.0)

Table 4. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska - Saddle Rock Unit colony, between 2003 and 2005.

Year	Area (ha)	Density (individuals\ha)	Population Size
2003	1.2	--	--
2004	1.1	13.2 (-2.8 - 29.2)	14.3 (-1.7 - 30.3)
2005	0.28	108.7(76.5-140.9)	30.4(14.0-46.7)

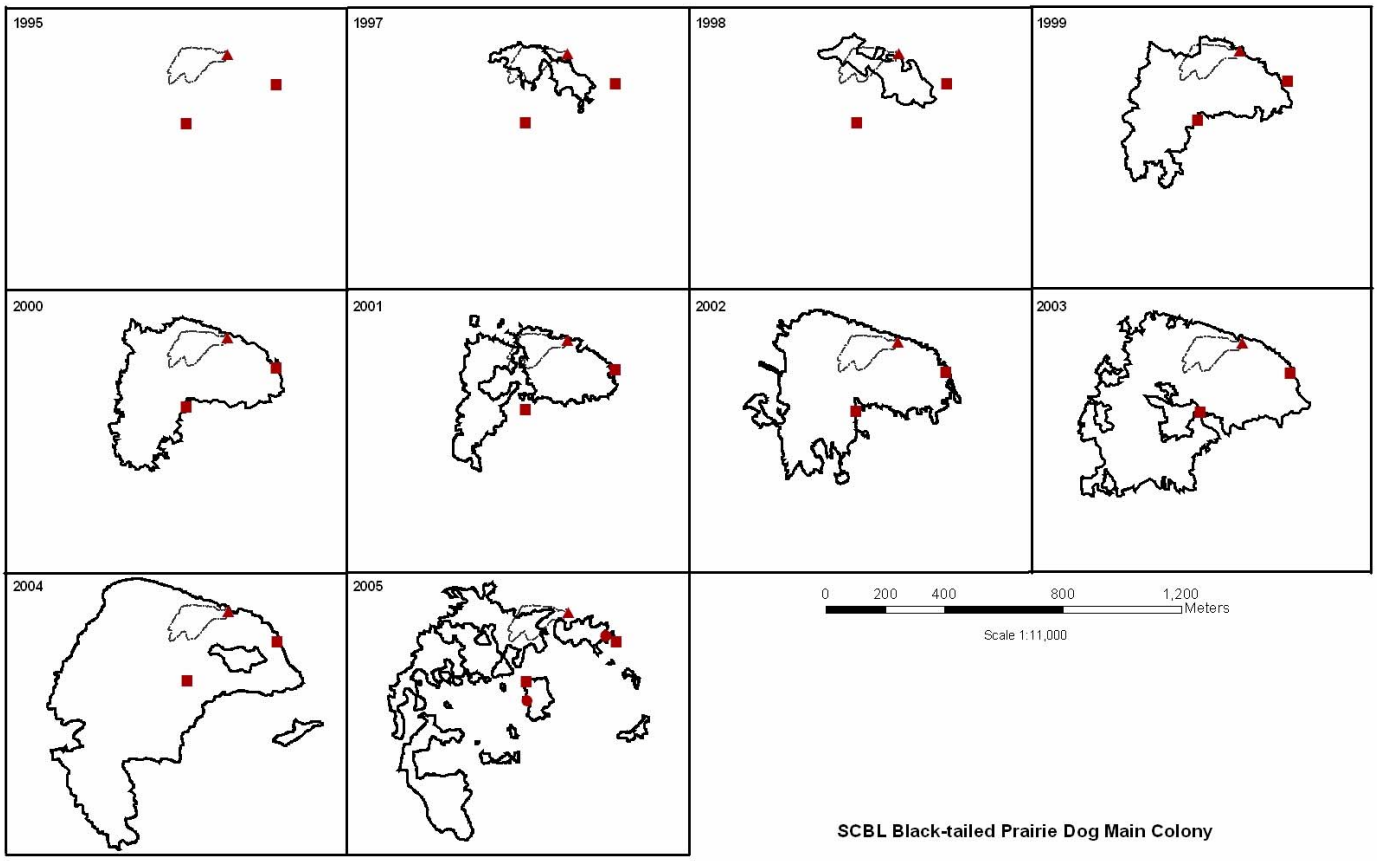

Figure 1. Black-tailed prairie dog (*Cynomys ludovicianus*) colony sizes and shapes at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2005, exception 1996. The colony size and shape was roughly the same for 1995 and 1996. The colony boundary for 1995 is shown on all years as a reference. Solid squares symbolize the location of monitoring stands from 2001-2004. Circles symbolize the location of monitoring stands in 2005.

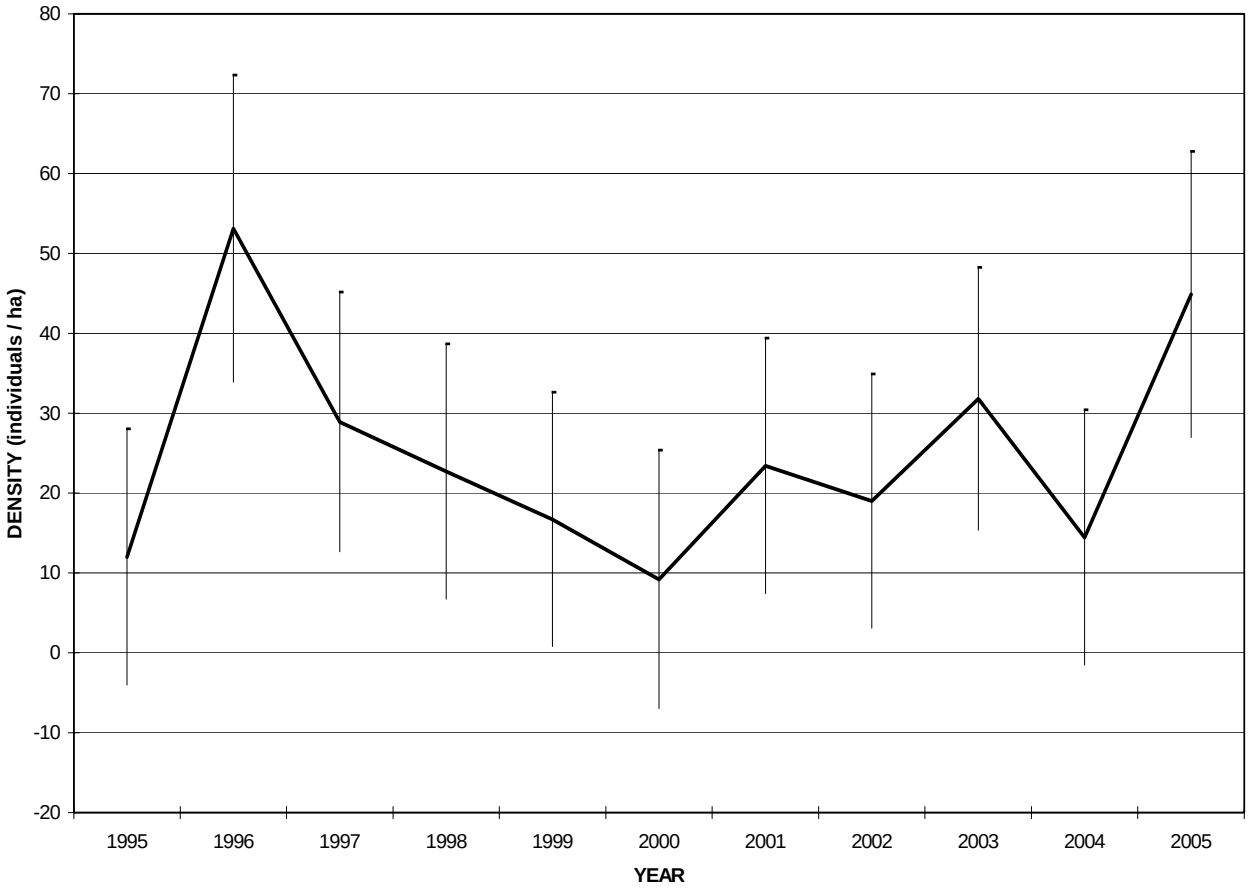

Figure 2. Annual estimates of black-tailed prairie dog densities (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2005. Bars at each annual density estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their density estimate are not significantly different.

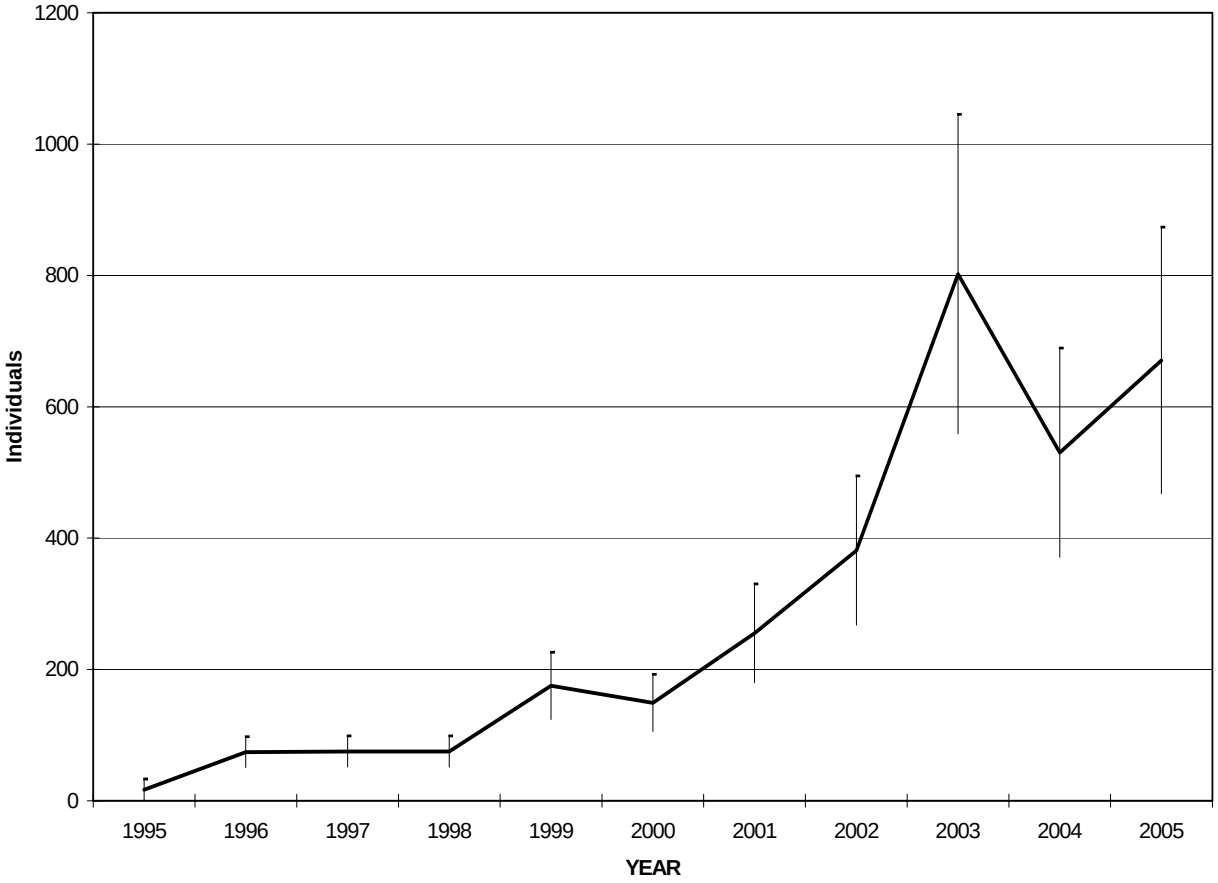

Figure 3. Annual estimates of black-tailed prairie dog population sizes (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2005. Bars at each annual population estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their population estimate are not significantly different.

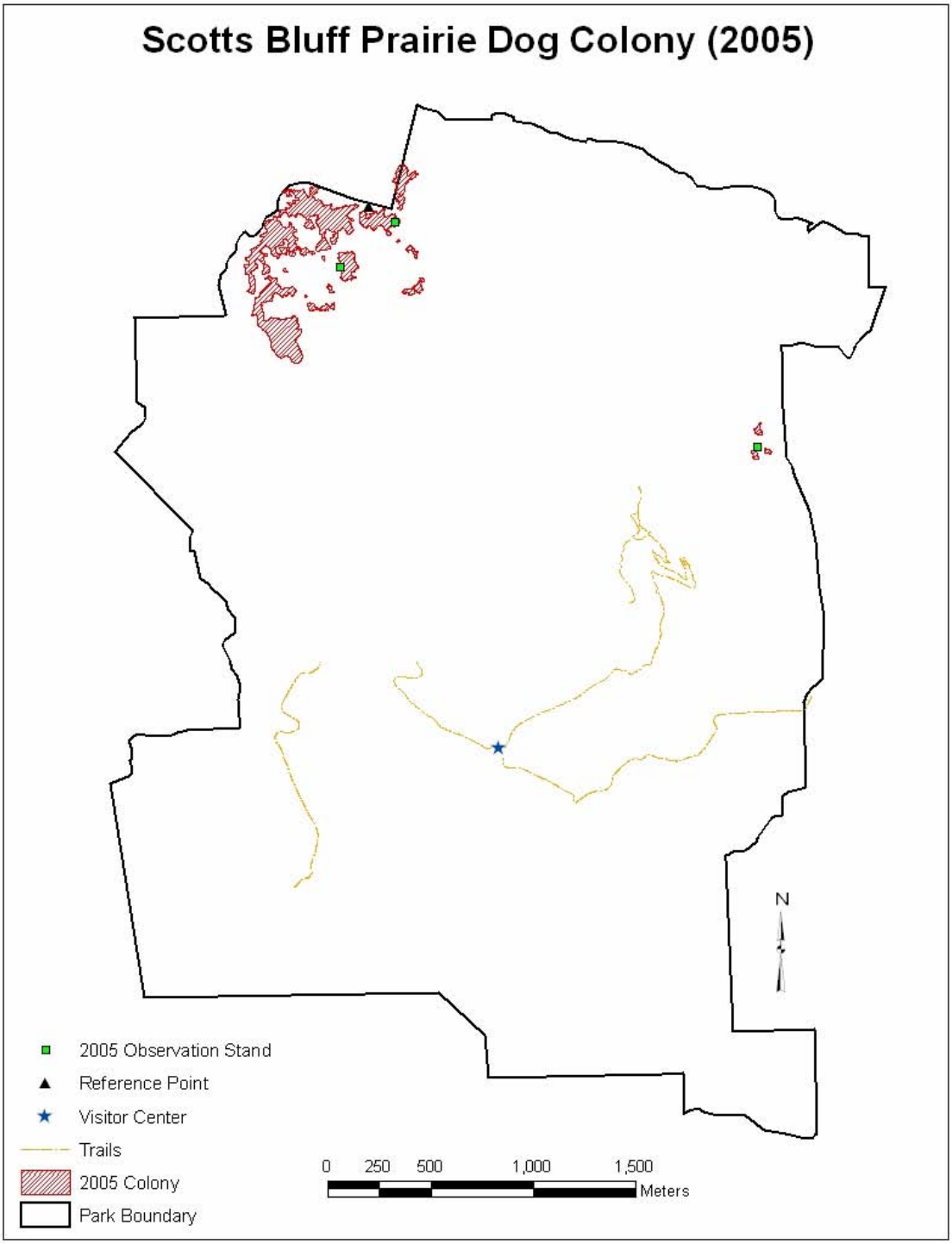

Figure 4. Black-tailed prairie dog (*Cynomys ludovicianus*) colony locations at Scotts Bluff National Monument during 2004.

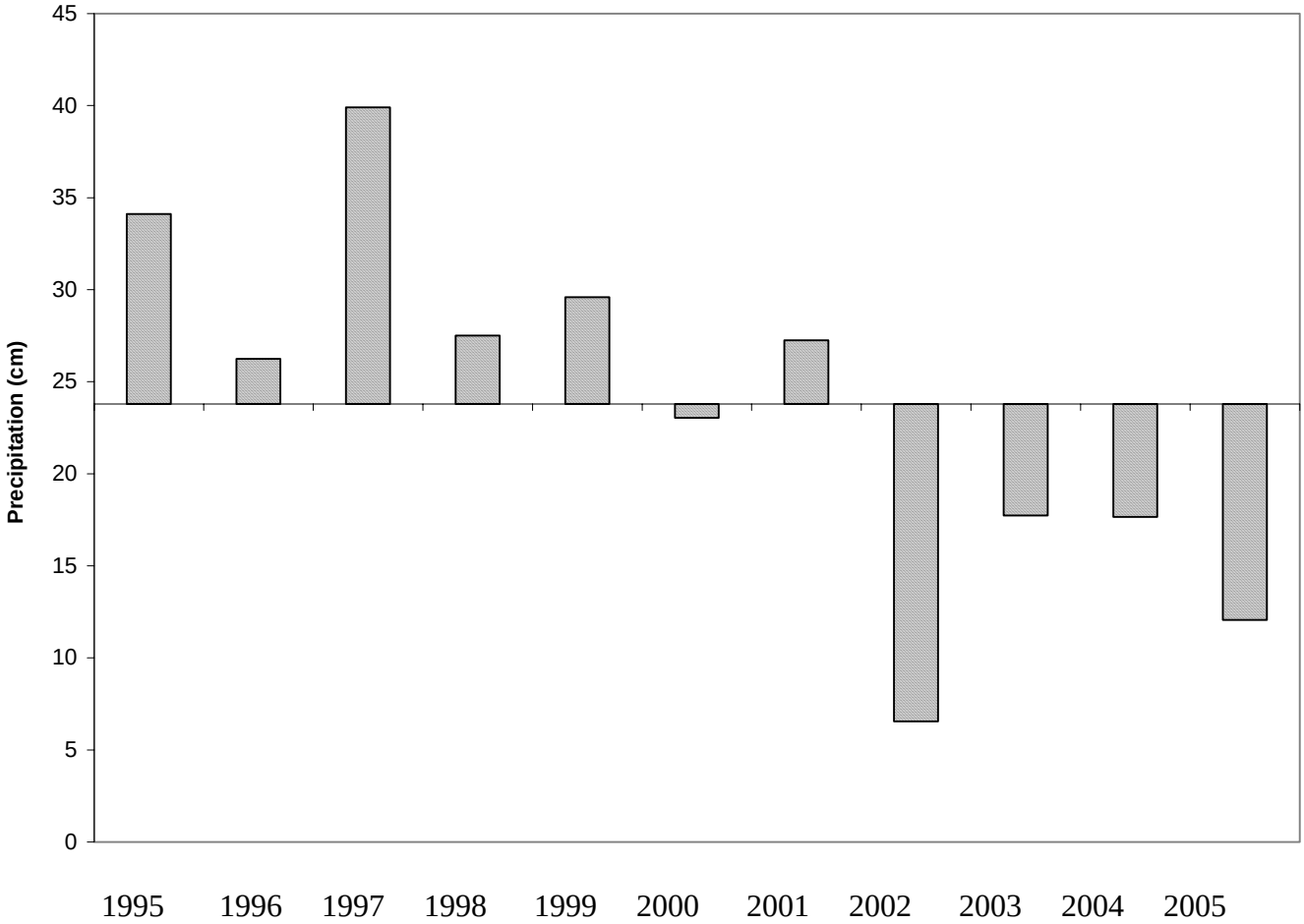

Figure 5. Cumulative precipitation for the first seven months of each year, shown annually as deviations from the eleven year average (1995-2005) at Scotts Bluff National Monument, Nebraska. Annual precipitation averaged 23.785945 cm for the first seven months of each year during the eleven year period.

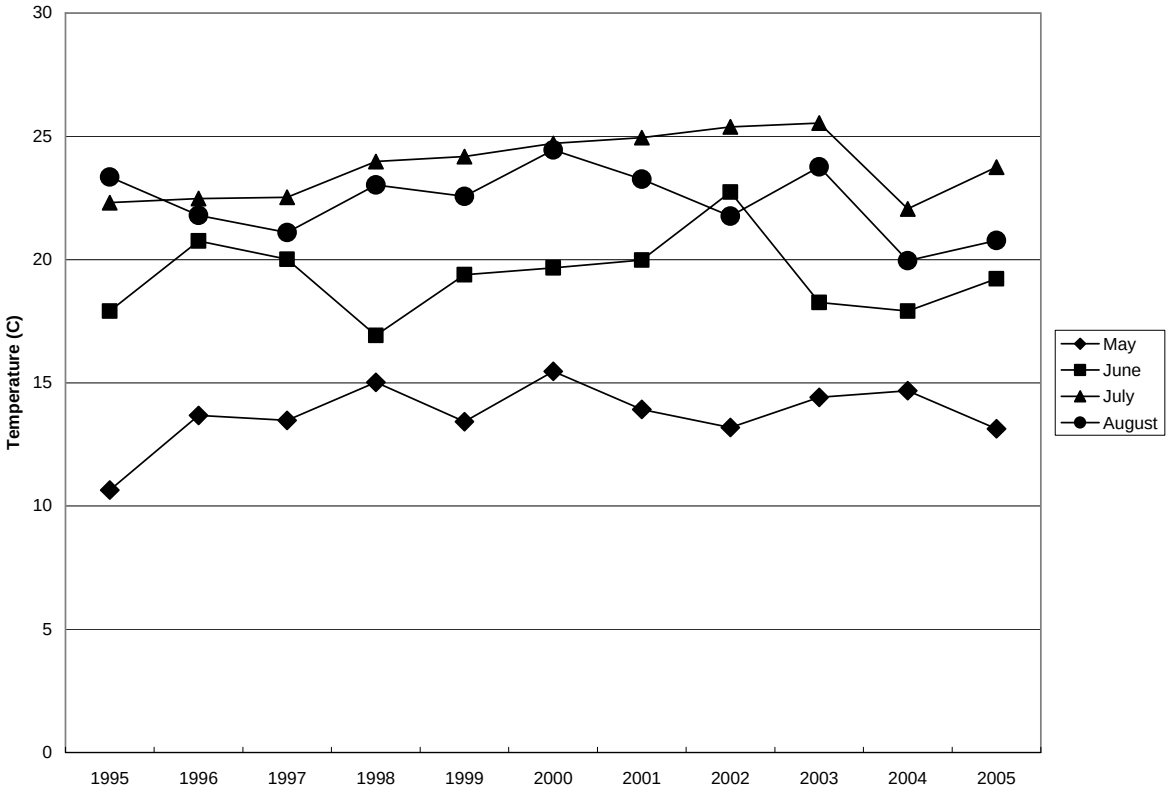

Figure 6. Mean annual temperatures for May-August at Scotts Bluff National Monument, Nebraska during an eleven year period.