

Annual Status Report

2003

**Black-tailed Prairie Dog Monitoring at
Scotts Bluff National Monument**



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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 remains 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 require the eradication of the species on both private and public held lands at the expense of the landowner (Desmond et al. 2000). However, this requirement for eradication of BTPD has been relaxed in many states since the Fish and Wildlife Services ruled the species warrants listing as threatened under the Endangered Species Act of 1973 (US Fish and Wildlife Service 2000). 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. 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 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 PC-LTEM staff continue annual BTPD monitoring. This report describes monitoring results for 2003.

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 BTPD colony at SCBL was observed from two observation stands in 2003. With the exception of only four replicate counts taken from one observation stand on July 24, 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 24, 25 and 26. As a result of recent colony expansion, two observation stands were again necessary in 2003 to view the entire population. 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. Daily replicate counts from each stand were combined in order to calculate estimates of population density and size. 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 (Figure 1). 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. Surveys were conducted between 6:45 – 8:45 am on mornings with little or no precipitation, temperatures $> 10^{\circ}\text{C}$ (50°F) and wind speeds < 32 kmph (20 mph). Timing of replicate counts from each stand was synchronized so counts could be combined.

Using the combined visual count data, two calculations were made to estimate annual BTPD density and abundance within the colony at SCBL. 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).

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:

$$\begin{aligned} \text{Density lower limit, } P &= P - 1.96 [\text{SE}(P)] \\ \text{Density upper limit, } P &= P + 1.96 [\text{SE}(P)] \\ \text{Abundance lower limit, } T &= T - 1.96 [\text{SE}(T)] \\ \text{Abundance upper limit, } T &= T + 1.96 [\text{SE}(T)] \end{aligned}$$

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) = $\sqrt{\text{Variance (P or T)}}$ (Plumb et. al. 2001). Means with overlapping confidence intervals are not significantly different.

2.2 Black-tailed Prairie Dog Colony Mapping

Boundaries of both the active burrows and active clip line on the BTPD colony at SCBL were delineated using a Global Positioning System in conjunction with a PC-based Geographic Exploration System, ArcView™. Burrows were classified as active if burrow openings were > 7-cm in diameter, the burrow was within 5-m of an active clip line, 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 active burrows on the perimeter of the colony and delineate the perimeter of the active clip line prior to GPS mapping. Boundaries were walked in their entirety regardless of which mapping technique was employed in order to close the colony polygons.

Both active burrows and active clip line were combined using ArcView™ in order to determine the largest extent of the active colony perimeter. As a rule, mapping of both perimeters independently produces varying yet statistically similar estimates of colony size (Plumb et. al. 2001). Therefore, combining both active burrows and active clip line within a year gives a more robust measure of colony size. A small section of the colony, < 0.5 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 colony at SCBL throughout the year. Observation of a substantial die-off in the population during the year alerts 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

The results of BTPD monitoring in 1995-2003 are given in Table 2 and Figures 2 and 3. The density of BTPD was 31.81 individuals/ha, representing an increase of 12.81 individuals/ha (67%) from 2002 (Figure 2). Density averaged 7.73 individuals/ha higher than the nine-year average (1995-2003) of 24.08 individuals/ha. This year's density was the second largest-recorded since monitoring began in 1995. Population size in 2003 was estimated at 802 individuals, demonstrating an increase of 421 individuals (110%) over 2002 levels (Figure 3). The BTPD population estimate was 579.44 individuals higher than the nine year average (1995-2003) of 222.56 individuals/year. This year's estimated population was the largest-recorded under the current monitoring protocol, in use since 1995.

3.2 Black-tailed Prairie Dog Colony Mapping

Maps showing changes in the location and extent of the BTPD colony at SCBL between 1995 and 2003 are shown in Figure 1. The colony area was 25.22 ha in 2003, representing an increase in size of 5.22 ha (26%) from 2002 (Table 2). The relative shape and location of the main colony was largely unchanged, with the colony expanded to the east and south slightly. Colony size was 15.03 ha larger than the nine year average of 10.17 ha.

The two new BTPD colonies that were recorded in 2002 were again mapped in 2003 (Figure 4). One located north of the irrigation canal near the original colony with an initial area of 0.096 ha increased in size to encompass 1.716 ha in 2003, an increase of 1.62 ha (1687 %). The colony located in the Saddle Rock Unit had an area of 0.865 ha in 2002 and an area of 1.224 ha in 2003, an increase in size of 0.359 ha (42%).

3.3 Sylvatic Plague Surveillance

Sylvatic plague was not observed in the BTPD colonies at SCBL during 2003.

3.4 Other Observations

Coincidental counts of burrowing owls revealed four individuals on the colony, down from seven in 2002. Sightings of burrowing owls will continue to be recorded and included in annual reports.

4.0 DISCUSSION

Plumb et al. (2001) recommended conducting visual counts on a single 200 x 200-m section of a colony. However, the unique crescent shape of the BTPD colony at SCBL and variations in population densities across the colony dictated dividing the colony into two sections for visual counts and subsequently sampling the entire colony. In the future, two stands will continue to be used for observing the colony unless its size, topography and vegetative cover become such that one observation stand is sufficient.

Increases in density of BTPD on the main colony at SCBL have occurred only three times since monitoring began in 1995, years 1996, 2001, and 2003 (Figure 2). In all other years (except in 2001, when colony size declined 5.3 ha over the previous year in spite of an increase in density) densities have declined even though colony sizes have continually increased. The increase in BTPD individuals/ha of 12.81 above 2002 estimates (Figure 2) was the smallest one year density increase recorded since monitoring began. The density increase between 1995 and 1996 of 41 individual/ha was the largest. Even with the increased BTPD density observed in 2003, estimates of individuals/ha was not significantly different than other years based on overlapping confidence intervals.

Both high densities and increasing colony size combined to produce the largest BTPD population size recorded (Figure 3). Based on overlapping confidence intervals, 2003 population estimates were significantly greater than all other years.

It appears that the outward expansion of the main BTPD colony observed in recent years continued in 2003, resulting in the largest area ever recorded (Table 2 and Figure 1). Increased population densities may have caused colony expansion as competition for resources forced prairie dogs to establish burrows on the periphery in an attempt to limit their foraging distance. It is also very probable that favorable climatic conditions, higher precipitation than 2002 (Figure 5) and moderate temperatures (Figure

6) in early 2003 resulted in a higher survival and breeding rates among adult BTPD and a higher survival rate for their 2003 young. Thus colony expansion to accommodate this increased number of individuals was needed. All three colonies within the monument have undergone similar expansions in size. Although individuals were not counted on the colony north of the main colony or the Saddle Rock Unit colony, numbers of individual prairie dogs on both appear to be greater than in 2002.

Presently, colonies occupy only a small portion of the monument (i.e. 3.7% of the monument's 698-ha of grassland). Physical barriers once thought to limit colony expansion on the main colony were breached in 2002 and again failed to serve as barriers to additional colony expansion in 2003. Ridges created when wind blown sediment was deposited along fence lines bounding the southern and portions of the eastern side of the colony no longer limit expansion. However, the canal and adjoining road still provide a barrier for expansion to the north and the fenced boundary and adjacent private cropland on the west continue to limit expansion in that direction. Individuals that were able to cross the canal during a dry period in 2002 continued to expand the colony established north of the main colony. Because colony expansion is somewhat limited, dispersal from the colony and the establishment of new colonies similar to what happened north of the canal may occur. Monument staff should continue to monitor for new occurrences of BTPD colonies in other areas of the monument. Dispersal from colonies within and outside the monument (most likely the source of the Saddle Rock Unit colony) may produce new colonies at SCBL. Dispersal usually begins in late winter and is complete by the end of June (Garrett and Franklin 1988; Hoogland 1995). The two colonies discovered in 2002 will be visited again in 2004 to determine if any future BTPD population abundance monitoring should be initiated.

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 expansions 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 assessment 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. If BTPD were to be listed as federally threatened, recovering their numbers on NPS lands will become even more important.

5.0 PLANS FOR 2004

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 BTPD colony if its size and shape dictates they are needed. Abundance monitoring will be initiated on the new colonies 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.
- 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.

Table 1. Colony size, population density and number of individual Black-tailed Prairie Dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska between population 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. Colony size (95% CI), population density (95% CI) and number of individual Black-tailed Prairie Dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska between 1995 and 2003.

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	31.81 (15.4-48.3)	802 (558.7-1045.5)

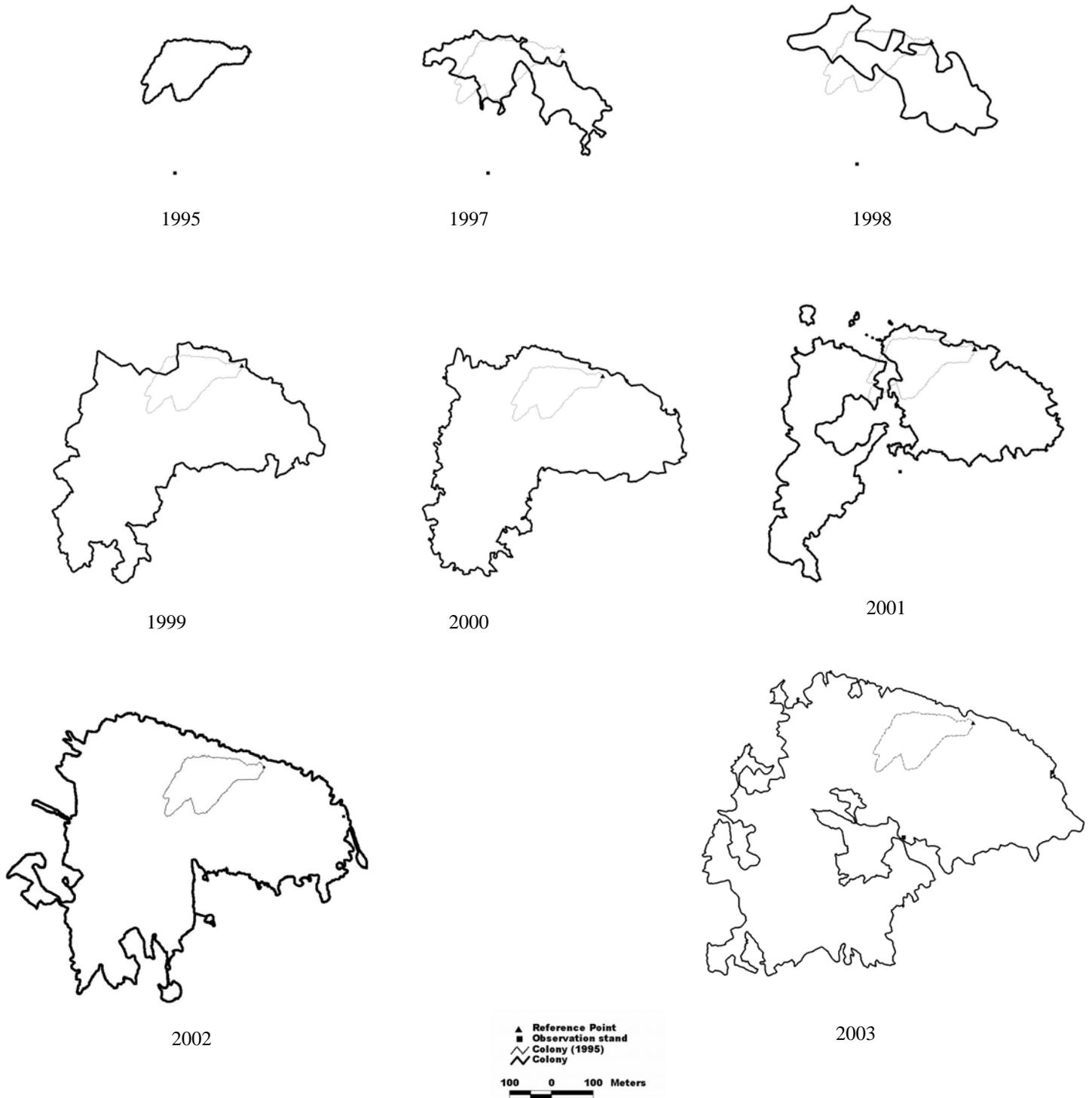


Figure 1. Black-tailed prairie dog (*Cynomys ludovicianus*) colony sizes and shapes at Scotts Bluff National Monument, Nebraska for years 1995 to 2002, exception 1996. The colony size and shape was roughly the same for 1995 and 1996. The colony boundary for 1995 is shown on all years as a reference.

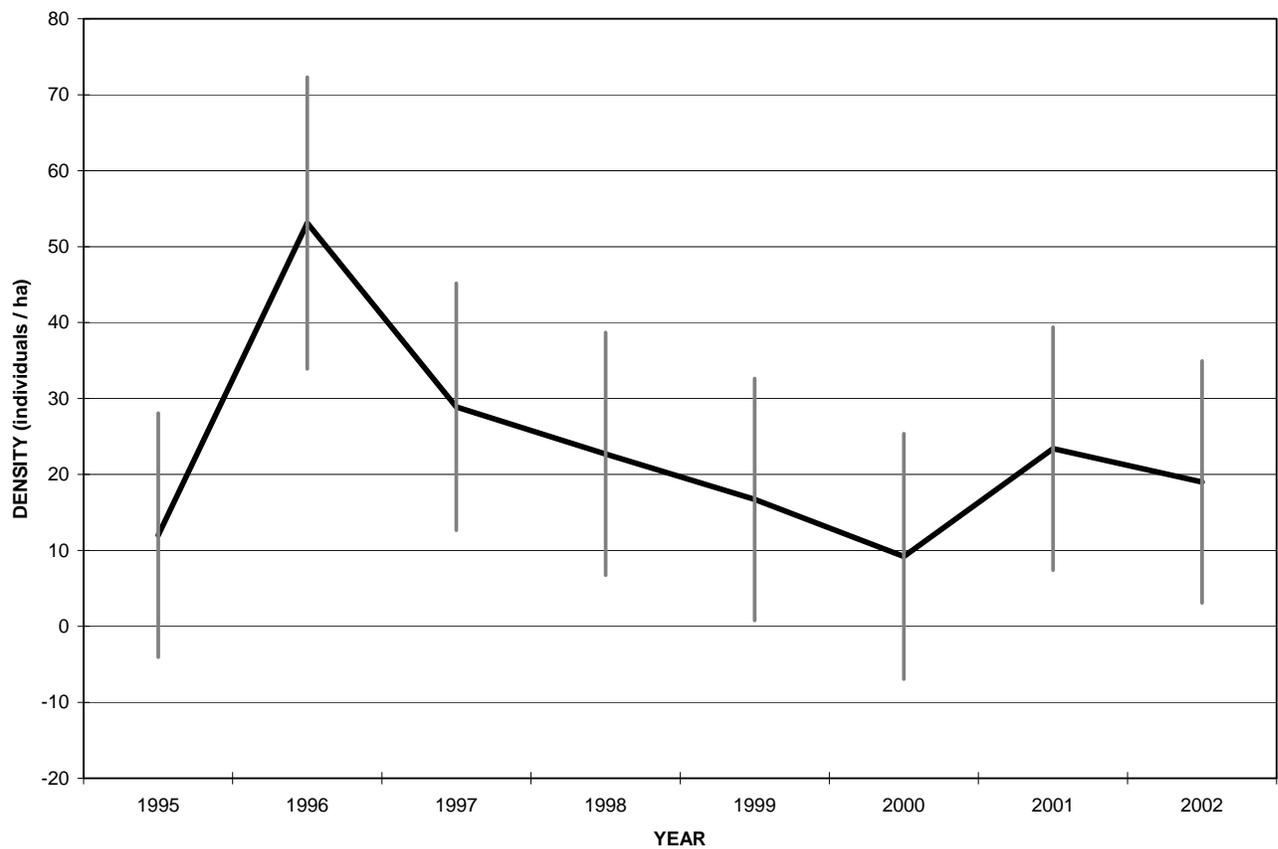


Figure 2. Estimated Black-tailed prairie dog densities (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska for years 1995 to 2003. Bars at each annual density estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their density estimate are not significantly different.

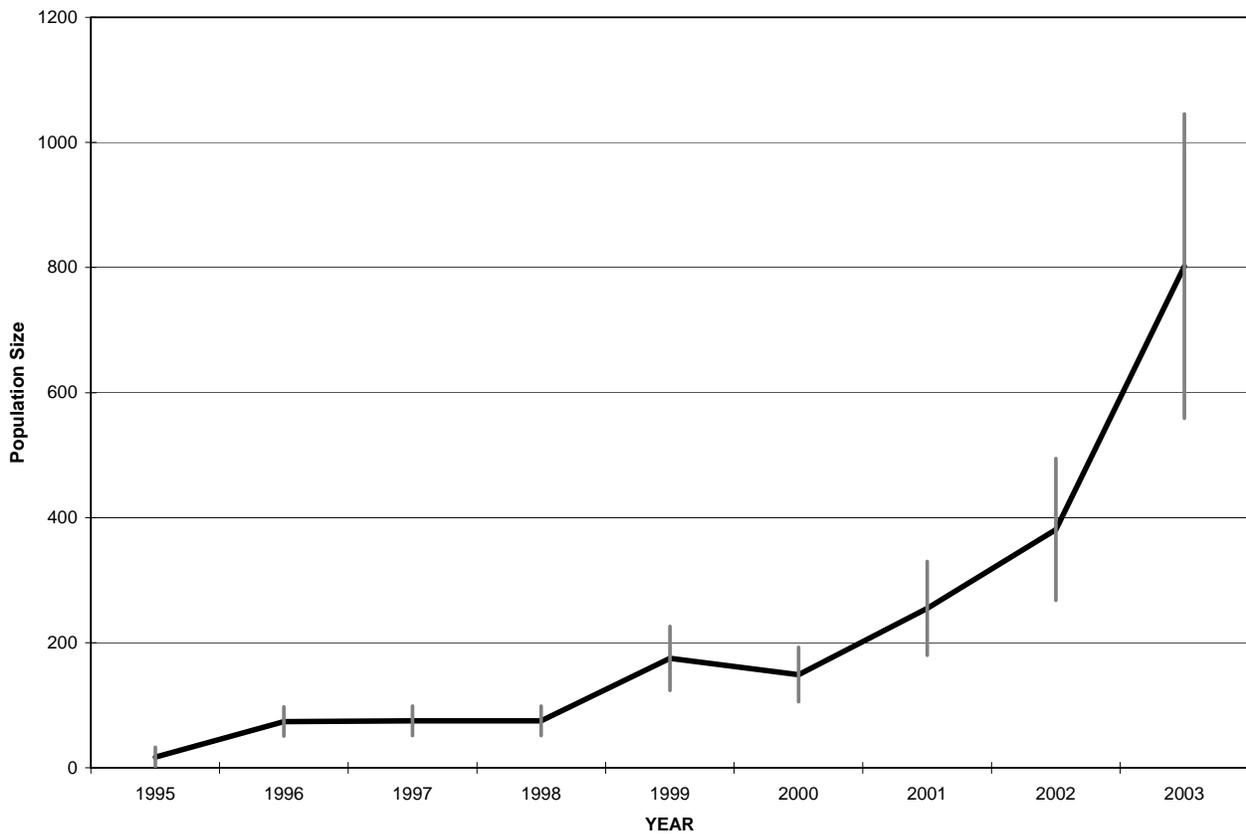


Figure 3. Estimated Black-tailed prairie dog population size (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska for years 1995 to 2003. Bars at each annual population estimate represent a calculated confidence interval for that year. It is assumed that years with widely overlapping confidence intervals about their population estimate are not significantly different.

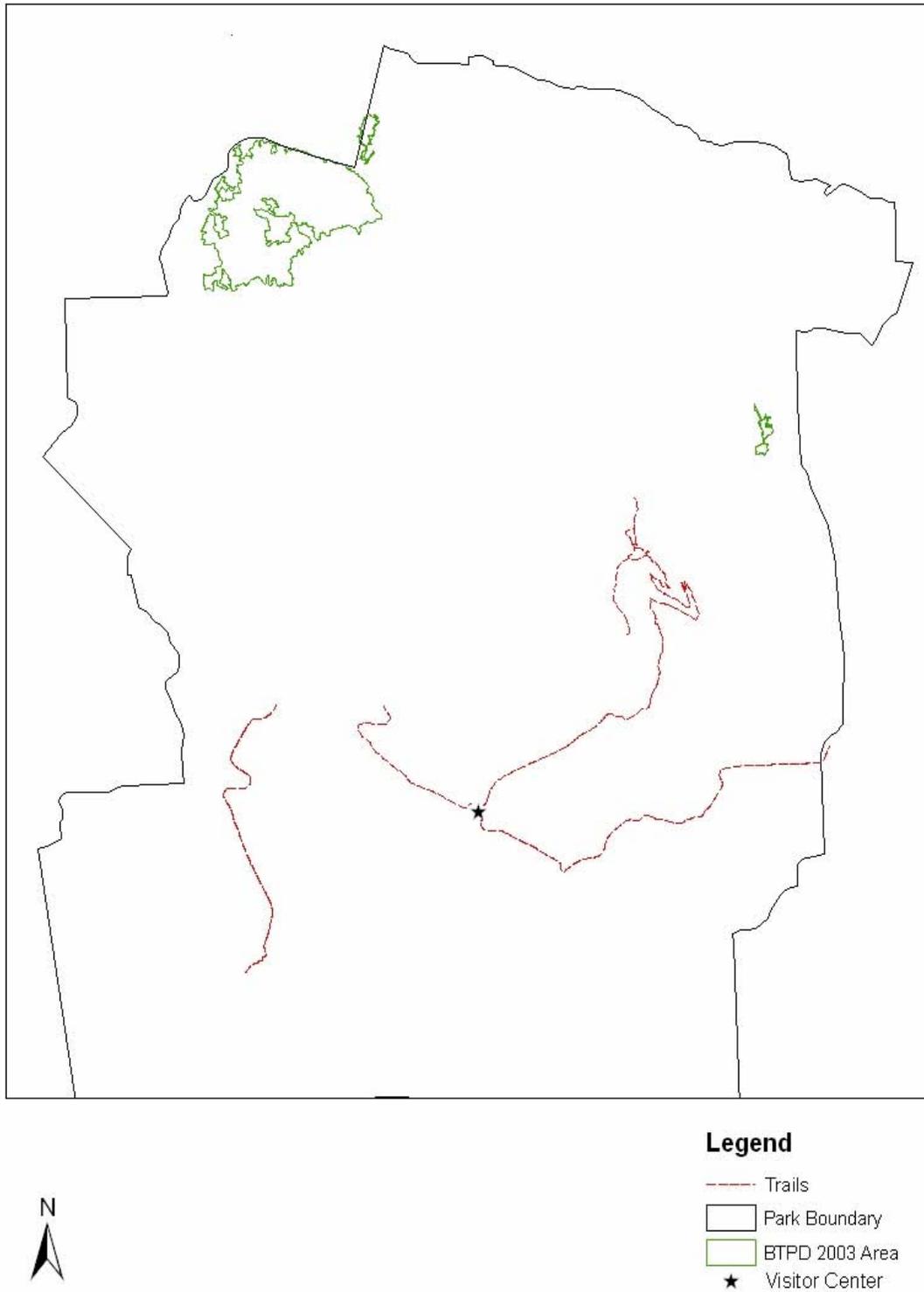


Figure 4. Black-tailed prairie dog (*Cynomys ludovicianus*) colony locations at SCBL during 2003.

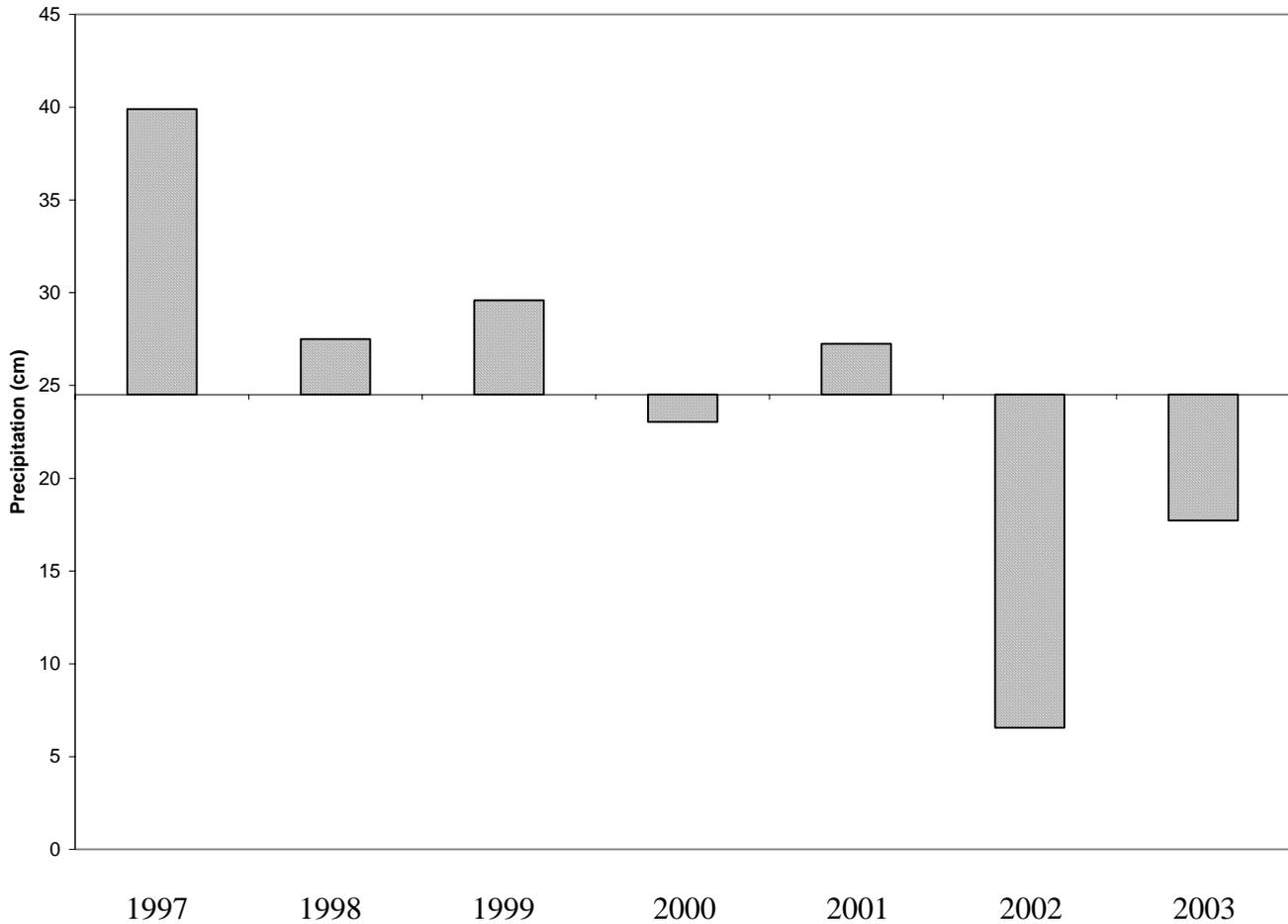


Figure 5. Cumulative precipitation for the first seven months of each year shown annually as deviations from the seven year average (1997-2003) at Scotts Bluff National Monument, Nebraska. Precipitation averaged 24.51 cm for the first seven months of a seven-year period.

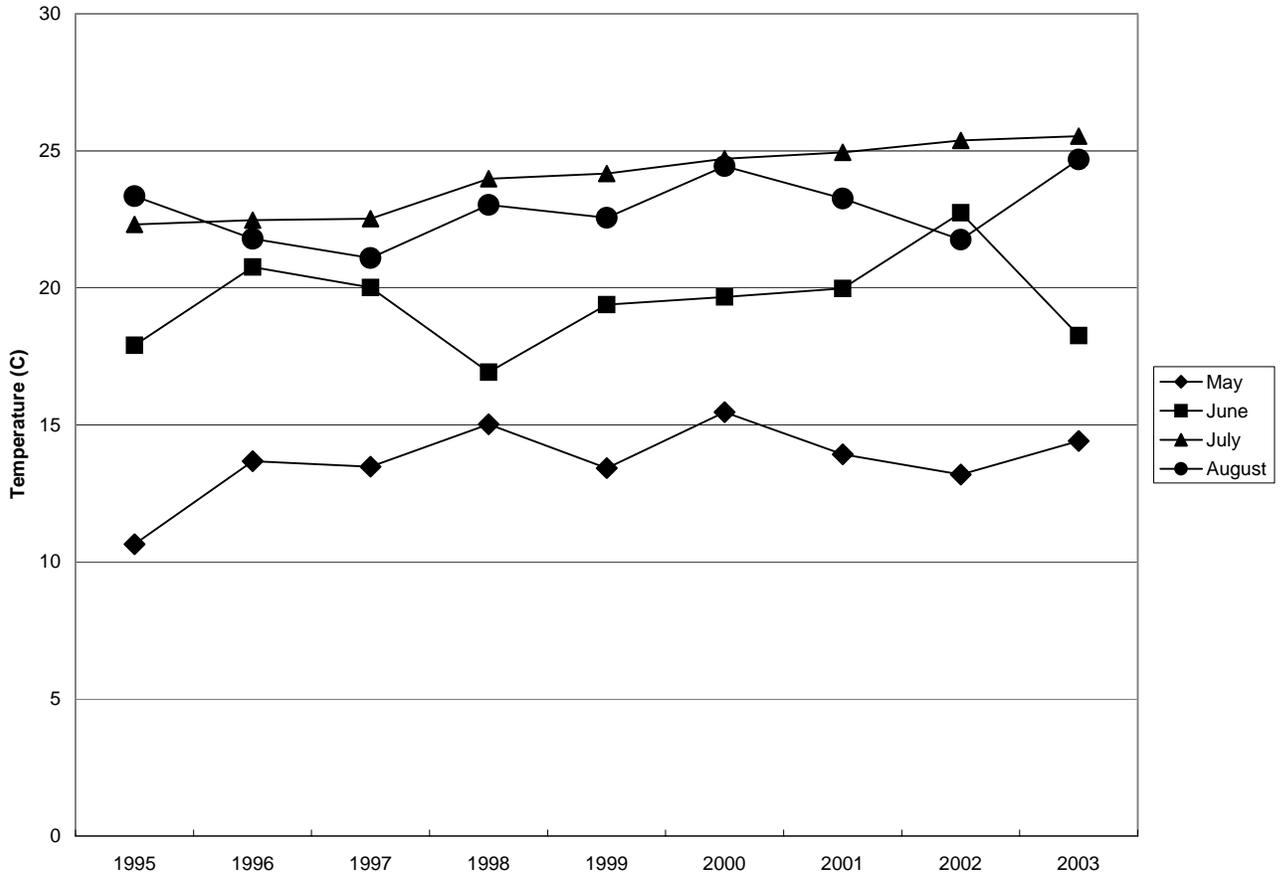


Figure 6. Mean temperatures May-August for a nine year period at Scotts Bluff National Monument, Nebraska.