



Wind Cave National Park Black-Footed Ferret Reintroduction – 5-Year Review

Natural Resource Report NPS/WICA/NRR—2015/916



ON THE COVER

A black-footed ferret being reintroduced to Wind Cave National Park by Barbara Muenchau.
Photograph courtesy of National Park Service/Tom Farrell

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Executive Summary

Wind Cave National Park, located in western South Dakota, is one of the premier wildlife parks in the country. Although only 33,851 acres in size, it supports a diversity of iconic Northern Great Plains species including bison (*Bison bison*), pronghorn antelope (*Antilocapra americana*), and elk (*Cervus elaphus*). In 2012 the park supported an estimated 1,955 acres of black-tailed prairie dog (*Cynomys ludovicianus*) colonies, a species reduced to only 2% of its historic range. Prairie dogs are obligate prey species for the critically endangered black-footed ferret (*Mustela nigripes*).

The black-footed ferret was thought extinct until 1981 when a population was discovered in Wyoming. Due to disease and other concerns the last remaining 18 animals were brought into captivity by 1987. From 1991-2007 the descendants of those animals were released back into the wild. However, the ferret recovery program was running out of large reintroduction sites, defined as sites with more than 5,000 acres of prairie dog colonies. Wind Cave National Park agreed to become a ferret reintroduction site, but due to the relatively small prairie dog acreage the reintroduction was viewed as an experiment.

In 2007, 49 black-footed ferrets were released into the park. Sixteen animals came from captive breeding facilities and 33 were transplanted from a wild population. Forty-five of the animals were released in 3 prairie dog colonies in the southern end of the park and 4 animals were released in the north central area of the park. In 2010 another 12 animals, all from captive breeding facilities, were released on the east side of the park.

As of the fall of 2012, there are an estimated 57-67 black-footed ferrets at Wind Cave. They have been documented in 9 of 24 prairie dog colonies with 80-90% of the animals occurring in the northern portion of the park. Further research and monitoring is needed to understand the reasons why ferrets are primarily occupying prairie dog colonies in the northern area of the park despite the majority of releases taking place in prairie dog colonies at the southern end of the park.

Plague, a disease not native to North America, continues to be a major threat to the park's prairie dog and ferret populations because it is highly fatal to both species. Although the plague bacterium (*Yersinia pestis*) has been detected in the park, no epizootics have been observed. The park conducts an active prairie dog burrow dusting program (i.e., putting an insecticide in burrows) in an effort to control fleas that transmit the disease. In 2013 the park became part of a 3-year multi-state study to field test an oral plague vaccine for prairie dogs.

The black-footed ferret reintroduction at Wind Cave has generally been positively supported by the local public. Although some neighbors express concern about prairie dog expansion, there is less animosity towards ferrets.

The visiting public appears to be very supportive and interested in the ferret program. From 2007-2012 the park conducted a variety of outreach and education programs regarding ferrets. For example, the park conducted summer night-time ranger-led spotlighting walks for ferrets. Although ferrets are less observable at this time of the year than they are in the fall, the night-time walks were

popular with visitors. From 2008-2012 fifty-three night-time walks were conducted with 1,084 visitors participating. This is believed to be the only regularly-scheduled program established for the public to see ferrets in the wild. To reach more visitors the park created ferret displays and an interactive software program in the park visitor center. From 2008-2012 it is estimated that several hundred thousand visitors were exposed to ferrets as part of the park's interpretive and outreach programs. Even more people were reached through press releases and other outreach activities.

After 5 years the Wind Cave National Park black-footed ferret reintroduction is considered a success. Several other small reintroduction sites have reintroduced ferrets following the early success of Wind Cave (however, plague has created problems for some of them). Whether ferret populations in the park can sustain themselves and remain viable over a longer term remains to be seen. Continuing management and monitoring of ferrets, prairie dogs, and other components of the ecosystem is strongly encouraged.

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We also acknowledge and thank the many people who have made this report possible by their involvement in the Wind Cave ferret program. A full list of the participants can be found in Appendix E.

Introduction

Wind Cave National Park (Wind Cave) in western South Dakota is one of the premier wildlife parks in the National Park System. The park played a critical role in the early 20th century in bringing bison (*Bison bison*) back from the brink of extinction. It also played a vital role in restoring and conserving other Great Plains species such as pronghorn antelope (*Antilocapra americana*) and Rocky Mountain elk (*Cervus elaphus*). The 33,851-acre park is also a sanctuary for between 1,000-3,000 acres of black-tailed prairie dog (*Cynomys ludovicianus*) colonies (Wind Cave National Park 2006b), a species reduced to only about 2% of its historic range.

Prairie dogs are the primary prey of the critically endangered black-footed ferret (*Mustela nigripes*). The black-footed ferret was thought by many to be extinct until a single population was discovered near Meeteetse, Wyoming in 1981. Due to concerns about disease and the viability of the remnant population the remaining 18 survivors were brought into captivity by 1987 to start a captive breeding program. Ferrets from that program were released into the wild starting in 1991 in Wyoming and subsequently at other locations throughout their historic range. However, the ferret recovery program soon ran out of reintroduction sites with large (>5,000 acres) prairie dog complexes and hence, smaller complexes were considered for experimental reintroductions.

In the year 2000 Wind Cave National Park began discussing and assessing the feasibility of reintroducing black-footed ferrets to the park. The idea was initially met with some reluctance by the ferret recovery program due to the limited prairie dog acreage at the park. But the protected status of the park's prairie dogs, lack of any evidence of plague, the public outreach potential, and a dearth of other recovery sites all made the park a candidate for a ferret reintroduction.

In 2007 black-footed ferrets were reintroduced to the park. A smaller follow-up release occurred in 2010. The park has systematically monitored the ferret population as well as its obligate prey species, the black-tailed prairie dog. As of the date of this report there appears to be a healthy population of both species at the park. The Wind Cave National Park ferret reintroduction is generally viewed as a success, although much work remains to be done.

This report documents the black-footed ferret reintroduction at Wind Cave National Park, with an emphasis on 2007-2012, the first five years of the reintroduction program. The report describes the historic background of the site, the rationale for the reintroduction program, the methods used, and the results. It discusses the successes and failures of the program in the opinion of the authors. The report then places the Wind Cave reintroduction effort within the context of the larger black-footed ferret recovery program. Lastly, this report provides recommendations for future ferret management and monitoring at the park.

Study Area

Wind Cave National Park was established in 1903 by President Theodore Roosevelt to protect Wind Cave, one of the longest caves in the world and well known for its outstanding and unusual geologic features known as boxwork. The park was subsequently expanded in 1912 in part for purposes of conserving “native American game animals” such as plains bison, pronghorn antelope, and elk. By 1946 the park encompassed approximately 28,000 acres. In the year 2000 it was expanded to 28,295 acres and in 2011 it increased to the current 33,851 acres.

The park lies within Custer County, South Dakota, 6 miles north of the town of Hot Springs. It is bounded by Custer State Park on the north, Black Hills National Forest on the west, and private lands on the south and east. State Highways 385 and 87 run generally north-south through the park. One gravel road on the northern end of the park generally runs northwest-southeast while the second gravel road runs north-south through the eastern half of the park.

The park habitat is comprised of a mosaic of mixed-grass prairie and ponderosa pine (*Pinus ponderosa*) forests (Figure 1). Dominant prairie vegetation in the park includes blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyron smithii*), and little bluestem (*Schizachyrium scoparium*). Dominant vegetation in the forest is ponderosa pine. Fire is a natural process at the park and plays an important role in maintaining prairie and controlling the spread of woodland areas. Grazing is also a significant ecological driver that maintains habitats.

The park contains many species of wildlife found in prairie and forested ecosystems including bison, pronghorn, mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), elk, wild turkey (*Meleagris gallopavo*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), mountain lion (*Puma concolor*), black-tailed prairie dog, and other mammals, birds, reptiles, and amphibians. Bison, elk, and pronghorn were absent at the time of park creation and were subsequently reintroduced. The herd of 400-500 bison is especially important as it is a relatively genetically diverse herd and shows little or no evidence of cattle introgression, unlike many other bison herds. The park may be the only site in the world that supports bison, elk, pronghorn antelope, sharp-tailed grouse (*Tympanuchus phasianellus*), burrowing owl (*Athene cunicularia*), black-tailed prairie dog, and as of 2007, the black-footed ferret, all of which are iconic grassland species.

The park is managed under National Park Service (NPS) policies (National Park Service 2006) and other authorities, including the Endangered Species Act of 1973. Park specific plans have been developed for resources and species of high management concern. The 33,851 acres includes 5,555 acres that were added in 2011. A management plan for the new expansion is currently in preparation. The northern half of the expansion is comprised of rugged topography dominated by mountain mahogany (*Cercocarpus montanus*) and ponderosa pine, while the southern half is more rolling hills of grassland habitat. No prairie dogs are known to currently exist on the newly acquired land.

The park receives approximately 750,000 visitors a year. Peak visitation is in the summer and the primary attractions are the cave and the wildlife. Wildlife viewing is generally either from vehicles or from the network of approximately 30 miles of hiking trails. The park has an established campground

and backcountry camping is allowed in the western portion of the park. Approximately 57% of park visitors stayed in motels, campgrounds, and other lodging outside the park and visitor spending attributed to the park was estimated at \$22.8 million in 2010, which supported 380 jobs (Cook 2011).



Figure 1. Typical scene showing a mixture of prairie and ponderosa pine forest.

History, Size, and Distribution of Prairie Dog Colonies

The black-footed ferret is entirely dependent on prairie dogs (Figure 2) for food and shelter; therefore, a discussion of prairie dogs is a prerequisite for a discussion of black-footed ferrets. In spite of the keystone role that prairie dogs play (Kotliar 2006), their almost total elimination on private lands (Proctor et al. 2006), and National Park Service (NPS) policies to conserve all native wildlife, their conservation even on park lands has not been easy. Prairie dog control, typically in the form of poisoning or shooting, has often been a controversial topic within the agency and the public. Licht et al. (2009) stated that “of all the native species found on National Park Service lands, perhaps none have been as maligned by park managers as the various species of prairie dog.” Wind Cave is typical of the agency’s struggles with conserving the much-maligned species (Roddy 2009).

Prairie dogs were probably present within the park when the unit was first established in 1903 and have probably been on site for thousands of years (Carlson and White 1987). The first recorded prairie dog control efforts in the park started in 1921 and periodically afterwards in 1927, 1934, and

1952-55 (Lovaas 1973). Prairie dog control within the park was requested by park personnel in 1964, 1967, 1970 and 1972 but denied (Lovaas 1973). Klukas (1987) suggested that prairie dog control at the park should be carried out at intervals no longer than five years.



Figure 2. A black-tailed prairie dog family.

In 1982 a management plan was developed for prairie dogs at Wind Cave (Wind Cave National Park 1982, Klukas 1987). The plan called for no more than 700 acres of prairie dogs and regular toxicant use to control populations. Prairie dog shooting by park employees was apparently also used for control of the population (Klukas 1987). Roemer and Forrest (1996) reported that Wind Cave National Park used lethal control on 1,922 acres of prairie dogs from 1982-92.

As the twentieth century came to a close the public's attitudes toward prairie dogs became more positive, scientists more diligently documented the ecological value of the species, and the agency was becoming more confident in its conservation mission. As a result, the National Park Service began showing more support of prairie dogs and more restraint in control programs (Supernaugh 1999).

Prairie dog management in the NPS entered a new phase when on July 31,

1998, the National Wildlife Federation (NWF) petitioned the federal government to list the black-tailed prairie dog as threatened throughout its range (Licht et al. 2009). As a result of the petition, on January 14, 1999, the Regional Director of the Midwest Region of the NPS signed a memorandum halting all lethal prairie dog control on agency lands in the region (with an exception for human "health and safety"; Schenk 1999). The memo stated that the listing petition brought the agency "to a point in time where we must consider our past views and actions toward this often maligned species." Approximately one year later the NPS Associate Director for Natural Resource Stewardship and Science sent a memo to the U.S. Fish and Wildlife Service clarifying NPS's position on prairie dogs (Soukup 1999). The memo stated that control actions were limited to 1) human health hazards, 2) threats to cultural resources, and 3) good neighbor purposes.

On February 4, 2000, the U.S. Fish and Wildlife Service responded to the NWF petition by designating the black-tailed prairie dog a candidate species, meaning there was sufficient evidence to

list it as threatened, but the action was precluded by other listing actions (U.S. Fish and Wildlife Service 2000). However, on August 18, 2004, the species was removed from the candidate list, with the U.S. Fish and Wildlife Service justifying the removal on evidence that the distribution, abundance, and trend data were not as dire as earlier believed (U.S. Fish and Wildlife Service 2004). As a result of the revised status, and the acrimony surrounding the species, the Midwest Regional Office of the NPS issued a new and more lenient policy on black-tailed prairie dogs (Quintana 2004). The memorandum re-opened the possibility of lethal control; however, it stated that “any park with prairie dog conservation issues must complete a park prairie dog conservation plan.”

Following approval of a prairie dog management plan (Wind Cave National Park 2006b) the park again conducted control actions, mainly removing prairie dogs along the park boundary adjacent to private property (“Good Neighbor Policy”). Approximately 50 acres of prairie dog colony were treated with zinc phosphide in 2006, 59 acres in 2007, 74 acres in 2008, and 81 acres in 2009 (Wind Cave National Park 2009). At the end of 2009 there were an estimated 2,800 acres of prairie dogs in the park. The prairie dog management plan and accompanying Finding of No Significant Impact (FONSI) called for maintaining 1,000-3,000 acres of prairie dogs in the park.

Several methods have been used to determine prairie dog acreages within the park. In 1938, aerial photo interpretation was used to determine acreages. Compass and measuring wheel were used in the 1960’s (Lovaas 1973). In 1978, acreages were derived from remote sensing using infrared color photography. In 1982 a combination of aerial photos and ground surveys were used to measure prairie dog acres. In 1990 all prairie dog colonies in the park were mapped and prairie dog densities were estimated to determine potential ferret habitat for reintroduction. Colonies were surveyed by walking the perimeter of the colonies and recording coordinates every 50-100 meters. Maps were then generated using the software AutoCad¹. Prairie dog densities were estimated using line transect methods to count active prairie dog burrows and convert to a prairie dog estimate (Biggins et al. 1993). From 1994 to present, prairie dog mapping has been completed by walking the perimeter of colonies and using Global Positioning Systems (GPS). From 1998 to 2013 the following criteria was used by field surveyors to delineate the colony edge:

Visually identify the dominant vegetation clip line when present; b) when continuity of a vegetation clip line falters, is not apparent or cannot be reasonably determined, continue to encircle the colony with an imaginary line which incorporates the extent of active burrows (fresh scat within 0.5 meters of burrow) within five meters of actively grazed prairie dog colony. There may be exploratory burrows at a great distance from the main colony, but burrows > 5 meters should be excised, if they appear to be “outliers”; otherwise extensive areas of un-colonized grassland could be included. Include all clip line and all active burrows < 5 meters outside clip line. Try to determine if the “clipping” is from prairie dogs or from other ungulates. Try not to include areas that are “clipped” due to ungulate grazing. Also, for accuracy in determining active acres of prairie dogs, large areas within the

¹ Use of product names does not constitute endorsement.

perimeter boundary, such as areas of tall grass, streambeds, rock outcrops, shrubbery, etc. should be excised from the active acreage of prairie dogs for that colony if at all possible.

The 2011-12 prairie dog distribution and abundance in the park is 24 colonies estimated at 1,955 acres (Table 1, Figure 3). Mean colony size is 80.0 acres with a range of 0.6–500.0 acres. The amount of acreage has varied greatly over the years. The reason for the substantial decline in acreage from 2009 to 2012 cannot be fully explained, but the period did coincide with above-average precipitation. From 2000 to 2013 prairie dog acreage has been substantially larger than in most of the twentieth century (however, this does not imply that it is above the ecological carrying capacity for the site). An additional 500 acres of prairie dog colony exists in Custer State Park directly north of the North Boundary prairie dog colony which, for purposes of ferret conservation, can be considered part of the Wind Cave prairie dog complex (Figure 3).

Table 1. Size of prairie dog colonies (in acres) and changes over time.

Prairie Dog Colony	Year											
	1938	1978	1982	1990	1994	1999-00	2001	2003	2005	2007	2009-10	2011-12
Apple Orchard									0.6	4	6	6
Bison Flats	30	609	645	697	504	543	646	746	862	992	900	*500
Boland (different than NE)										0.6	0	0.6
Campground (12) (Elk Mt.)	15		5	4					0	0	0	0
Cold Brook (Shirrtail Canyon)	45	35	35	0					0.1	2	4	3
Corrals (Bison trap)						4.7	3	11	11	35	59	64
Cottonwood									0.4	1	0.8	2
Goose Pimple Buttes	30		0	0					0	9	11	9
Highland Central								5	6	16	20	21
Highland Main (highland)	120	30	86	76	71	72	66	78	78	88	102	101
Keyhole									2	5	7	7
Norbeck (385/87)	35	154	170	39	51	50	92	121	108	181	160	214
North Boundary (NorthTown)	30	28	110	53	48	84	118	126	159	206	166	118
Northeast (earlier Boland)	40	34	35	18	25	11	24	37	41	50	41	41
North NPS 5 (N Highland)								4	30	47	35	27
Pringle (Pringle Cutoff)	10	82	125	109	111	118	118	101	116	114	90	77
Rankin ridge	0	10	10	12	12	10	10	7	10	7	6	5
Red Lick (merged w/ R.Reserve)			15									
Red Valley	105		20	11	13			2	24	43	83	90
Research Reserve	95	269	270	300	280	289	292	356	408	519	500	*300
Rocky Knob			5	0		0	0	0	0	0	0	0
Sanctuary		135	135	22	82	88	92	152	187	234	71	133
South Boundary (South Gate)								0.3	1	0	1	1

Table 1 (continued). Size of prairie dog colonies (in acres) and changes over time.

Prairie Dog Colony	Year											
	1938	1978	1982	1990	1994	1999-00	2001	2003	2005	2007	2009-10	2011-12
Southeast	0	147	170	196	19	42	64	108	117	245	214	230
Sylvan Prairie Dog Town						0			0	0	0	0
Trail #7a										2	2	4
Trail #7b											0.7	1
Upper Highland (Corrals)	145		5	0								
Upper Wind Cave Canyon								0.7	2	0	0	*0.2
Wind Cave Canyon	0	3	5	3		0			0	0	0	0
Total	700	1536	1846	1540	1216	1312	1525	1855	2163	2801	2479	1955

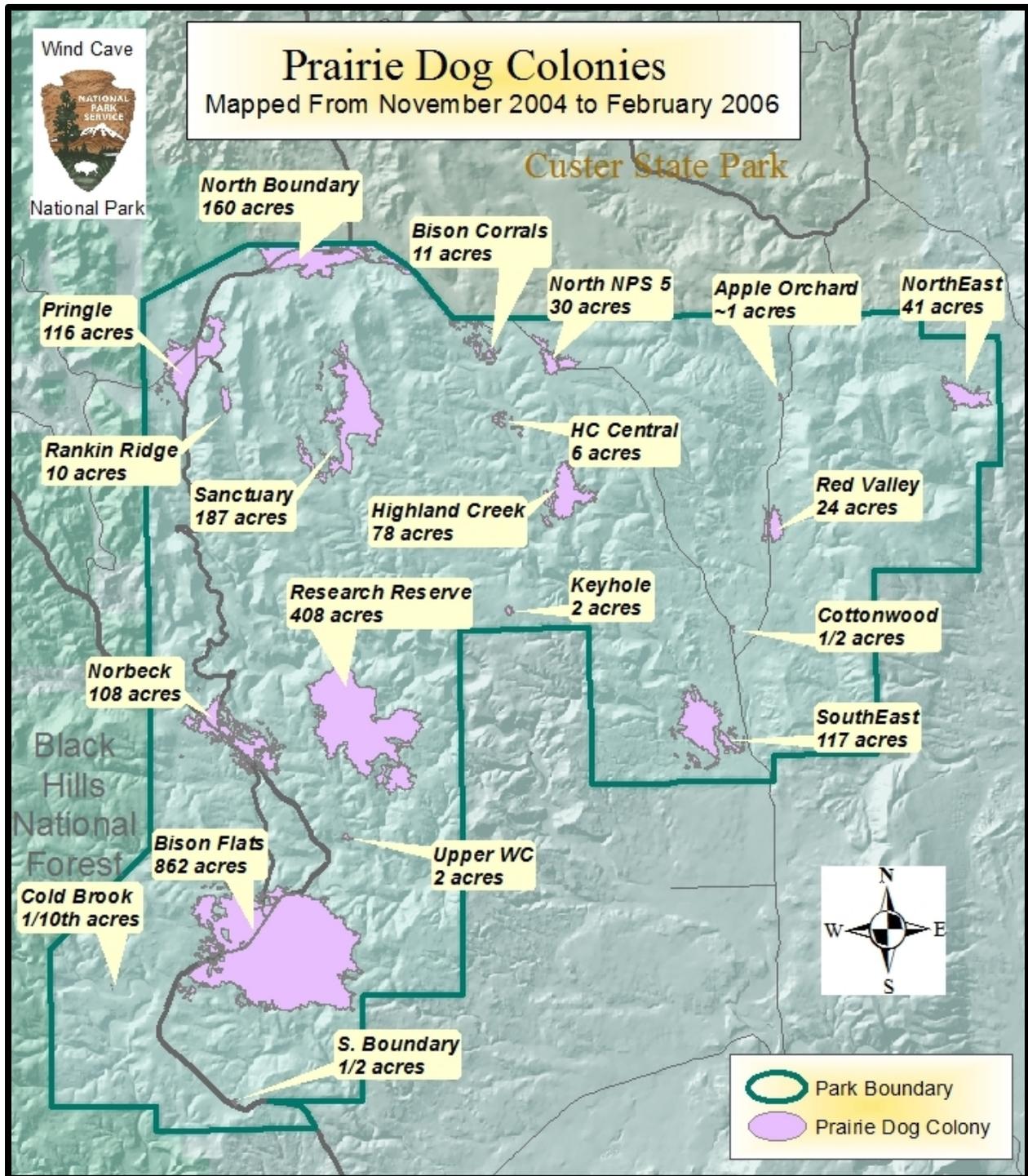


Figure 3. Prairie dog colonies in Wind Cave National Park from 2004-2006.

History of Black-footed Ferrets at the Park

Black-footed ferrets once occurred throughout much of the Great Plains. Many specimens were recorded in South Dakota including the first specimen taken in 1889 in Shannon County, just southeast of Wind Cave National Park. The first specimen documented in Custer County was in 1903

in Gillette Canyon and the first specimen documented within Wind Cave was in 1922 (Henderson et al. 1974). Three ferrets, trapped in Haakon County in August of 1953, were relocated to the park and featured in the Disney film “Vanishing Prairie.” The three relocated ferrets had disappeared by 1957 (Lovaas 1973). A reported ferret sighting by graduate student Milo Shult in 1968 prompted spotlight surveys but no ferrets were found. While black-footed ferrets were likely more common outside of the Black Hills, they were certainly indigenous to the park. The last reported sighting of a ferret in the park was in 1977. On July 20, 1977 a dictated memo was taken by park employee Jean Donnell from Randy Williams, stating “Randy Williams, a seasonal park naturalist was driving from park headquarters to Hot Springs on July 18, 1977 about 11 p.m. At the south edge of the Bison Flats Prairie Dog Town on the right side (west) he sighted a black footed ferret. He said it looked to his headlights. He said it had a black mask around his eyes and the rest of the head was white. Randy stopped and backed up to try to get a better look but it was gone.” It was one of the last known ferrets observed in the state before the species was declared extirpated. Although during recent discussions with Randy Williams he seemed a little less certain about his sighting in 1977. The park also has a record from 1971 in which a wildlife officer of the South Dakota Department of Game, Fish and Parks reported seeing a ferret in the park.



Figure 4. A just-released black-footed ferret at Wind Cave National Park.

The black-footed ferret was formally declared as endangered with enactment of the Endangered Species Act of 1973. However, in the following years the species was thought by many to be extinct. Interest in the ferret was re-kindled with the discovery of a small population near Meeteetse, Wyoming in 1981. Although the Meeteetse population crashed due to sylvatic plague and canine

distemper, the last 18 individuals were salvaged and formed the genesis of a successful captive breeding program (Miller et al. 1996). In 1989 Wind Cave was considered a potential reintroduction site pending further data on prairie dog abundance and distribution. Prairie dog surveys in 1990 determined there were 1,540 acres of prairie dogs within the park (Shreves 1990). To ensure that there were no existing ferrets in the park spotlight surveys were conducted in 1990, but no ferrets were observed (Shreves 1990). However, the U.S. Fish & Wildlife Service eventually decided to commence reintroduction into larger prairie dog complexes (>5,000 acres) so Wind Cave was not considered a high priority reintroduction site at that time.

Eventually, ferrets were reintroduced to most of the larger prairie dog complexes in North America. At the same time the ferret recovery program continued to raise ferrets in captivity, but with fewer large complexes available for releases. As a result, staff at Wind Cave began internal discussions about submitting an application to reintroduce ferrets to the park. Official scoping began in 2002. However, it was determined that a prairie dog management plan was needed first. The prairie dog management plan was completed in 2006 (Wind Cave National Park 2006b). The Finding of No Significant Impact (FONSI) for the prairie dog management plan was signed May 29, 2006. In response to a public comment received regarding ferrets and the suitability of the prairie dog plan, the agency wrote in a FONSI that:

As previously stated, this plan is not based upon the reintroduction of black-footed ferrets, but upon the purpose and need as outlined on pages 1-3. True, the potential for reintroduction is considered in the analysis and the park feels Alternative C (1,000-3,000 acres) does encompass enough acres to be considered as a reintroduction site for black-footed ferrets. The U.S. Fish and Wildlife Service, in a March 16, 2006 response letter to the environmental assessment, concluded that Alternative C would have beneficial effects for black-footed ferrets, were they to be reintroduced.

The park then completed a black-footed ferret reintroduction plan in late 2006 (Wind Cave National Park 2006a). The Finding of No Significant Impact (FONSI) for the ferret reintroduction plan was signed April 12, 2007. In conjunction with the plan the park submitted a formal request to the U.S. Fish and Wildlife Service to receive ferrets, either from the captive breeding facility or from a wild population with surplus animals, for purposes of reintroducing ferrets to the park. On July 4, 2007 seven ferrets were released (Figure 4) and Wind Cave National Park officially became the 14th reintroduction site in North America.

History and Status of Plague at the Park

Plague, caused by the bacterium *Yersinia pestis*, is not native to North America and was inadvertently introduced to North America as early as 1900. The disease, often called sylvatic plague when it occurs in wildlife, is highly fatal to both black-footed ferrets and prairie dogs (Abbott and Roche 2012). Plague has decimated many prairie dog populations (Cully et al. 2006) and severely impacted the overall black-footed ferret recovery program. The presence or absence of plague is an important consideration in evaluating potential ferret reintroduction sites.

Prior to and at the time of the black-footed ferret reintroduction in 2007 it was believed that plague was not present at Wind Cave National Park. In fact, plague was considered to be essentially absent in western South Dakota until 2005 when an epizootic was documented in prairie dogs on the Pine Ridge Indian Reservation in nearby Shannon County. Plague epizootics continued to spread to Conata Basin/Badlands National Park, but visual evidence of plague in prairie dogs (e.g. large areas of unoccupied colonies and vegetatively overgrown burrows) was not observed at Wind Cave National Park. This perception of no plague greatly elevated the reintroduction value of Wind Cave compared to other new reintroduction sites. As a result of plague in Pine Ridge and Conata Basin/Badlands, a study was initiated with the University of South Dakota to determine the status of plague at Wind Cave and four other Great Plains parks. The study used a nested polymerase chain reaction (PCR) technique (Hanson et al. 2007) to confirm the presence of plague bacterium DNA within fleas collected from the park. The results of the study, and the control efforts conducted at the park, are discussed in the following sections.

Status of other Wildlife at the Park

Several wildlife species that occur at the park have a strong interaction with ferrets and can influence a ferret reintroduction. The most noteworthy is the black-tailed prairie dog; the status of that species is discussed elsewhere in this report. Several other species can also affect a ferret reintroduction, most importantly via predation of ferrets. The status of those species at the park is discussed here.

The coyote is widely reported to be a significant predator of black-footed ferrets (Poessel et al. 2011). It is possible that ferrets evolved in a relatively coyote-free ecosystem prior to European settlement as wolves (*Canis lupus*) were abundant on the Great Plains and are known to displace coyotes. The absence of wolves allows coyotes to flourish in the region and coyotes are now the apex predator. Some sites have conducted limited coyote control prior to or in conjunction with ferret releases with mixed results in terms of increasing survivorship of ferrets (Breck et al. 2006); however, no control occurred at Wind Cave. Coyote density in the park was estimated at 0.22-0.44 coyotes/km² (25-50 individuals) in 2003, but decreased by 48% to 0.14-0.27 coyotes/km² (16-31 individuals) after an epizootic of sarcoptic mange in 2004 (Chronert et al. 2007). The coyote density within the park may be higher than surrounding lands due in part to the absence of hunting. However, we suspect that coyote density within the park remained low at the time of the ferret reintroduction in 2007 because of continuing visual evidence of mange in the coyote population.

Another regularly observed potential mammalian predator of ferrets is the bobcat. Although most common in thick cover and rugged topography they do venture out into prairie dog colonies and have been observed preying on prairie dogs (Hoogland 1995, Licht 2010). There are no known records of bobcat predation on black-footed ferrets, but it is conceivable. American badgers (*Taxidea taxus*) are known to occasionally prey upon black-footed ferrets (Eads et al. 2013); they too are found in the park. Like ferrets, badgers are fossorial animals, prairie dogs are an important prey, and they are mostly nocturnal.

Other potential predators of ferrets occur in the park, but little is known about their distribution, abundance, habitat use, or food preferences. One noteworthy potential predator is the great-horned owl (*Bubo virginianus*). Often observed at night in or near prairie dog colonies, great-horned owls

have been documented as predators of black-footed ferrets and survival of reintroduced ferrets appears to be lower near areas where owls may perch (Poessel et al. 2011). Other potential avian predators of ferrets observed in the park include golden eagles (*Aquila chrysaetos*), red-tailed hawks (*Buteo jamaicensis*), and bald eagles (*Haliaeetus leucocephalus*).

Reintroduction

The idea of reintroducing black-footed ferrets to Wind Cave National Park was first contemplated in 1990 when an internal analysis and report was filed by Dennis Shreves “*Back from The Brink - Ferret Habitat Survey at Wind Cave National Park*”. Some of his initial thoughts were moved forward by park staff around the year 2000. They approached the NPS Midwest Region Wildlife Biologist who then broached the idea to the Executive Committee of the Black-footed Ferret Recovery Implementation Team (BFFRIT-EC). There was some concern and reluctance by some committee members due to the relatively small amount of prairie dog acreage at the park. Up to that time the recovery program was considering only reintroduction sites that had at least 5,000 acres of prairie dogs, and preferably, 10,000 or more acres. Due to the relatively small amount of prairie dog acreage at the park, and questions about the likelihood of success, the Wind Cave National Park ferret reintroduction program had a very strong experimental approach.

Pre-release Studies and Preparation

In the year 2000 park staff started the proposal writing, information gathering, data analyses, preparatory actions, environmental compliance, and other actions necessary to receive an allocation of black-footed ferrets for reintroduction purposes. Many of the actions were required by the BFFRIT-EC or mandated by the Endangered Species Act or NEPA. At that time it was hoped the park would have all the tasks completed in order to release ferrets in 2003, the 100-year anniversary of the park. However, that ambitious schedule was not met because it was subsequently determined that a prairie dog management plan needed to be completed prior to the ferret plan being completed. The following is a brief overview of the pre-release activities.

In the year 2000 the park developed and submitted a proposal to receive internal NPS funding to help conduct the needed actions. The proposal was ultimately successful. About the same time the park evaluated and scored the suitability of the site for ferret reintroduction based on a score-sheet developed by the ferret recovery program. All potential reintroduction sites had to complete the score sheet with the allocation of ferrets being based on the relative scores of the sites. The park scored a 32 out of a possible 65. The score was higher than two sites that had already received ferrets, and above all but two other potential reintroduction sites. The one parameter in which the park scored relatively low was the amount of prairie dog acreage.

Although not explicitly required by the ferret recovery program process, the park used methods outlined by Biggins et al. (2006b) to estimate a Ferret Family Rating (FFR). The FFR is a relative measure of habitat suitability for ferrets and is mostly used to compare different sites. FFR should not be interpreted as an exact measure of expected ferret productivity. The analysis suggested that the park had a FFR of 101 based on the prairie dog acreage in 2006 (Table 2). However, that acreage was well above the long-term mean for the park. Furthermore, the prairie dog densities reported for 2006 were substantially higher than those reported for 1990 (the time of the Shreves report) especially at the large Bison Flats prairie dog colony. Using the 1990 acreage of 1,722 acres the estimated FFR for the park was 32.

Table 2. Prairie dog colony density and ferret family rating in 1990 and 2006.

Colony	Colony Size (acres)		Prairie Dogs / acre		Ferret Family Rating	
	1990	2006	1990	2006*	1990	2006
Apple Orchard		4.0		23.6		0.0
Bison Flats	696.6	992.4	15.4	24.4	14.1	31.7
Boland		0.5		23.6		0.0
Boland (NE)	17.5	49.9	12.7	23.6	0.0	1.5
Corrals		35.1		23.6		1.1
Cottonwood		1.0		23.6		0.0
Elk Mountain	4.0		9.7		0.0	
Goose Pimple Buttes		8.9		23.6		0.0
Highland Creek	75.9	88.0	16.2	23.6	1.6	2.7
Highland Central		16.1		23.6		0.5
Keyhole		4.9		23.6		0.0
Norbeck	39.0	181.1	13.5	23.6	0.7	5.6
North Town CSP	187.3	500.1	13.9	23.6	3.4	15.5
North Town WICA	52.9	206.1	13.9	23.6	1.0	6.4
NPS 5		47.0		23.6		1.5
Pringle	109.2	114.2	13.4	23.6	1.9	3.5
Rankin Ridge	12.1	6.9	25.1	23.6	0.4	0.0
Red Valley	10.6	43.0	14.3	23.6	0.0	1.3
Research Reserve	299.0	519.2	12.7	21.3	5.0	14.5
Sanctuary	22.2	234.0	14.1	23.6	0.4	7.2
Shirrtail Canyon		2.0		23.6		0.0
SouthEast	196.0	245.1	13.7	26.1	3.5	8.4
Trail #7a		2.0		23.6		0.0
Total	1722.3	3301.3	14.5	23.6	32.0	101.4

Three colonies were transected in 2006 (Bison Flats, Research Reserve and Southeast). Values on the colonies not sampled (italicized) are the mean of all transects from the three sampled colonies. Prairie dogs/acre were estimated using line-transect methodology described in Biggins et al. 1993. Ferret Family Rating was calculated as (colony size x prairie dogs/acre)/763 and all values <0.35 were disregarded and the colony was rated as zero.

The prevalence of diseases, particularly canine distemper and sylvatic plague, are a high concern in ferret recovery. The park collected disease prevalence information incidental to other projects. For example, a coyote research project was conducted from 2003-2007. A total of 22 coyotes were captured, with blood samples collected from 16 and analyzed at Wyoming State Veterinary Laboratory in Laramie. Titers were high for canine distemper in 2003, but dropped in 2004. The levels remained about the same in 2007 although the sample size was small. One coyote tested positive for tularemia in 2004. All coyotes tested negative for plague. On June 7, 2005 a prairie dog was submitted for testing and was also negative for plague.

Prior to submitting a formal request for ferrets the park had numerous discussions with representatives of the U.S. Fish and Wildlife Service regarding the project, including site visits by agency representatives with ferret expertise. The park also took an active role in the ferret recovery program including joining committees, attending meetings, assisting on tasks, and participating in

ferret surveys at nearby sites. For example, park staff became members of the Black-footed Ferret Recovery Implementation Team – Conservation Subcommittee. Park staff coordinated with Devils Tower National Monument on the capture and transfer of excess prairie dogs to the ferret captive breeding center, benefitting the overall recovery program.

In January of 2006 the park completed a Prairie Dog Management Plan (Wind Cave National Park 2006*b*). The FONSI was signed in May 2006. In November 2006 the park completed a Black-footed Ferret Reintroduction Plan / Draft Environmental Assessment (Wind Cave National Park 2006*a*). The FONSI (Finding of No Significant Impact) was signed April 12, 2007 which set the stage for future reintroductions of ferrets into the park.

Goals of the Reintroduction

The 5-year goals of the black-footed ferret reintroduction at Wind Cave (Wind Cave National Park 2006*a*) were:

- Test the viability of using a reintroduction site with less than 5,000 acres of prairie dog complexes;
- Establish a self-sustaining population of black-footed ferrets;
- Provide surplus wild-born ferret kits for translocations to other sites;
- Meet NPS policy by reintroducing an extirpated species;
- Support the NPS mission in keeping with NPS policies;
- Collaborate with park partners on the project;
- Educate the public about black-footed ferret restoration and conservation; and
- Avoid or minimize adverse effects on local economies, life styles, and the natural environment.



Figure 5. Releasing black-footed ferrets in the Norbeck Prairie Dog Colony in 2007.

The Reintroduction

In early July of 2007, 8 adult wild-born male ferrets were trapped in the Conata Basin by the U.S. Fish & Wildlife Service, the U.S. Forest Service, and Prairie Wildlife Research. The animals were released at the park on July 4-5 in the Bison Flats and Research Reserve prairie dog colonies (Figure

5). The sites were chosen because they were large colonies with dense prairie dog populations and they were not near the park boundary. The release was a hard release in that the animals were not penned or otherwise held long enough to become acclimated with their new environment, a standard practice in the ferret program. The release occurred during daylight hours. Animals were released approximately 492 feet (150 m) from each other with distances between animals ranging from 180 – 1,158 feet (55 – 353 m). These were the first ferrets within the park since 1977. The releases were not open to the public or media.

Additional ferrets were released in September-November of 2007 using methods similar to the July release. The releases included both wild-born and captive-raised animals (Table 3) and were open to the public and media (Figure 6). All total, 49 ferrets (25 males, 24 females) were released in 2007. All but 4 of the ferrets released were in the southern half of the park distributed among 3 colonies (Figure 7). In the fall of 2010 another 12 captive-born ferrets were released in the park (Table 4). The animals were released into two colonies in the east half of the park that had no known occupation of ferrets up to that time (Figure 8).



Figure 6. Media at a 2007 release of a black-footed ferret.

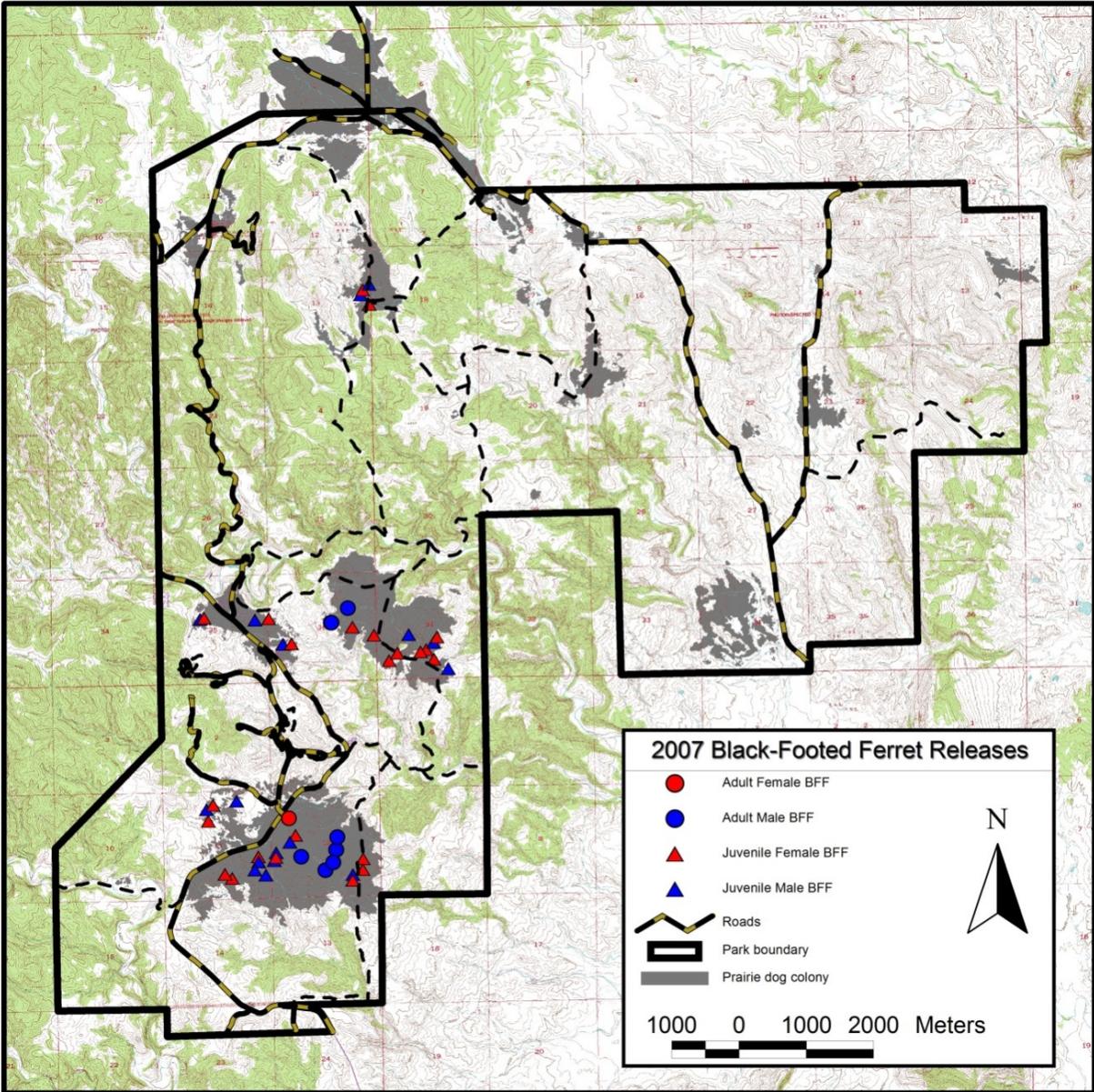


Figure 7. Black-footed ferret release sites in 2007.

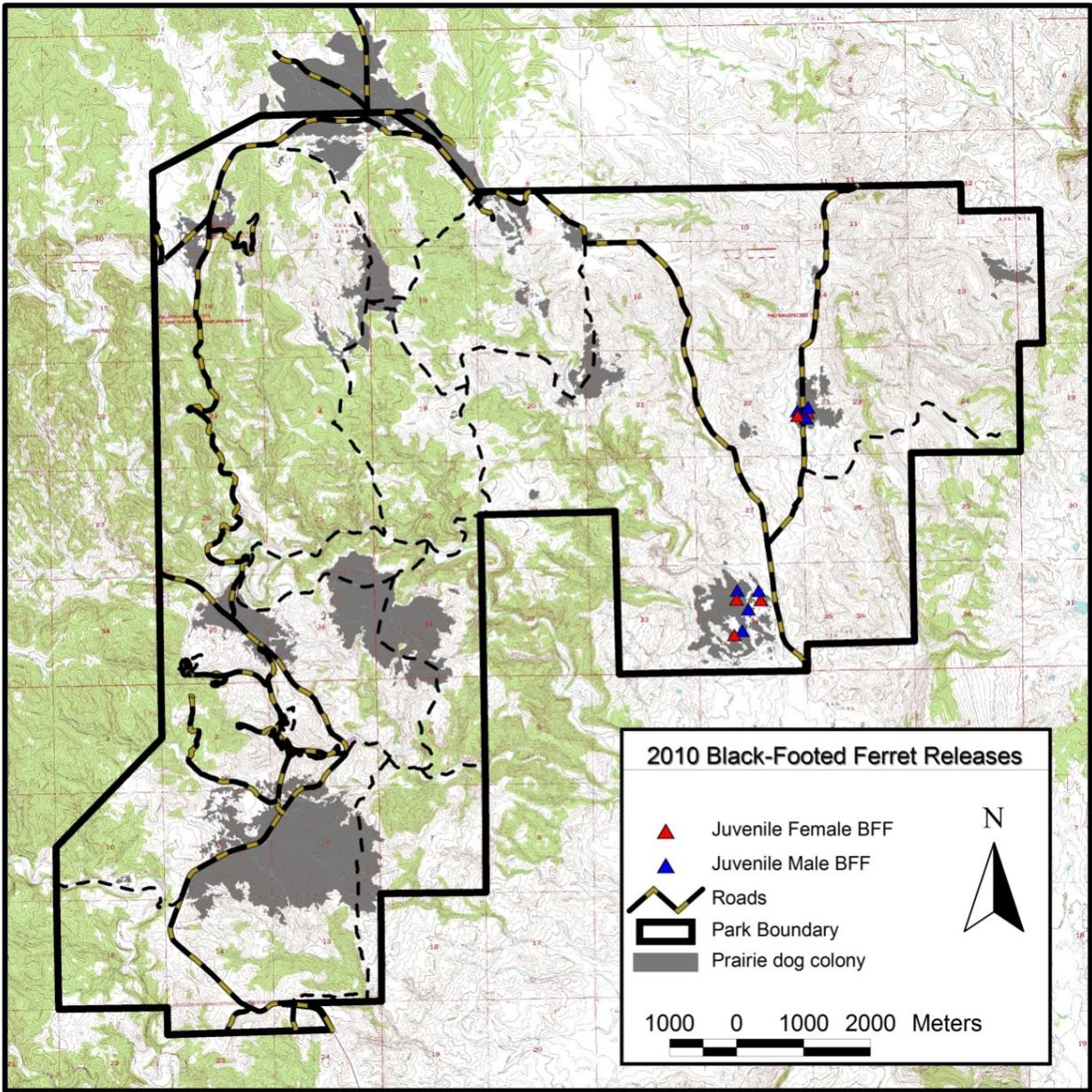


Figure 8. Black-footed ferret release sites in 2010.

Table 3. Demographics of black-footed ferrets released in 2007.

Colony	Date	Captive		Wild		Total		Total
		Juvenile	Adult	Juvenile	Adult	Juvenile	Adult	
Bison Flats	7/4	0	0	0	4 (4.0)	0	4 (4.0)	4 (4.0)
	7/5	0	0	0	1 (1.0)	0	1 (1.0)	1 (1.0)
	9/13	7 (4.3)	1 (0.1)	0	0	7 (4.3)	1 (0.1)	8 (4.4)
	9/25	0	0	2 (0.2)	0	2 (0.2)	0	2 (0.2)
	9/28	4 (1.3)	0	0	0	4 (1.3)	0	4 (1.3)
	10/2	0	0	5 (4.1)	0	5 (4.1)	0	5 (4.1)
	11/6	0	0	1 (0.1)	0	1 (0.1)	0	1 (0.1)
<i>Sub-total</i>		<i>11 (5.6)</i>	<i>1 (0.1)</i>	<i>8 (4.4)</i>	<i>5 (5.0)</i>	<i>19 (9.10)</i>	<i>6 (5.1)</i>	<i>25 (14.11)</i>
Research Reserve	7/4	0	0	0	3 (3.0)	0	3 (3.0)	3 (3.0)
	9/26	0	0	2 (0.2)	0	2 (0.2)	0	2 (0.2)
	9/28	4 (2.2)	0	0	0	4 (2.2)	0	4 (2.2)
	10/3	0	0	5 (1.4)	0	5 (1.4)	0	5 (1.4)
<i>Sub-total</i>		<i>4 (2.2)</i>	<i>0</i>	<i>7 (1.6)</i>	<i>3 (3.0)</i>	<i>11 (3.8)</i>	<i>3 (3.0)</i>	<i>14 (6.8)</i>
South Norbeck	10/3	0	0	2 (1.1)	0	2 (1.1)	0	2 (1.1)
North Norbeck	10/3	0	0	4 (2.2)	0	4 (2.2)	0	4 (2.2)
Sanctuary	10/3	0	0	4 (2.2)	0	4 (2.2)	0	4 (2.2)
Total		15 (7.8)	1 (0.1)	25 (10.15)	8 (8.0)	40 (17.23)	9 (8.1)	49 (25.24)

Values in parentheses are male:female.

Table 4. Demographics of black-footed ferrets released in 2010.

Colony	Date	Captive		Wild		Total		Total
		Juvenile	Adult	Juvenile	Adult	Juvenile	Adult	
Southeast	11/4	7 (4.3)	0	0	0	7 (4.3)	0	7 (4.3)
Red Valley	11/4	5 (3.2)	0	0	0	5 (3.2)	0	5 (3.2)
Total		12 (7.5)	0	0	0	12 (7.5)	0	12 (7.5)

Values in parentheses are male:female.

Post-release Management Actions

The ferret program at Wind Cave National Park consists of management actions and monitoring actions. The former are actions and projects that are intended to directly enhance or control the abundance and distribution of the species whereas monitoring is conducted to understand the status and trend of the population and other characteristics of the species. The following sections describe management actions that were conducted from 2007-12 for purposes of enhancing, protecting, or controlling prairie dog and ferret populations at the park.

Habitat

Other than plague control (see below), little direct habitat management was conducted for purposes of prairie dogs and ferrets. Prairie dog control using zinc phosphide occurred on limited acres and away from areas known to be inhabited by ferrets (Wind Cave National Park 2009). From 2007-12 both bison and elk numbers were somewhat higher than the long-term high, which may have benefited prairie dogs as heavy grazing can cause prairie dog expansion. However, 2007-12 was wetter than the previous several years; high precipitation can restrict or contract prairie dog distribution. The contraction in prairie dog acres from 2007-12 is most likely due to precipitation, although other factors cannot be ruled out including predation by ferrets. Coyote numbers also appeared to increase during that time as the mange epizootic appeared to have subsided.

Plague

Plague was not known to occur in the park at the time of ferret reintroduction in 2007. However, plague epizootics in nearby Pine Ridge Indian Reservation (15-25 miles away) and Conata Basin (50 miles away) raised concerns about an epizootic occurring at Wind Cave.

The presence of ferrets, human health concerns and the importance of the prairie dog ecosystem prompted the park to pro-actively dust prairie dog colonies in August of 2008 to prevent a plague outbreak, even though plague had not yet been documented within the park (Licht et al. 2010). Dusting consists of applying the insecticide deltamethrin (in a powder form) into prairie dog burrows (Figure 9). The powder kills the fleas in the upper portion of the burrow system that are a vector of the plague bacterium (*Yersinia pestis*) life cycle (Cully et al. 2006). As prairie dogs pass through the dusted burrows the insecticide powder can also kill fleas on their fur. However, dusting is generally effective for only 10-12 months before it must be applied again.

Dusting with deltamethrin is a very expensive and time-consuming undertaking (Wind Cave National Park 2009, 2011). Due to financial and logistical constraints not all prairie dog colonies in the park were dusted nor were all portions of some colonies dusted (Figures 10-14). As many as 1,198 acres were dusted in a year (Table 5) with an average of 835 acres. On average 41,769 burrows were dusted each year. Colonies with black-footed ferrets were given the highest priority.

Table 5. Dusting effort 2008-2012.

Year	Acres	Method	Total Burrows	Dust(lbs) Used	Amt (gm) /Burrow	Person Hrs.	Burrow/Hr.	Acre/Hr	Cost /Acre
2008	1100	ATV	60,505	593	4.45	1235	57	0.89	\$48.76
2009	725	ATV	33,298	290	4.00	443	75	1.64	\$26.48
2010	900	ATV	37,777	395	4.74	825	46	1.10	\$28.05
2011	1198	Foot	58,640	645	4.99	476.5	123	2.51	\$22.16
2012	252	Foot	18,626	263	6.40	128.3	145	2.00	\$25.46
Average	835		41,769	437	4.90	621.6	89.2	1.60	\$31.39

Due to concerns about the non-target impacts of dusting the park initiated and implemented several studies on the impacts to other wildlife species. One study looked at the impacts on tiger salamanders (*Ambystoma tigrinum*), a species that resides in prairie dog burrows (Brian Smith, Black Hills State U., unpub. data; Kolbe et al. 2002). Preliminary data found evidence of deltamethrin in the tissue of salamanders; however, no population-level impacts have been observed. A pilot study by Licht (2013) found some evidence that dusting may actually be protecting deer mouse (*Peromyscus maniculatus*) and 13-lined ground squirrel (*Spermophilus tridecemlineatus*) populations, although the sample size was very limited. A more extensive and rigorous study is currently being conducted by Auburn University.



Figure 9. Park staff dusting burrows.

No plague epizootics have been observed at the park; however, plague can also occur in the environment at non-epizootic levels (Biggins et al. 2010, Matchett et al. 2010). Fleas were collected from prairie dog burrows in the park during 2009-2011 to test for presence of plague bacterium. Approximately 6% of the fleas within 7 of 9 colonies sampled contained plague genetic material (Dr. Hugh Britten, U. of South Dakota, unpub. data). It is unclear as to why there has not been an observed plague epizootic in the park prairie dog colonies.

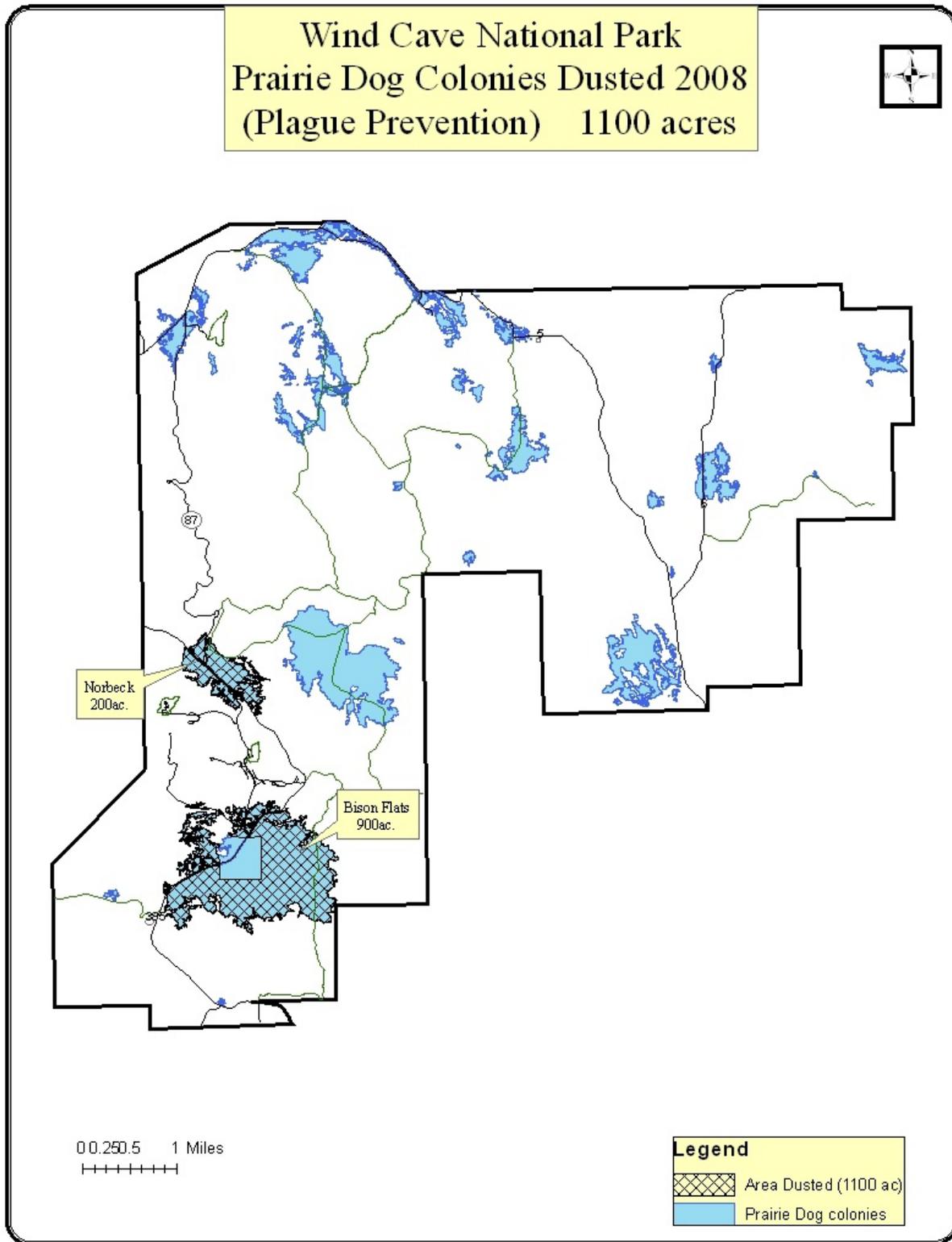


Figure 10. Map of prairie dog colonies dusted in 2008.

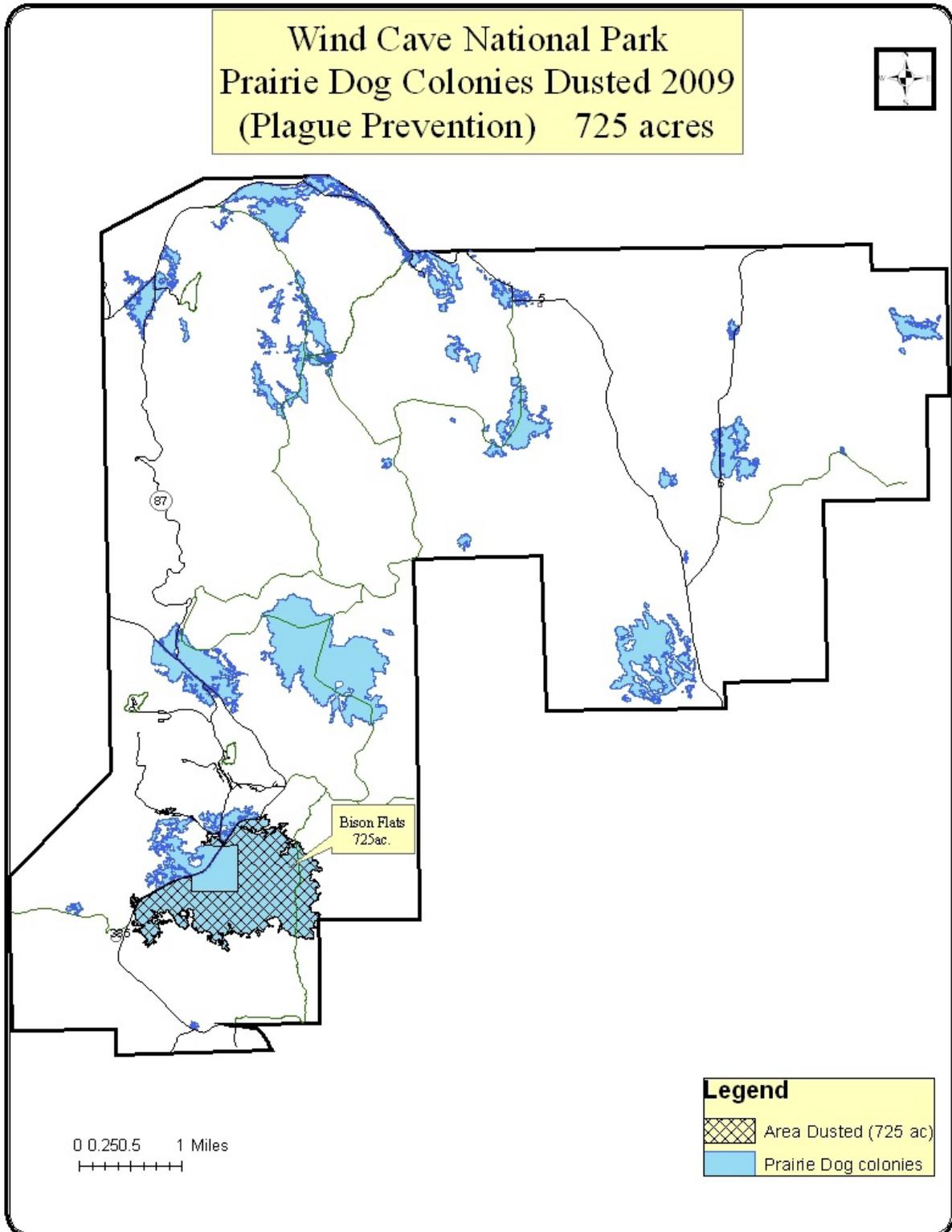


Figure 11. Map of prairie dog colonies dusted in 2009.

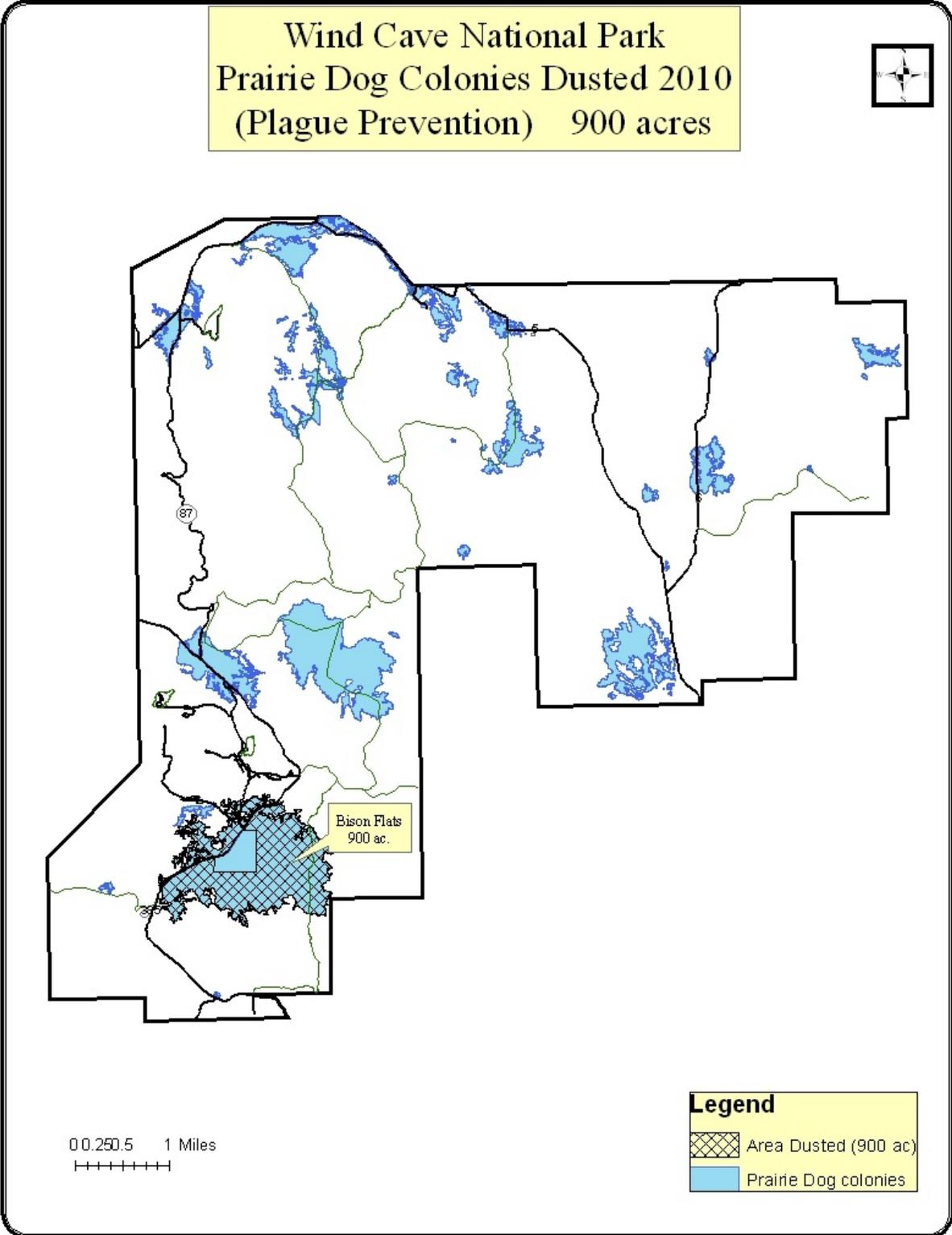


Figure 12. Map of prairie dog colonies dusted in 2010.

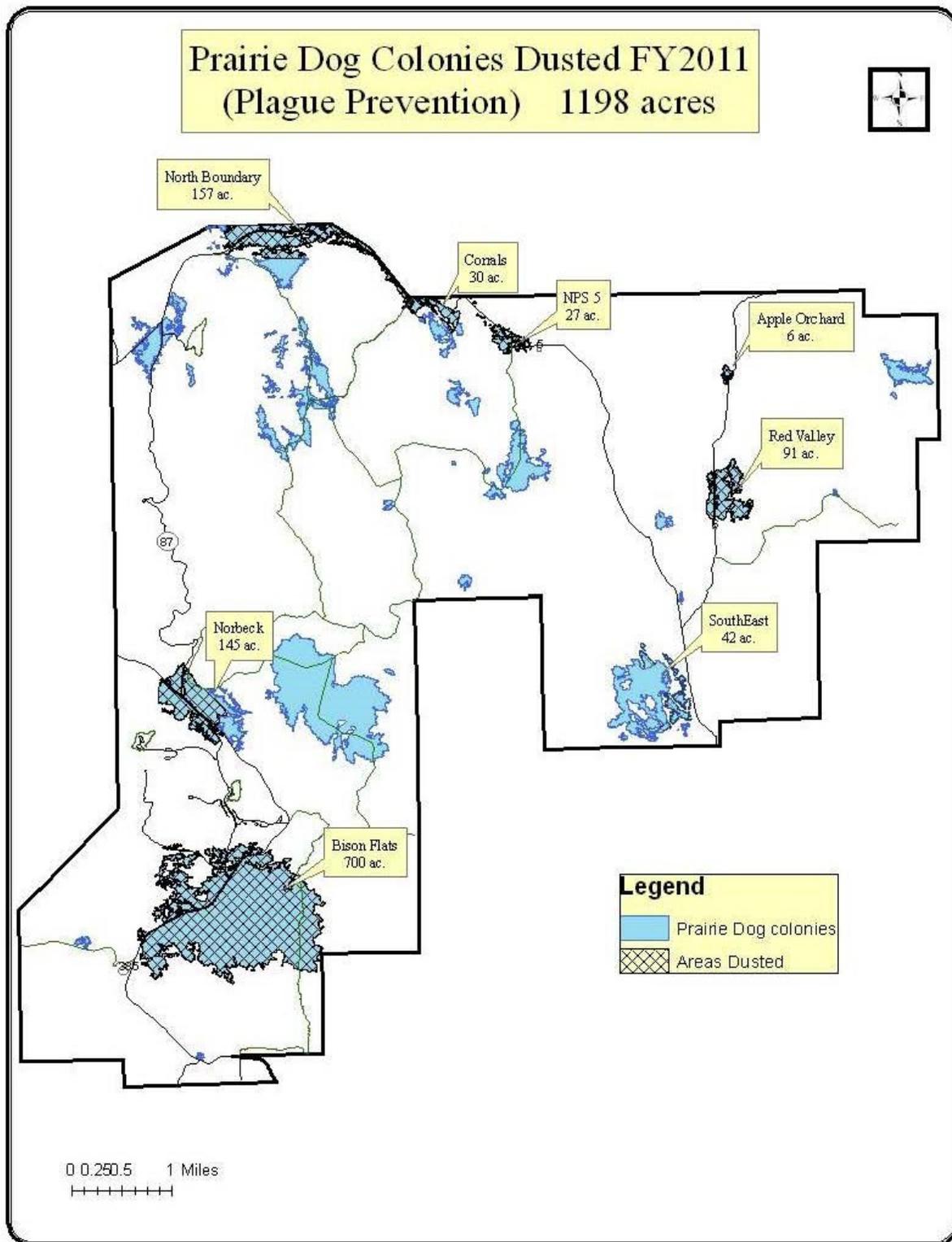


Figure 13. Map of prairie dog colonies dusted in 2011.

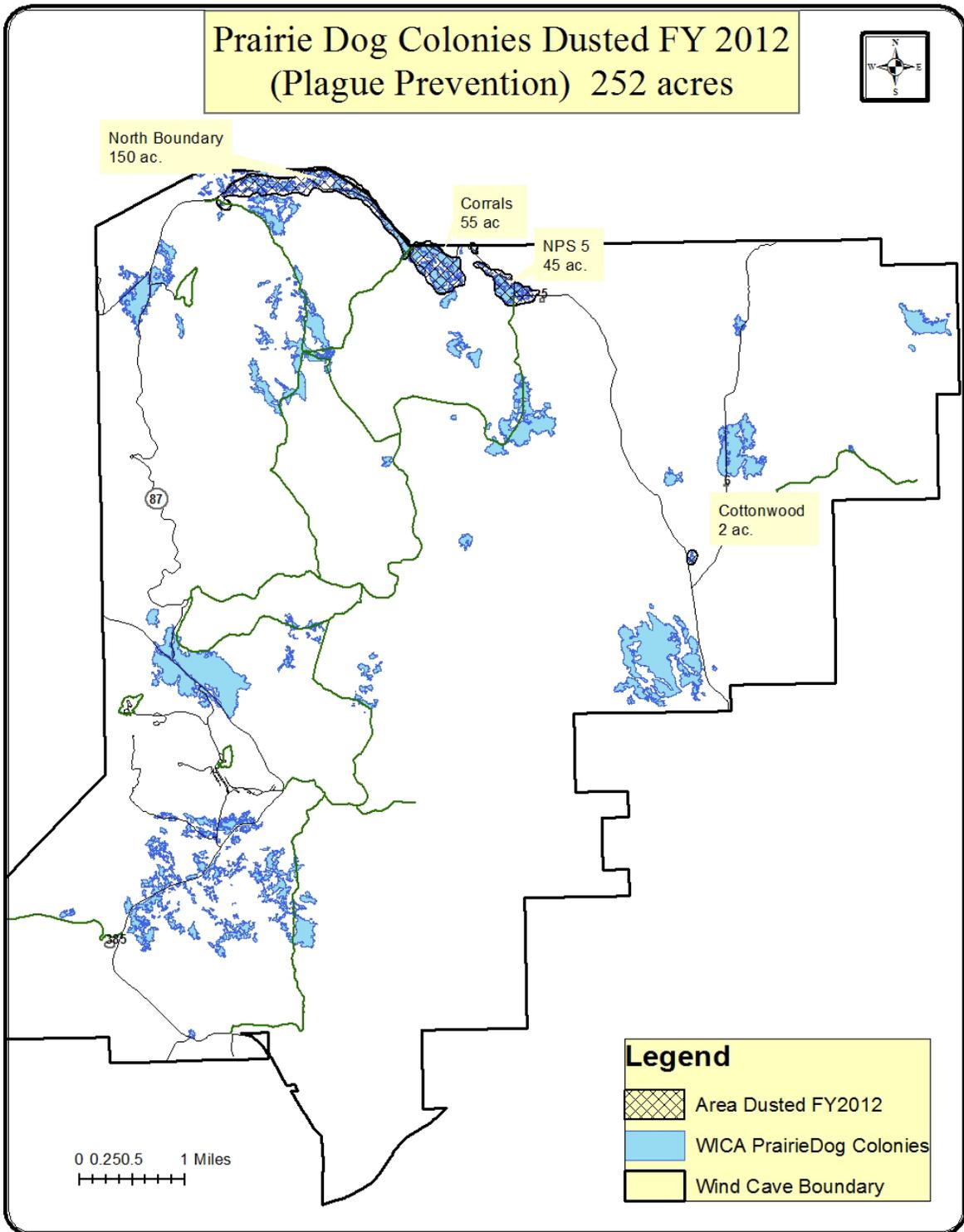


Figure 14. Map of prairie dog colonies dusted in 2012.

Plague can kill ferrets directly as well as indirectly (by killing prairie dogs thereby reducing their prey base). Ferrets born in captivity are provided plague vaccine prior to release into the wild and free-ranging ferrets are also vaccinated during capture in the fall population surveys. The vaccine, a fusion protein vaccine initially developed for human use, had been given experimentally to black-footed ferrets in lab conditions and it proved to be efficacious (Abbott and Rocke 2012). Research from Conata Basin, South Dakota suggests that vaccination in addition to dusting increases survivorship of black-footed ferrets during a plague epizootic (Livieri 2013). However, there is evidence that black-footed ferrets are most protected when they receive two doses of plague vaccine several weeks apart (Rocke et al. 2008). Wind Cave vaccinated black-footed ferrets captured during fall spotlight surveys in 2010-12 (Table 6). When possible, animals were given booster shots.

Table 6. Ferrets vaccinated against plague.

Year	Adult Ferrets with 1 shot (male.female)	Adult Ferrets with 2 shots (male.female)	Kit Ferrets with 1 shot (male.female)	Kit Ferrets with 2 shots (male.female)
2010	0.2		5.0	
2011	5.8	0.1	2.4	
2012	3.11	0.1	11.11	2.1

Blood samples were collected from ferrets in 2008-09 for future research needs such as genetic analyses (Figure 15). Ectoparasites, including fleas and ticks, were also collected for future research needs.



Figure 15. Drawing blood from an anesthetized ferret.

Education and Outreach

The park integrated ferret ecology and conservation into its interpretive program. A special ferret program was conducted at the park on April 26, 2008 that was attended by approximately 200 visitors, local media, and an author of a ferret book (Licht 2007). The ferret reintroduction was the cover story in the park's newspaper that year, distributed to 35,000 visitors (they were also the cover story in 2012). An interactive ferret software program was developed for display in the visitor center. In 2013 a ferret diorama was developed and displayed in the visitor center. Approximately 100,000 people walk through the visitor center each year. Numerous press releases were issued regarding the ferret reintroduction (see Appendix C).

In 2008 the park began conducting ranger-led night-time spotlighting walks during the summer months. The walks were conducted several times a week shortly after sunset and lasted for one to one and one-half hours. Although ferrets often are not active aboveground until much later in the night, some groups did see ferrets. The charismatic nature of ferrets, along with their extremely endangered status, had a profound impact on visitors who successfully saw the animals. Visitors who were not fortunate enough to see ferrets still had positive experiences as they often saw other night-time wildlife and got to experience the night-time prairie sky. From 2008 to 2012 approximately 53 walks were conducted with 1,084 visitors participating. The walks are believed to be the only regularly-scheduled event open to the public for purposes of seeing black-footed ferrets in the wild. In 2009 the park also tested daytime walks through prairie dog colonies, but they were less successful in terms of visitor participation.

Starting in 2009 the park also gave 2 different "discovery programs" about ferrets that were presented about 3 times a week during the summer period. On average about 25 people attended the programs. The programs were also given in subsequent years, but to fewer people.

Although it is not possible to precisely say how many people the park education and outreach program reached regarding ferrets and ferret conservation, it was substantial. Based on visitor center estimates, park newspaper printings, park website visitation, and other estimates it seems reasonable to conclude that hundreds of thousands of park guests were exposed to ferret ecology and management. And thousands of people got a more in-depth exposure through night-time walks, discovery programs, and presentations given by park staff. In terms of ferret education and outreach, the Wind Cave reintroduction effort has been extremely successful. For a full list of education and outreach activities conducted from 2007-2012 see Appendix C.

Monitoring



Figure 16. Black-footed ferret caught in a trap (in Conata Basin).

using methods prescribed by Biggins et al. (2006a). Spotlight surveys were conducted from vehicles and on foot with observers using high-powered spotlights to scan prairie dog colonies for the green eyeshine of ferrets. Vehicles were restricted to the black-top and gravel roads in the park. Several prairie dog colonies are accessible by road, but cannot be covered entirely by spotlighting from a vehicle. Areas not covered by vehicles were surveyed on foot. Spotlight surveys were conducted in the spring and fall. The fall surveys (September and October) were typically conducted with more observers and covered more areas. In addition, an objective of the fall surveys was to capture ferrets for purposes of identifying, marking, delivering plague vaccines, and other sampling.

Spotlight surveys conducted on foot typically require more personnel than by vehicle to cover the same amount of prairie dog colony. Also, it can be more difficult to recruit volunteers for spotlighting by foot, particularly for areas that may have smaller probabilities of observing a black-footed ferret.

During the fall surveys, when a ferret was observed a trap was placed over the burrow (Figure 16). Field personnel would regularly return to the trap throughout the night. If a ferret was captured it was brought to a processing center. At the processing center anesthetized ferrets were implanted with a passive integrated transponder (PIT) tag. Nighttime spotlight surveys were also conducted in the spring from mid-March thru mid-April during the height of the ferret breeding season. To avoid disrupting their breeding behavior “donut readers” were placed over the burrow entrance instead of a trap being placed into the burrow. The readers are a way of passively identifying a ferret without having to trap and anesthetize the ferret. If a previously caught ferret with a subcutaneous transponder passed through the reader its unique chip number would be recorded. The springtime surveys provide an indication of winter survival and available ferrets going into the breeding season.

The ferret program at Wind Cave National Park is comprised of management actions and monitoring actions. The following sections describe monitoring actions that were conducted from 2007-12 for purposes of understanding the status and trends of prairie dogs, ferrets, and plague at the park.

Methods

The primary method used to monitor black-footed ferrets at Wind Cave was spotlighting

The park also conducted snow-track surveys when conditions were conducive to that method and personnel were available. The primary objective of snow-track surveys was to determine which prairie dog colonies were occupied by ferrets and follow up in spring or fall with spotlight surveys.

Concurrent with the ferret monitoring projects the park conducted monitoring of prairie dogs and plague. Prairie dog monitoring consisted of mapping the perimeter of prairie dog colonies by walking the clip line on the edge of the town with a GPS unit. Plague monitoring consisted of swabbing prairie dog burrows in an effort to collect fleas. Fleas were sampled by the U. of South Dakota for the presence of the plague bacterium (Hanson et al. 2007).

Results

The following sections give an overview of the ferret and plague monitoring results from 2007-12. It is anticipated that other more thorough analyses will be conducted and presented in peer-reviewed scientific journals.

Ferret Monitoring

Spotlighting surveys were conducted in the fall of 2007 and in the spring and fall each year thereafter. A total of 2,515 hours were spent spotlighting from 2007-12 (Table 7). A minimum of 220 ferrets were observed, or a ferret every 11.4 person hours surveyed. All ferret locations were recorded using GPS (Figure 17).

Table 7. Spotlight surveys for ferrets 2007-2012.

Season	Acres Covered	# of Spotlight Hours	# Minutes / acre	Minimum # of Unique Ferrets Spotlit
Fall 2007	1819.2	185.75	6.1	10
Spring 2008	1301.3	144	6.6	5
Fall 2008	1911.4	258.25	8.1	26
Spring 2009	1656.6	122.25	4.4	5
Fall 2009	2205.4	311.25	8.5	16
Spring 2010	1585.4	132	5.0	12
Fall 2010	2042.6	497	14.6	34
Spring 2011	463.3	37.75	4.9	5
Fall 2011	1701.3	370.5	13.1	47
Spring 2012	317.8	52.5	9.9	3
Fall 2012	1611.4	403.75	15.0	57
Total	16615.7	2515		220

The portion of each colony that could be surveyed from the road was estimated using GIS. Each ferret observation from a vehicle was plotted in a GIS and the minimum distance between the road and ferret was calculated. The mean minimum distance from a vehicle (i.e., road) to a ferret observation was 224.4 ft. (SD = 179.4; range = 0.2 – 1210.3). Ferret observations declined with increasing distance from the road (Figure 18) which could be interpreted in two ways; 1) there are more ferrets near the road, or 2) ferret sightability declines with distance from the road. Marinari (1992) used ferret eye-shine models to estimate detectability of ferrets from vehicles and found high detectability up to 557.7 feet (170 m) with a sharp decrease in detectability up to 853.0 ft. (260 m).

No observers detected the models > 853.0 ft. (260 m) from the road. A plausible explanation for the declining detectability with distance from road at Wind Cave was that topography and other obstructions prevented the rate of spot-lighting coverage observed by Marinari (1992). However, it is also possible that ferret presence may have actually been greater near the roads due to higher prairie dog abundance near roads due to less predator activity. Less predator activity near roads could have also resulted in more ferret use of those areas. These possibilities warrant further study.

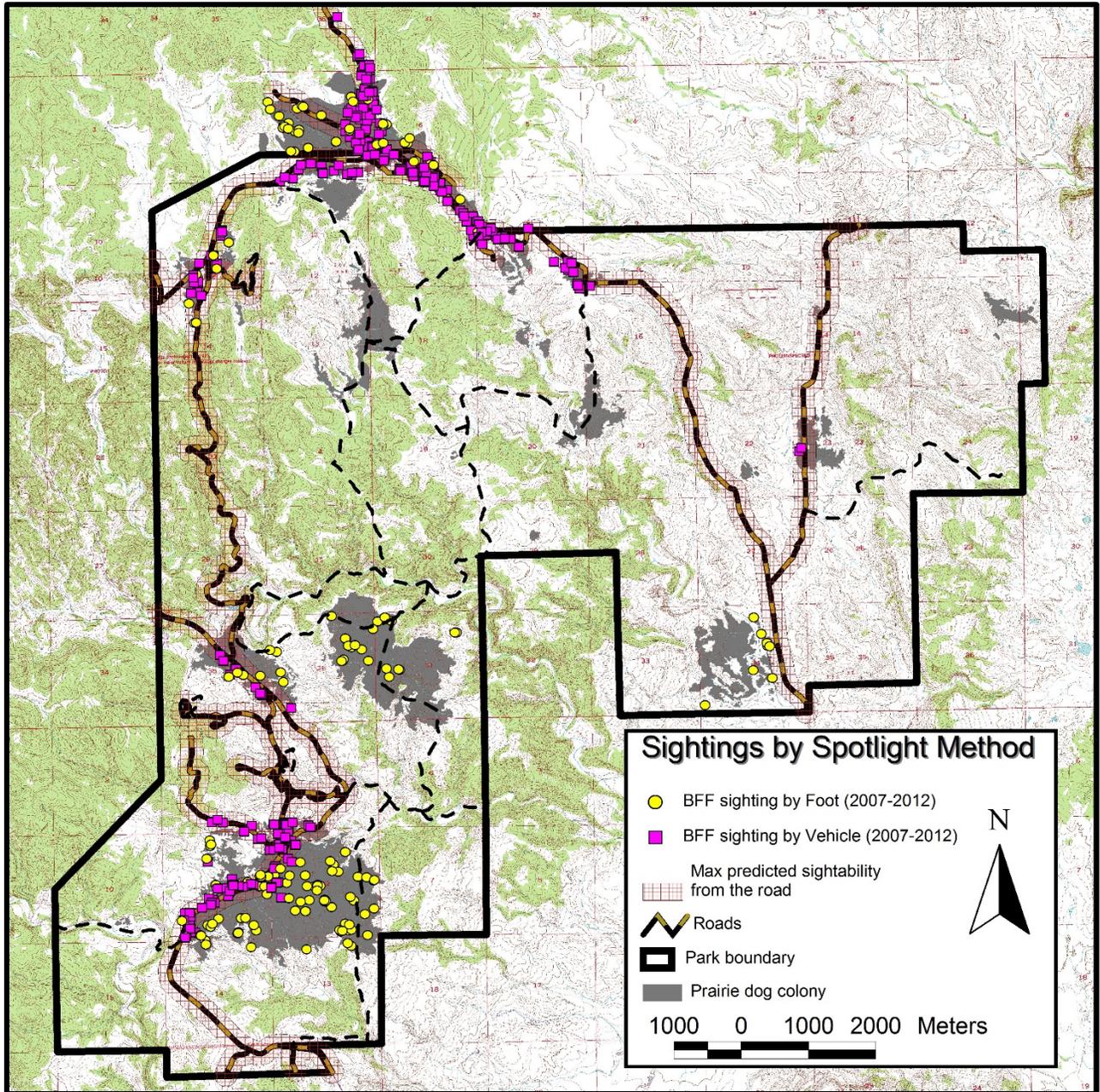


Figure 17. Locations of ferrets observed by spotlighting 2007-2012.

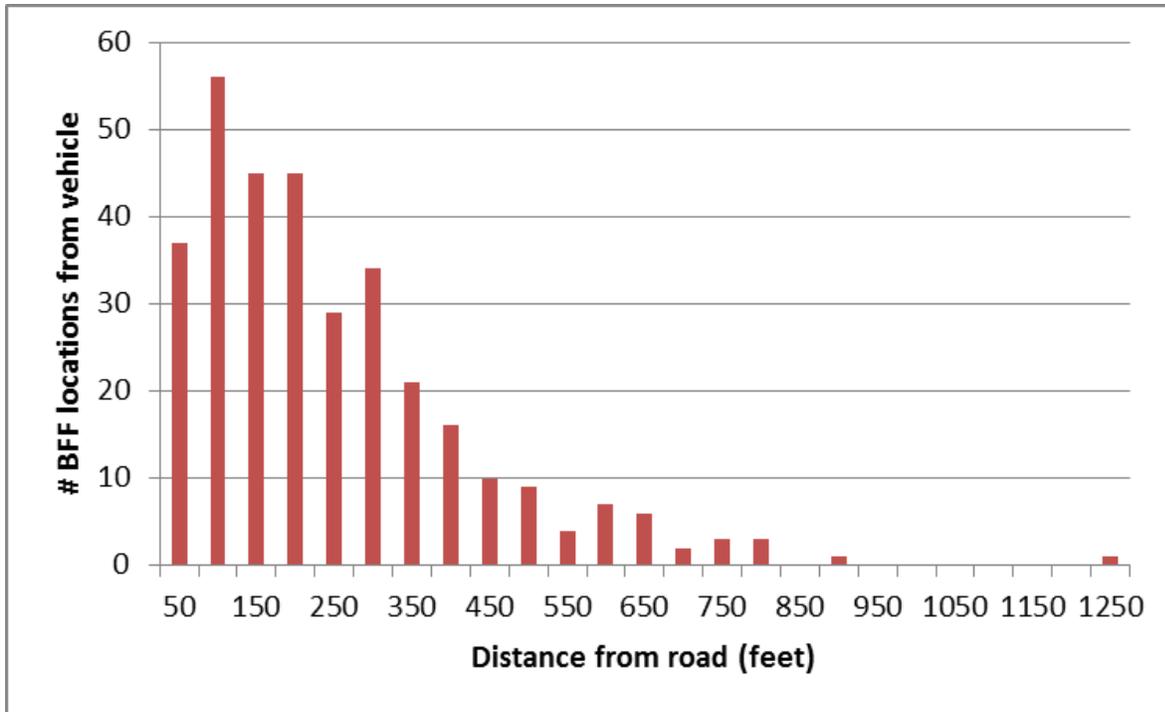


Figure 18. Ferret observations by spotlighting and distance from road.

Using the 2010 prairie dog map and buffering each road by 557.7 ft. (170 m) to simulate an effective spotlighting distance (Marinari 1992) encompassed 27.8% of the colony acreage in the park and adjoining Custer State Park (i.e. 884.8 acres of prairie dog colony are within 557.7 feet of a road: Figure 17). Spotlighting from a vehicle can therefore theoretically survey 27.8% of the park’s prairie dog colonies that are known to or likely contain black-footed ferrets as of 2010 (Table 8). However, the estimate is likely an over-estimate because topography prevents some areas within the buffer from being adequately covered from the road. Conversely, the analysis suggests that a minimum of 72.2% of the prairie dog acreage in the park can only be surveyed on foot.

Spotlight surveys on foot are more physically demanding and require more personnel and equipment. The park has limited resources and must allocate spotlighting resources wisely. We compared spotlight sighting rates (# ferret sightings / minute / acre) to investigate potential differences between foot and vehicle spotlight surveys. We compared sighting rates on colonies that both foot and vehicle surveys were used in the same season and assumed that ferret density was uniform within a colony. Eight paired samples from Bison Flats, Norbeck and North Boundary/CSP (Table 9) were compared using a t-test with no significant difference found ($t = 2.36, p = 0.36$) suggesting that foot and vehicle surveys are comparable for spotlight surveys.

Table 8. Area and percentage of colonies that can be surveyed by spotlighting from road.

Colony	Acres Surveyed from Vehicle	Total Acres	% of Colony Surveyed by vehicle
Apple Orchard	5.6	5.6	100.0
Bison Corrals	32.4	58.9	55.0
Bison Flats	199.5	957.5	20.8
Cold Brook	0.0	4.2	0.0
Cottonwood	0.8	0.8	100.0
Custer State Park	302.6	496.6	60.9
Goose Pimple Buttes	0.0	10.6	0.0
Highland Creek Center	0.0	20.3	0.0
Highland Creek Lower	0.0	102.4	0.0
Keyhole	0.0	4.5	0.0
Norbeck	110.1	180.4	61.0
North Boundary	82.5	166.2	49.6
Northeast	0.0	41.3	0.0
NPS 5	29.8	34.8	85.6
Pringle	69.7	89.6	77.8
Rankin Ridge	0.0	5.5	0.0
Red Valley	43.7	83.4	52.4
Research Reserve	0.0	518.6	0.0
Sanctuary	0.0	186.5	0.0
South Boundary	1.3	1.3	100.0
Southeast	6.8	213.8	3.2
Trail #7a	0.0	1.9	0.0
Total	884.8	3184.7	27.8

Table 9. Comparison of ferrets observed from road and foot spotlighting.

Colony	Survey	# ferret sightings per minute per acre for Foot Surveys	# ferret sightings per minute per acre Vehicle Surveys
Bison Flats	Fall 2007	1.44	0.96
Bison Flats	Fall 2008	0.90	1.95
Bison Flats	Fall 2009	1.27	0.66
Bison Flats	Fall 2010	1.39	0.59
Bison Flats	Fall 2011	0.13	1.36
Norbeck	Fall 2007	2.00	1.78
Norbeck	Fall 2008	0.45	0.71
North Boundary	Fall 2011	1.45	4.91
Average		1.13	1.62

Ferrets were released on 4 colonies in 2007 and 2 additional colonies in 2010. Ferrets were subsequently found on 11 colonies from 2007-12 as verified by spotlighting (Figure 17). See Appendix B for a detailed list of colonies surveyed and ferrets observed.

Spotlighting provided the best means of estimating the size of the population. The population has increased relatively steadily every year from an estimated minimum number alive (MNA) of 10 animals in the fall of 2007 to an estimated MNA of 57 in the fall of 2012 (Figure 19). The year 2009 was likely an aberration as spotlighting indicated that the population decreased, but it more than doubled by the following fall.

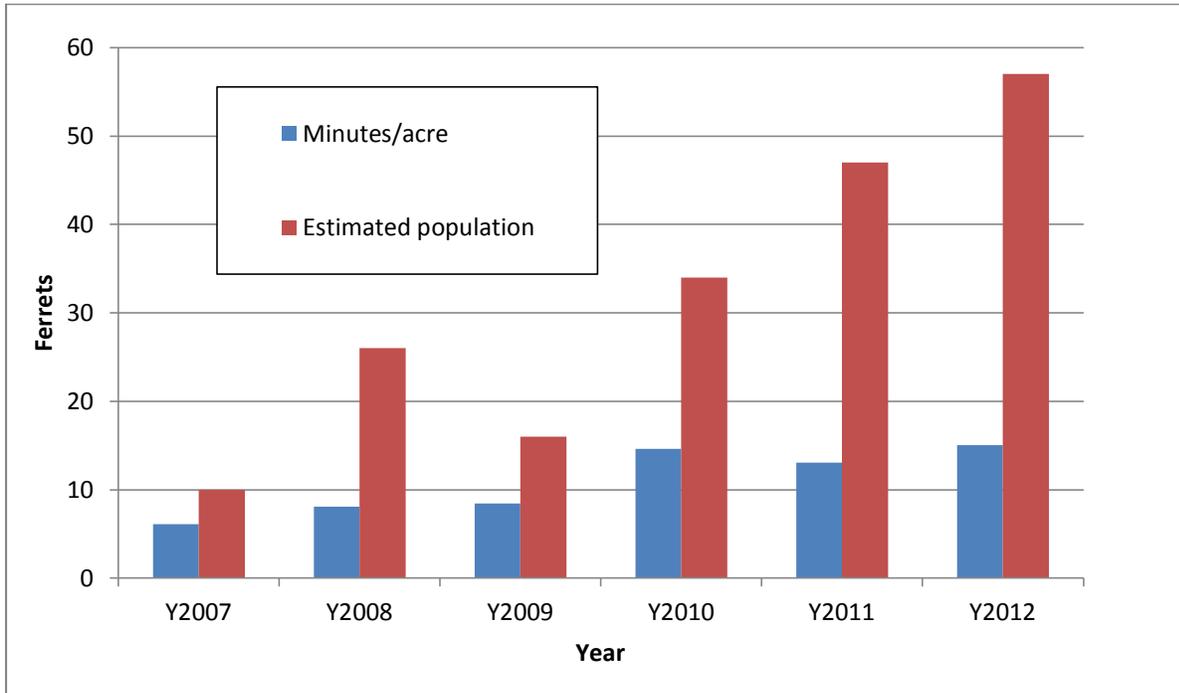


Figure 19. Spotlight survey effort and estimated ferret population 2007-2012.

A critical task for monitoring and evaluating reintroduction success was to capture, uniquely mark, and release free-ranging ferrets. Marking would allow for identification of individuals born in the wild to determine survivorship, movement, and other ecological data. Capturing occurred only during the fall spotlight surveys in 2008-12. A total of 119 anesthesia sessions were conducted from 2008-12. Of the anesthetized animals, 51 were male and 59 were female (Table 10).

Table 10. Ferrets captured and anesthetized 2008-2012.

Year	# Individual Ferrets (male.female)	Total # anesthesia sessions
2008	11.7	18
2009	3.4	7
2010	10.10	20
2011	9.13	24
2012	18.25	50
Total	51.59	119

Mark and recapture of animals allow for estimates of individual survival over time. The results, when analyzed with other demographic parameters such as recruitment, can be used to understand changes in population abundance over time and long-term viability. Survival rates were calculated as the

percentage of known and identified animals from one time period to the next. During a spotlight survey some animals seen are not identified thus survival estimates presented here represent a minimum survival rate. Thirty-day survival for ferrets released in 2007 was estimated to be 22.2% for adults and 32.5% for juveniles (Table 11). One-year survival for animals released in 2007 was 0% for adults and 15.0% for juveniles (Table 12). These animals were naïve to Wind Cave. Juvenile ferrets captured in the fall of 2008-11 (i.e. animals that had been born and raised in Wind Cave) had an estimated one-year survival of 27.0% (Table 13).

Table 11. Retrospective minimum survival to 30 days for ferrets released in 2007 as of 2012.

Gender	Captive		Wild		Total	
	Juvenile	Adult	Juvenile	Adult	Juvenile	Adult
Male	1/7 (14.3%)	-	4/10 (40.0%)	1/8 (12.5%)	5/17 (29.4%)	1/8 (12.5%)
Female	3/8 (37.5%)	1/1 (100.0%)	5/15 (33.3%)	-	8/23 (34.8%)	1/1 (100.0%)
Total	4/15 (26.7%)	1/1 (100.0%)	9/25 (36.0%)	1/8 (12.5%)	13/40 (32.5%)	2/9 (22.2%)

Table 12. Retrospective minimum survival to one year for ferrets released in 2007 as of 2012.

Gender	Captive		Wild		Total	
	Juvenile	Adult	Juvenile	Adult	Juvenile	Adult
Male	0/7 (0.0%)	-	2/10 (20.0%)	0/8 (0.0%)	2/17 (11.8%)	0/8 (0.0%)
Female	3/8 (37.5%)	0/1 (0.0%)	1/15 (6.7%)	-	4/23 (17.4%)	0/1 (0.0%)
Total	3/15 (20.0%)	0/1 (0.0%)	3/25 (12.5%)	0/8 (0.0%)	6/40 (15.0%)	0/9 (0.0%)

Table 13. Retrospective minimum survival to one year for ferret kits as of 2012.

Gender	Kits caught in Fall of...				Total
	2008	2009	2010	2011	
Male	4/10 (40.0%)	1/3 (33.3%)	1/8 (12.5%)	0/2 (0.0%)	6/23 (26.1%)
Female	1/4 (25.0%)	1/2 (50.0%)	2/4 (50.0%)	1/4 (25.0%)	4/14 (28.6%)
Total	5/14 (35.7%)	2/5 (40.0%)	3/12 (25.0%)	1/6 (16.6%)	10/37 (27.0%)

There were no observed ferret mortalities at the park. Although two major black-top highways and two gravel roads go through the park, and vehicle-caused mortalities to other wildlife species occur, no ferrets were known to be hit by vehicles.

Reproduction of ferrets was documented every year from 2008-12 (Table 14). The Southeast Prairie Dog Colony was noteworthy in that adult females were documented, but there have been no documented litters of kits.

Table 14. Wild-born black-footed ferret kits captured in fall 2008-2012.

Year	# Kits Captured (males:females)
2008	14 (10.4)
2009	11 (5.6)
2010	23 (14.9)
2011	16 (5.11)
2012	27 (15.12)*
Total	91 (49.42)

Only kits caught in fall 2012, i.e., does not include any unmarked adults caught in fall 2013 (i.e. kits missed from fall 2012) whereas the other totals include those type of captures. Values in parentheses are male:female.

Re-captures of ferrets with previously implanted PIT tags indicated that during the 5-year post-release period at least four ferrets dispersed from the colony of release or initial capture. The greatest movement, as measured by a straight line between colonies, was a 3.3-mile movement by a captive-raised female (#6788) from the Red Valley Colony within Wind Cave National Park to a colony in Custer State Park (Table 15). The movement occurred in less than a year. One animal (#08-012), a wild born male, moved from its initial colony to another colony and then returned back to its original colony.

Table 15. Known inter-colony movements by ferrets 2007-2012.

Ferret ID#	Age at Start (days)	Gender	Initial Colony	Second colony	Distance (m)
07-009	124	Male	Sanctuary	North Boundary	2602
07-103	124	Male	Norbeck	Bison Flats	2746
08-012	129	Male	Norbeck	Research Reserve	1470
08-012	324	Male	Research Reserve	Norbeck	1349
6788	143	Female	Red Valley	Custer State Park	5259

Opportunistic snow-track surveys were conducted to aid in the understanding of ferret presence and absence in the colonies. Because Wind Cave receives an average of 30" of snowfall per year it may be one of the better ferret recovery sites to use snow-track methods. Also, access to most of the prairie dog colonies in the park is good, thus park personnel can quickly take to the field when snow conditions are suitable. Park personnel spent 127 hours snow-tracking black-footed ferrets on 23 unique days over a 5-year period resulting in identification of 47 unique black-footed ferret track-sets (Table 16). Snow-tracking results were found to be useful in planning spotlight survey efforts in the following year.

The systematic spotlight surveys and the opportunistic snow-tracking efforts were the primary tools used to monitor ferret distribution and abundance. However, incidental observations of ferrets by staff or the public aided ferret monitoring and helped guide future efforts. For example, the first observation of a ferret in Custer State park was an incidental observation that was subsequently verified by park staff. The observation led to an expanded spotlighting effort to include the southwestern portion of the state park as well as the northern colonies within Wind Cave.

Table 16. Snow-track surveys for ferrets 2007-2012.

Date	Colony	Acres Covered	Search Hours	# Distinct Ferret Tracks	Snow Condition
3/5/2008	Bison Flats/Norbeck	500/100	11	6/1	Good
3/6/2008	North Boundary	75	1	0	Marginal
3/6/2008	Sanctuary	100	3	0	Marginal
4/1/2008	Bison Flats	600	9	1	Good
4/2/2008	Bison Flats	400	8	4	Good
4/2/2008	Norbeck	125	2	0	Good
4/2/2008	Pringle	75	1	0	Good
4/8/2008	Norbeck/Research Reserve	75/400	11.5	2/5	Good
1/15/2009	Sanctuary	100	3.5	0	Good
1/27/2009	Bison Flats	400	9	0	Poor
4/9/2009	Bison Flats	300	8	1	Good
4/10/2009	Bison Flats	600	20	3-6	Marginal
2/10/2010	Norbeck/Research Reserve	80/450	8.5	2-3/0	Good
2/10/2010	Norbeck/Pringle/North Boundary	100/50/50	4.5	1/0/1-2	Good
4/2/2010	Research Reserve	300	3	1-2	Marginal
4/2/2010	Bison Flats	100	2	1+	Marginal
2/23/2010	North Boundary	5	0.5	1	Fair
1/12/2011	Red Valley	90	2	3	Good
1/12/2011	Pringle/North Boundary/NPS 5	25/35/25	2	1/2/1	Good
1/20/2011	Southeast	200	6	3	Marginal
4/15/2011	Red Valley	90	4	0	Fair to Poor
4/19/2011	Southeast	175	5	0	Fair
2/29/2012	Red Valley	75	2.5	1	Marginal
Total		5800	127	47	

Prairie Dog Monitoring

The distribution and abundance of prairie dogs from 2007 to 2012 is discussed elsewhere in the document. It is worth noting that monitoring prairie dog colonies became extremely difficult over this time period due the competing demands of dusting, ferret monitoring, and other activities. Furthermore, many large and clearly delineated colonies appeared to become fragmented and broken up during this period, making mapping extremely difficult. It's possible that the increased precipitation caused the fragmentation of colonies and subsequent contraction in overall size, although other factors cannot be ruled out.

Plague Monitoring

Fleas were collected from burrows within a subset of prairie dog colonies in the park. Fleas were collected by placing a cloth material deep into prairie dog burrows; fleas would cling to the cloth and could be collected when the material was withdrawn from the burrow (Figure 20). In 2009 fleas were collected by NPS personnel; in 2010-11 fleas were collected by representatives of the University of South Dakota. This effort was part of a multi-park study being conducted by Dr. Hugh Britten and

Erica Mize of the university. The collected fleas were sampled for the presence of plague bacterium using a nested PCR protocol (Hanson et al. 2007). The preliminary results are present in Table 17. Out of 1,073 fleas tested, 69 were positive for plague. Positive fleas were found in all years and in several colonies widely distributed across the park.



Figure 20. Swabbing a prairie dog burrow to collect fleas for plague surveillance.

During the fall 2008 spotlight survey, blood was collected from 18 ferrets for disease testing. All 18 were negative using Centers for Disease Control (CDC) plague serology tests. In 2011, 22 fleas were collected from 5 ferrets and sent to the University of SD for testing using the PCR protocol (Hanson et al. 2007). All were negative for plague.

A research project looking at habitat selection and population ecology of bobcats took place in the Black Hills during 2007-08 (Mosby 2011). Blood samples were collected from a total of 12 bobcats, 3 of which were animals located within Wind Cave. All three were negative for plague. One bobcat located west of the park did return with a low plague titer (1:32) suggesting prior exposure to the disease. It was an adult female with a home range several miles away from the park. The animal was harvested by a trapper the following year. On April 28, 2010 a female bobcat was found dead in an active prairie dog colony. The animal was sent in for necropsy and testing. It was determined that the most likely cause of death was predation by another larger predator. Plague test results were negative.

Table 17. Preliminary data from flea/plague research conducted by U. of South Dakota.

Prairie Dog Colony	Date Collected	# of Fleas Collected	# of Fleas Tested	# of POS Fleas	Collector	Date Dusted (for Collection Year)
Southeast	summer 2009	41	41	5	Licht	
Bison Flats	summer 2009	29	29	5	Licht	August/Sept 2009
Sanctuary	summer 2009	13	13	2	Licht	
Norbeck	summer 2009			NA	Licht	
Red Valley	summer 2009			NA	Licht	
Southeast	March 2010	22	22	2	Park Staff	
Southeast	April 2010	155	155	6	Mize	
Bison Flats	April 2010	207	207	1	Mize	July/Sept 2010
Red Valley	April 2010	196	196	3	Mize	
Pringle	July 2010	4	4	0	Mize	
Norbeck	July 2010	43	43	0	Mize	
Red Valley	July 2010	34	34	1	Mize	
North Boundary	July 2010	56	56	3	Mize	
Southeast	July 2010	12	12	0	Mize	
Bison Flats	July 2010	11	11	2	Mize	
Sanctuary	July 2010	14	14	2	Mize	
NPS 5	July 2010	9	9	0	Mize	
Red Valley	May 2011	71	0	na	Mize	March/April 2011
North Boundary	May 2011	69	40	12	Mize	May/August 2011
Norbeck	May 2011	78	1	1	Mize	August 2011
Research Reserve	May 2011	62	41	5	Mize	
Sanctuary	May 2011	79	55	12	Mize	
Bison Flats	May 2011	71	35	0	Mize	July/August 2011
Southeast	May 2011	116	55	7	Mize	August 2011
Total		1393	1073	69		

Discussion

Measuring the success of an endangered species reintroduction is a very important part of a recovery program. Wind Cave outlined 8 specific goals that could be evaluated. The 5-year goals of the black-footed ferret reintroduction at Wind Cave (Wind Cave National Park 2006a) were:

1. Test the viability of using a reintroduction site with less than 5,000 acres of prairie dog complexes. The ultimate measure of success is determining whether a viable ferret population was established. Comparing the number of animals released to the population size at 5 years across many release sites provides us with a relative measure of success at Wind Cave. Although the park is one of the smallest reintroduction sites in terms of prairie dog acreage it is second only to the Conata Basin, South Dakota in terms of the 5-year population abundance relative to the number of animals released at the site (Table 18). It is also one of the most successful sites in terms of ferret abundance relative to prairie dog acreage.

Table 18. Black-footed ferret release sites and 5-year success.

Site*	Number of Ferrets Released	5-year Population Size	Ratio of Abundance to Number Released
Kansas	125	39	0.3
Espee Ranch, AZ	70	0	0.0
<i>Lower Brule, SD</i>	82	12	0.1
<i>UL Bend NWR, MT</i>	148	85	0.6
<i>Wind Cave NP, SD</i>	61	57	0.9
Utah	215	33	0.2
Mexico	257	17	0.1
Conata Basin, SD	157	209	1.3
Fort Belknap, MT	180	0	0.0
<i>BLM 40-complex, MT</i>	92	0	0.0
Wolf Creek, CO	189	13	0.1
Cheyenne River, SD	201	112	0.6

*Italicized and bold sites contain prairie dog complexes <5,000 acres at initial reintroduction time.

Minimum survival of ferrets released at Wind Cave in 2007 was 12.2% to year one. For animals born at Wind Cave and alive in the fall of their natal year the one-year survival was estimated at 27.0%. Both of these minimum survival estimates at Wind Cave compare favorably to one-year survival estimates of 8.3%, 11.4%, and 22.8% for released ferrets at Badlands, Conata Basin, and UL Bend, respectively. After five years it appears that some sites with less than 5,000 acres of prairie dogs may be able to support a ferret population.

2. Establish a self-sustaining population of black-footed ferrets. The initial release of black-footed ferrets in 2007 occurred in Bison Flats, Research Reserve, Norbeck, and Sanctuary prairie dog colonies and the 2010 release occurred in Southeast and Red Valley colonies. After release, ferrets persisted and reproduced each year, spread to new colonies and did not require augmentation. The black-footed ferret population at Wind Cave has demonstrated that it is, at present, self-sustaining.

3. Provide surplus wild-born ferret kits for translocations to other sites. Wind Cave did not provide surplus wild-born ferret kits to other sites although there were enough kits that it could have occurred in 2012 when 27 kits were captured and the park population was a minimum of 57 black-footed ferrets. The U.S. Fish and Wildlife Service, in consultation with their partners, makes the final determination regarding translocation of wild animals.
4. Meet NPS policy by reintroducing an extirpated species. Wind Cave National Park became the second NPS unit to reintroduce black-footed ferrets and met NPS policy to reintroduce an extirpated species.
5. Support the NPS mission in keeping with NPS policies. The reintroduction of black-footed ferrets into Wind Cave fully supported NPS mission and policies.
6. Collaborate with park partners on the project. Wind Cave worked with multiple partners on reintroduction of black-footed ferrets, including but not limited to: US Fish & Wildlife Service, Badlands National Park, US Forest Service, and Prairie Wildlife Research.
7. Educate the public about black-footed ferret restoration and conservation. Wind Cave successfully educated the public and media with ranger-led walks, displays at the visitor center, park newspapers, and regular contact with local reporters resulting in well-informed articles in the Rapid City Journal. It is estimated that several hundred thousand visitors were exposed to ferret ecology and management, and several thousand got in depth exposure in ranger lead walks and programs.
8. Avoid or minimize adverse effects on local economies, lifestyles, and the natural environment. Despite opposition to the reintroduction by agricultural interests there is no evidence that black-footed ferret reintroduction at Wind Cave negatively affected the local economy, lifestyles or natural environment.

By many measures, the reintroduction of black-footed ferrets to Wind Cave National Park has been a success. The key to ferret conservation is to maintain a healthy and large prairie dog ecosystem. National parks generally do a good job of protecting all wildlife, including prairie dogs (McCain 2009); however, plague poses challenges to prairie dog conservation regardless of the land management agencies policies or priorities. Plague was not known to occur at the park at the time of the reintroduction. It was thought that South Dakota was safe as plague distribution had generally remained fixed west of the Dakotas for several decades. The emergence of a plague epizootic in the Conata Basin, and the subsequent detection of plague bacterium at Wind Cave, dramatically changed ferret management at the park. The park began a costly and time-consuming dusting program in hopes of preventing a plague epizootic. Whether this dusting has prevented a plague epizootic is not known. What is known is that prairie dog colonies at the park appear healthy and they appear to wax and wane within the range of natural variability and processes. In summary, the ferret reintroduction at Wind Cave has met the project's goals.

Future Actions and Management Recommendations

In spite of much trepidation and concern within the ferret recovery community, the reintroduction of black-footed ferrets to Wind Cave National Park has, after five years, been a success. The success goes well beyond the boundaries of Wind Cave National Park as the reintroduction has inspired several other ferret reintroductions at small sites.

Yet much work remains to be done and much has yet to be learned. The high mortality rates and small population size at the park means that there is a high level of uncertainty about long-term success. However, at some point the reintroduction will be considered successful enough that even if the population were to become extirpated again a compelling argument could be made to conduct another reintroduction. Having ferrets at Wind Cave contributes to the global conservation of the species and returns a native species to the mixed grass prairies of southwestern South Dakota.

To insure long-term viability of the Wind Cave ferret population we recommend the following actions:

- Maintain sufficient prairie dog acreage. At the time of the reintroduction the park had approximately 2,500 acres of prairie dogs. The ferret recovery program supported the project and allocated ferrets based on this acreage. We recommend that the park maintain 2,500 acres of prairie dogs at a minimum.
- Evaluate new areas for prairie dogs. The park acquired new land in 2011. The land does not currently support prairie dogs. The site should be evaluated for prairie dog expansion.
- Monitor for plague. Studies conducted by the park and the University of South Dakota indicate that the plague bacterium is present in some prairie dog colonies. However, additional information on the distribution and prevalence of plague would lead to more informed management actions.
- Continue plague management. Dusting with insecticide continues to be the best and most efficient form of plague control. Until better methods are developed, it should continue, especially in colonies where ferret densities are high. In the future bait-delivered plague vaccines may become a more effective means of plague control. The park should continue to vaccinate ferrets against plague as well.
- Maintain adequate personnel and equipment. The park has limited staff and resources to conduct ferret and prairie dog management and monitoring. Plague control is especially time-consuming and expensive. The loss of staff has also hindered prairie dog and ferret conservation as remaining staff assume more duties. The park should maintain, and if possible, increase personnel and fiscal resources for prairie dog and ferret management programs.
- Promote volunteer assistance. Volunteers have played a critical role in the ferret program, especially in terms of assisting on the night-time spotlighting surveys. Although a fascinating activity, night-time spotlighting can be difficult work that taxes the enthusiasm of volunteers. Efforts need to continue to recruit and properly recognize and reward their efforts.

- Promote research. The Wind Cave ferret reintroduction was viewed as an experiment, to see if ferrets could survive on a smaller prairie dog complex. This work summarizes, but does not fully analyze what has occurred. The park also should reach out to partners to continue research on ferrets, prairie dogs, plague and related issues.
- Continue outreach. Prior to the reintroduction there was some concern about the impact of reintroducing the endangered black-footed ferret to the site. Those concerns have subsided. The park and ferret recovery program needs to promote the ferret program and the conservation of the species as well as the prairie dog ecosystem.

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Appendix A: Record of all Black-footed Ferret Locations 2007-2012

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
05-172	M	081*111*877	7/4/07	Bison Flats	623679	4822115	763	Conata	R	
05-173	M	081*099*603	7/5/07	Bison Flats	623162	4822013	764	Conata	R	
06-167	M	043*042*609	7/4/07	Bison Flats	623520	4821815	398	Conata	R	
06-168	M	042*892*856	7/4/07	Bison Flats	623695	4822303	398	Conata	R	
06-169	M	043*275*844	7/4/07	Bison Flats	623636	4821929	398	Conata	R	
06-169	M	043*275*844	11/1/07	Bison Flats	622705	4822721	517	Conata	S	V
06-170	M	043*265*866	7/4/07	Research Reserve	623600	4825492	398	Conata	R	
06-171	M	043*292*280	7/4/07	Research Reserve	623608	4825489	398	Conata	R	
06-172	M	042*784*258	7/4/07	Research Reserve	623852	4825706	398	Conata	R	
07-009	M	100*541*094	7/22/09	North Boundary*	622914	4832708	782	Conata	I	
07-009	M	100*541*094	10/3/07	Sanctuary*	624040	4830362	124	Conata	R	
07-011	M	100*532*371	10/2/07	Bison Flats	622472	4821819	123	Conata	R	
07-011	M	100*532*371	11/14/07	Bison Flats	621513	4821640	166	Conata	S	V
07-019	F	100*562*638	10/3/07	Research Reserve	624465	4824926	124	Conata	R	
07-068	F	099*878*786	9/26/07	Research Reserve	623921	4825426	117	Conata	R	
07-068	F	099*878*786	11/15/07	Research Reserve	623829	4825864	167	Conata	S	F
07-084	F	100*564*079	9/25/07	Bison Flats	622136	4821692	116	Conata	R	
07-084	F	100*564*079	11/16/07	Bison Flats	621993	4822073	168	Conata	S	V
07-084	F	100*564*079	10/6/08	Bison Flats	622460	4822201	493	Conata	S	V
07-084	F	100*564*079	7/25/09	Bison Flats	621669	4821218	785	Conata	I	
07-084	F	100*564*079	3/30/10	Bison Flats	621857	4821983	1033	Conata	S	V
07-084	F	100*564*079	9/20/10	Bison Flats	621798	4821998	1207	Conata	S	V
07-084	F	100*564*079	10/19/10	Bison Flats	621460	4821438	1236	Conata	S	F
07-089	F	100*572*083	9/25/07	Bison Flats	622028	4821754	116	Conata	R	
07-091	F	100*541*334	9/26/07	Research Reserve	624240	4825307	117	Conata	R	
07-093	M	100*537*867	10/2/07	Bison Flats	622638	4821743	123	Conata	R	
07-094	M	100*526*005	10/2/07	Bison Flats	621753	4822714	123	Conata	R	
07-095	F	100*528*312	10/2/07	Bison Flats	621854	4822782	123	Conata	R	

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
07-096	M	100*553*580	10/2/07	Bison Flats	622202	4822842	123	Conata	R	
07-096	M	100*553*580	11/1/07	Bison Flats	622839	4822803	153	Conata	S	V
07-096	M	100*553*580	11/2/07	Bison Flats	622930	4823129	154	Conata	S	V
07-097	F	100*542*108	10/3/07	Norbeck	622677	4825549	124	Conata	R	
07-098	M	100*527*871	10/3/07	Norbeck	622889	4825170	124	Conata	R	
07-099	F	100*563*795	10/3/07	Norbeck	623018	4825177	124	Conata	R	
07-099	F	100*563*795	11/15/07	Norbeck	622112	4825325	167	Conata	S	V
07-100	F	100*554*597	10/3/07	Sanctuary	624166	4830219	124	Conata	R	
07-101	M	100*544*320	10/3/07	Research Reserve	625124	4825199	124	Conata	R	
07-102	F	100*552*586	10/3/07	Sanctuary	624070	4830435	124	Conata	R	
07-103	M	100*554*848	4/14/08	Bison Flats	621814	4822864	318	Conata	S	F
07-103	M	100*554*848	4/14/08	Bison Flats	621814	4822864	318	Conata	S	F
07-103	M	100*554*848	10/5/08	Bison Flats*	621860	4821983	492	Conata	S	V
07-103	M	100*554*848	10/3/07	Norbeck*	622472	4825530	124	Conata	R	
07-104	M	100*571*350	10/3/07	Norbeck	621659	4825540	124	Conata	R	
07-105	M	100*552*822	10/3/07	Sanctuary	624162	4830520	124	Conata	R	
07-107	F	100*528*278	10/3/07	Research Reserve	625175	4825279	124	Conata	R	
07-109	F	100*533*034	10/3/07	Research Reserve	624589	4825039	124	Conata	R	
07-109	F	100*533*034	11/16/07	Research Reserve	623870	4825757	168	Conata	S	F
07-110	F	100*529*851	10/3/07	Research Reserve	624931	4825058	124	Conata	R	
07-111	F	100*556*541	10/3/07	Norbeck	621716	4825557	124	Conata	R	
07-160	F	099*885*801	11/6/07	Bison Flats	621782	4822542	158	Conata	R	
07-160	F	099*885*801	4/16/08	Bison Flats	622822	4822748	320	Conata	S	F
08-001	M	104*769*882	10/5/08	Bison Flats	621840	4823130	126	WICA	S	V
08-001	M	104*769*882	10/20/10	Bison Flats	622434	4823077	871	WICA	S	V
08-002	F	104*782*033	10/5/08	Bison Flats	622004	4823126	126	WICA	S	V
08-002	F	104*782*033	10/6/08	Bison Flats	621924	4823167	127	WICA	S	V
08-002	F	104*782*033	4/22/09	Bison Flats	623147	4822797	325	WICA	S	V
08-002	F	104*782*033	6/15/09	Bison Flats	622844	4822477	379	WICA	I	
08-002	F	104*782*033	9/16/09	Bison Flats	622939	4823112	472	WICA	S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
08-002	F	104*782*033	3/30/10	Bison Flats	622845	4822753	667	WICA	S	V
08-003	F	104*632*629	10/6/08	Bison Flats	622980	4823040	127	WICA	S	V
08-004	M	104*795*265	10/6/08	Research Reserve	624413	4826175	127	WICA	S	F
08-004	M	104*795*265	10/9/08	Research Reserve	624413	4826175	130	WICA	S	F
08-005	M	104*773*552	10/6/08	Bison Flats	622522	4822884	127	WICA	S	V
08-005	M	104*773*552	3/17/10	Bison Flats	621857	4821985	654	WICA	S	V
08-005	M	104*773*552	10/20/10	Bison Flats	621445	4821418	871	WICA	S	V
08-006	M	104*638*040	10/5/08	Bison Flats	623020	4822858	126	WICA	S	V
08-006	M	104*658*040	10/6/08	Bison Flats	622873	4822012	127	WICA	S	V
08-007	M	104*784*799	10/5/08	Research Reserve	624307	4826117	126	WICA	S	F
08-008	F	104*635*260	10/6/08	Bison Flats	621459	4821719	127	WICA	S	V
08-009	M	104*781*279	10/6/08	Bison Flats	621439	4821779	127	WICA	S	V
08-009	M	104*781*279	10/6/08	Bison Flats	621439	4821779	127	WICA	S	V
08-010	F	104*783*323	10/6/08	Bison Flats	623653	4822504	127	WICA	S	F
08-011	M	104*785*312	10/9/08	Bison Flats	622785	4822481	130	WICA	S	V
08-012	M	104*632*853	10/8/08	Norbeck*	622709	4825693	129	WICA	S	F
08-012	M	104*632*853	3/31/10	Norbeck*	623020	4824829	668	WICA	S	V
08-012	M	104*632*853	4/21/09	Research Reserve*	624170	4825535	324	WICA	S	F
08-013	M	104*624*797	10/9/08	Bison Flats	622469	4821602	130	WICA	S	F
08-014	M	104*632*063	10/9/08	Bison Flats	624143	4822317	130	WICA	S	F
08-014	M	104*632*063	4/21/09	Bison Flats	623520	4821985	324	WICA	S	F
08-014	M	104*632*063	3/30/10	Bison Flats	622767	4822446	667	WICA	S	V
08-014	M	104*632*063	3/31/10	Bison Flats	622991	4822002	668	WICA	S	F
08-014	M	104*632*063	3/31/10	Bison Flats	622662	4822063	668	WICA	S	F
08-014	M	104*632*063	10/21/10	Bison Flats	622862	4822444	872	WICA	S	F
09-001	F	104*831*830	9/16/09	Bison Flats	622282	4821707	107	WICA	S	F
09-002	M	104*812*801	9/15/09	Pringle	621972	4831845	106	WICA	S	V
09-003	M	104*794*326	9/16/09	Bison Flats	622005	4822153	107	WICA	S	V
09-003	M	104*794*326	9/16/09	Bison Flats	622005	4822153	107	WICA	S	V
09-003	M	104*794*326	3/31/10	Bison Flats	623238	4821812	303	WICA	S	F

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
09-003	M	104*794*326	3/31/10	Bison Flats	623235	4821812	303	WICA	S	F
09-003	M	104*794*326	4/1/10	Bison Flats	623162	4821951	304	WICA	S	F
09-004	M	104*634*779	9/17/09	Bison Flats	623455	4822188	108	WICA	S	F
09-005	F	104*786*795	9/18/09	Bison Flats	621524	4821726	109	WICA	S	V
09-005	F	104*786*795	9/20/10	Bison Flats	621511	4821785	476	WICA	S	V
09-006	F	037*567*117	10/19/10	North Boundary	623045	4832697	505	WICA	S	V
09-006	F	037*567*117	9/15/11	North Boundary	623313	4832922	836	WICA	S	V
09-006	F	037*567*117	10/13/11	North Boundary	623485	4832787	864	WICA	S	V
09-006	F	037*567*117	10/24/12	North Boundary	624155	4833035	1241	WICA	S	V
09-007	F	037*574*009	10/19/10	Custer State Park	624147	4833557	505	WICA	S	V
09-008	M	037*557*302	10/20/10	Custer State Park	624029	4834542	506	WICA	S	V
09-009	M	037*567*611	10/20/10	Custer State Park	623911	4833742	506	WICA	S	V
09-010	F	037*040*331	10/20/10	Custer State Park	624004	4834508	506	WICA	S	V
09-011	F	037*065*014	10/19/10	Custer State Park	624174	4833647	505	WICA	S	V
09-011	F	037*065*014	9/14/11	Custer State Park	624324	4833358	835	WICA	S	V
10-001	M	082*381*597	9/20/10	Bison Flats	621746	4821381	111	WICA	S	F
10-001	M	082*381*597	9/24/10	Bison Flats	621756	4821317	115	WICA	S	F
10-001	M	082*381*597	10/21/10	Bison Flats	621769	4822593	142	WICA	S	F
10-002	M	082*381*290	9/21/10	Bison Flats	621913	4822152	112	WICA	S	F
10-003	M	082*378*264	9/21/10	Bison Flats	622086	4822030	112	WICA	S	V
10-003	M	082*378*264	10/20/10	Bison Flats	621851	4821625	141	WICA	S	F
10-004	M	082*380*811	9/22/10	Norbeck	622314	4825321	113	WICA	S	F
10-005	M	082*382*577	9/24/10	Custer State Park	624046	4833310	115	WICA	S	V
10-006	M	082*378*051	9/22/10	Corrals	625836	4831926	113	WICA	S	V
10-006	M	082*378*051	9/24/10	Corrals	625836	4831926	115	WICA	S	V
10-006	M	082*378*051	9/13/11	North Boundary	625341	4832359	469	WICA	S	V
10-006	M	082*378*051	10/13/11	North Boundary	625147	4832602	499	WICA	S	V
10-007	M	037*575*081	10/18/10	Bison Flats	622954	4822233	139	WICA	S	F
10-008	F	037*557*889	10/19/10	Custer State Park	624138	4833639	140	WICA	S	V
10-009	F	037*563*269	10/19/10	Custer State Park	624099	4833991	140	WICA	S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
10-009	F	037*563*269	10/20/10	Custer State Park	624112	4833971	141	WICA	S	V
10-009	F	037*563*269	10/14/11	Custer State Park	624363	4833214	500	WICA	S	F
10-009	F	037*563*269	10/24/12	Custer State Park	624848	4832953	876	WICA	S	F
10-010	M	037*576*785	10/19/10	Custer State Park	624138	4833207	140	WICA	S	V
10-011	F	037*596*887	10/19/10	Custer State Park	623900	4833694	140	WICA	S	V
10-011	F	037*596*887	10/13/11	Custer State Park	624217	4834000	499	WICA	S	V
10-011	F	037*596*887	10/25/12	Custer State Park	624190	4834341	877	WICA	S	V
10-012	F	037*038*044	10/20/10	Bison Flats	623877	4821523	141	WICA	S	F
10-012	F	037*038*044	10/20/10	Bison Flats	623921	4821537	141	WICA	S	F
10-013	F	082*375*071	9/13/11	Corrals	625932	4831924	469	WICA	S	V
10-014	M	082*375*517	9/13/11	Corrals	625933	4831922	469	WICA	S	V
10-015	M	082*513*067	9/13/11	Custer State Park	624098	4833990	469	WICA	S	V
10-016	M	025*024*071	9/13/11	Custer State Park	624136	4833826	469	WICA	S	V
10-017	M	082*519*550	9/14/11	Bison Flats	623080	4822805	470	WICA	S	V
10-017	M	082*519*550	9/15/11	Bison Flats	623080	4822805	471	WICA	S	V
10-018	F	082*383*368	9/13/11	Custer State Park	625530	4832225	469	WICA	S	V
10-019	M	082*287*576	9/13/11	Bison Flats	622846	4822972	469	WICA	S	V
10-020	F	082*382*635	9/14/11	Custer State Park	624131	4834029	470	WICA	S	V
10-021	F	082*524*067	9/15/11	Custer State Park	624219	4833185	471	WICA	S	V
10-021	F	082*524*067	10/14/11	Custer State Park	624294	4833204	500	WICA	S	F
10-022	F	082*521*259	9/15/11	Custer State Park	625093	4832947	471	WICA	S	V
10-022	F	082*521*259	10/22/12	Custer State Park	624873	4832964	874	WICA	S	F
10-022	F	082*521*259	10/24/12	Custer State Park	625140	4832900	876	WICA	S	F
10-023	M	082*382*016	10/14/11	North Boundary	625628	4832053	500	WICA	S	V
11-001	F	082*297*531	9/12/11	Bison Flats	623276	4823087	103	WICA	S	V
11-002	F	082*513*126	9/14/11	Bison Flats	622950	4823096	105	WICA	S	V
11-002	F	082*513*126	10/12/11	Bison Flats	622805	4822232	133	WICA	S	V
11-003	F	082*348*266	10/11/11	NPS 5	627127	4831468	132	WICA	S	V
11-004	M	082*382*121	10/11/11	Bison Flats	622937	4822883	132	WICA	S	V
11-005	M	082*383*108	10/13/11	North Boundary	623655	4832814	134	WICA	S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
11-005	M	082*383*108	10/14/11	North Boundary	623727	4832892	135	WICA	S	V
11-006	F	082*347*348	10/13/11	North Boundary	625726	4831840	134	WICA	S	V
11-006	F	082*347*348	10/23/12	North Boundary	625844	4831898	510	WICA	S	V
11-007	M	103*311*090	9/19/12	Pringle	621854	4831556	476	WICA	S	V
11-008	F	103*316*600	9/18/12	Pringle	621641	4831143	475	WICA	S	V
11-009	F	103*574*550	9/19/12	Pringle	621918	4831428	476	WICA	S	V
11-009	F	103*574*550	10/24/12	Pringle	621982	4831900	511	WICA	S	V
11-010	F	103*533*318	9/19/12	Custer State Park	624222	4833851	476	WICA	S	V
11-011	F	103*565*285	9/20/12	Custer State Park	623471	4833641	477	WICA	S	F
11-012	F	055*844*543	10/23/12	North Boundary	622925	4832717	510	WICA	S	V
11-013	M	055*825*888	10/23/12	North Boundary	625259	4832502	510	WICA	S	V
11-014	F	055*069*625	10/24/12	North Boundary	625625	4832058	511	WICA	S	V
11-015	M	055*050*114	10/24/12	Custer State Park	624133	4833929	511	WICA	S	V
11-016	F	055*069*360	10/25/12	NPS 5	627184	4831447	512	WICA	S	V
12-001	M	103*333*856	9/18/12	Custer State Park	623079	4833402	109	WICA	S	F
12-002	M	103*336*077	9/18/12	Custer State Park	624195	4833868	109	WICA	S	V
12-003	F	103*309*379	9/19/12	Custer State Park	624035	4834552	110	WICA	S	V
12-004	M	103*573*046	9/19/12	Custer State Park	622974	4833515	110	WICA	S	F
12-004	M	103*573*046	10/23/12	Custer State Park	624064	4834224	144	WICA	S	V
12-005	M	103*568*296	9/19/12	Custer State Park	622908	4833479	110	WICA	S	F
12-006	M	103*578*322	9/19/12	Custer State Park	623132	4833382	110	WICA	S	F
12-006	M	103*578*322	9/20/12	Custer State Park	623113	4833738	111	WICA	S	F
12-007	M	103*588*337	9/19/12	Custer State Park	623274	4833157	110	WICA	S	F
12-007	M	103*588*337	10/23/12	Custer State Park	624784	4833302	144	WICA	S	F
12-008	M	103*532*570	9/19/12	Custer State Park	625876	4831968	110	WICA	S	V
12-009	F	103*589*606	9/19/12	Custer State Park	622920	4833490	110	WICA	S	F
12-010	F	103*602*001	9/20/12	Custer State Park	624340	4833525	111	WICA	S	V
12-010	F	103*602*001	10/25/12	Custer State Park	624019	4833133	146	WICA	S	V
12-011	M	103*575*512	9/21/12	Custer State Park	625796	4832065	112	WICA	S	V
12-011	M	103*575*512	10/23/12	Custer State Park	625985	4831962	144	WICA	S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
12-012	M	103*568*060	9/21/12	Pringle	621917	4831363	112	WICA	S	F
12-013	M	103*584*012	9/20/12	Custer State Park	624745	4833236	111	WICA	S	F
12-014	M	103*570*350	9/21/12	North Boundary	625692	4831928	112	WICA	S	V
12-014	M	103*570*350	10/24/12	North Boundary	626193	4831810	145	WICA	S	V
12-015	F	103*569*032	9/21/12	Custer State Park	625090	4832911	112	WICA	S	F
12-015	F	103*569*032	10/24/12	North Boundary	625803	4831833	145	WICA	S	V
12-016	F	103*541*604	10/22/12	Custer State Park	625532	4832389	143	WICA	S	F
12-016	F	103*541*604	10/23/12	North Boundary	625133	4832584	144	WICA	S	V
12-017	M	103*532*123	10/22/12	Pringle	621654	4831438	143	WICA	S	V
12-018	M	103*563*536	10/23/12	North Boundary	624813	4832783	144	WICA	S	V
12-019	F	103*577*862	10/23/12	NPS 5	627133	4831338	144	WICA	S	V
12-020	F	103*556*376	10/22/12	Custer State Park	624285	4833721	143	WICA	S	V
12-020	F	103*556*376	10/24/12	Custer State Park	624151	4834147	145	WICA	S	V
12-021	F	055*842*000	10/22/12	Pringle	621567	4831232	143	WICA	S	V
12-021	F	055*842*000	10/25/12	Pringle	621564	4831261	146	WICA	S	V
12-022	F	055*801*347	10/22/12	North Boundary	624993	4832780	143	WICA	S	V
12-023	F	055*830*112	10/23/12	NPS 5	627305	4831060	144	WICA	S	V
12-024	F	055*050*308	10/22/12	Pringle	621531	4830992	143	WICA	S	V
12-025	M	055*793*895	10/24/12	Bison Flats	623307	4823058	145	WICA	S	V
12-026	F	055*806*328	10/24/12	Custer State Park	624099	4834370	145	WICA	S	V
12-027	M	055*042*529	10/24/12	Custer State Park	624135	4834173	145	WICA	S	V
4293	F	057*062*003	9/13/07	Bison Flats	622975	4822585	1543	FCC	R	
4293	F	057*062*003	11/1/07	Bison Flats	622973	4822593	1592	FCC	S	V
4293	F	057*062*003	11/2/07	Bison Flats	622882	4822728	1593	FCC	S	V
5483	M	098*048*312	9/13/07	Bison Flats	622789	4822074	142	FCC	R	
5484	F	098*303*774	9/13/07	Bison Flats	623077	4822332	142	FCC	R	
5484	F	098*303*774	10/8/08	Bison Flats	621595	4821493	533	FCC	S	V
5485	F	107*298*635	9/28/07	Research Reserve	625132	4824952	157	FCC	R	
5487	M	107*262*332	9/28/07	Research Reserve	624755	4825315	156	FCC	R	
5489	F	107*116*882	9/13/07	Bison Flats	622524	4822011	142	FCC	R	

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
5489	F	107*116*882	11/2/07	Bison Flats	622627	4822181	192	FCC	S	V
5489	F	107*116*882	10/7/08	Bison Flats	622679	4822329	532	FCC	S	V
5489	F	107*116*882	9/16/09	Bison Flats	623367	4822179	876	FCC	S	F
5492	M	098*079*794	9/13/07	Bison Flats	622529	4821936	132	FCC	R	
5495	F	107*113*581	9/28/07	Research Reserve	625016	4825091	147	FCC	R	
5496	M	107*115*557	9/28/07	Bison Flats	623927	4821751	143	FCC	R	
5496	M	107*115*557	11/1/07	Bison Flats	622770	4823099	177	FCC	S	V
5496	M	107*115*557	11/1/07	Bison Flats	622770	4823095	177	FCC	S	V
5496	M	107*115*557	11/2/07	Bison Flats	622769	4823097	178	FCC	S	V
5497	M	107*314*322	9/28/07	Research Reserve	625342	4824811	143	FCC	R	
5498	F	107*305*796	9/28/07	Bison Flats	623924	4821665	143	FCC	R	
5499	F	107*126*816	9/28/07	Bison Flats	624080	4821984	143	FCC	R	
5500	F	107*283*874	9/28/07	Bison Flats	624076	4821826	143	FCC	R	
5500	F	107*283*874	3/29/10	Bison Flats	623915	4821296	1056	FCC	S	F
5502	M	074*095*272	9/13/07	Bison Flats	622761	4821957	127	FCC	R	
5503	M	074*005*864	9/13/07	Bison Flats	622992	4822230	127	FCC	R	
5504	F	073*618*020	9/13/07	Bison Flats	622785	4822006	127	FCC	R	
6677	F	041*029*531	11/4/10	Southeast	630020	4825826	156	NZP	R	
6677	F	041*029*531	4/12/11	Southeast	630099	4825756	315	NZP	S	F
6677	F	041*029*531	4/28/11	Southeast	630006	4825933	331	NZP	S	F
6682	M	041*024*372	11/4/10	Southeast	629670	4825966	156	NZP	R	
6702	M	041*002*538	11/4/10	Red Valley	630564	4828643	153	NZP	R	
6704	F	041*031*550	11/4/10	Red Valley	630714	4828616	153	NZP	R	
6704	F	041*031*550	4/5/12	Red Valley	630826	4829175	671	NZP	S	F
6714	M	041*017*360	11/4/10	Red Valley	630697	4828536	150	FCC	R	
6767	M	041*036*592	11/4/10	Southeast	629832	4825685	145	NZP	R	
6768	M	041*038*596	11/4/10	Southeast	629987	4825964	145	NZP	R	
6786	M	041*003*372	11/4/10	Red Valley	630724	4828695	143	LZG	R	
6788	F	041*031*834	10/12/11	Custer State Park*	626542	4831957	487	LZG	S	V
6788	F	041*031*834	11/4/10	Red Valley*	630568	4828573	143	LZG	R	

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
6790	M	041*037*894	11/4/10	Southeast	629742	4825365	141	LZG	R	
6792	F	041*005*074	11/4/10	Southeast	629656	4825834	141	LZG	R	
6792	F	041*005*074	4/29/11	Southeast	630091	4825796	317	LZG	S	F
6792	F	041*005*074	4/5/12	Southeast	630129	4825750	659	LZG	S	F
6792	F	041*005*074	9/19/12	Southeast	629886	4825392	826	LZG	S	F
6793	F	041*038*363	11/4/10	Southeast	629624	4825301	141	LZG	R	
6793	F	041*038*363	4/29/11	Southeast	629897	4826176	317	LZG	S	F
Unk			10/30/07	Bison Flats	622761	4823103			S	V
Unk			10/31/07	Bison Flats	622549	4822178			S	F
Unk			10/31/07	Bison Flats	623759	4821506			S	F
Unk			10/31/07	Bison Flats	621522	4821692			S	V
Unk			10/31/07	Bison Flats	622920	4823120			S	V
Unk			11/1/07	Bison Flats	622891	4822731			S	V
Unk			11/1/07	Bison Flats	621522	4821692			S	V
Unk			11/1/07	Bison Flats	622351	4822182			S	V
Unk			11/2/07	Bison Flats	623829	4821626			S	F
Unk			11/2/07	Bison Flats	624247	4822269			S	F
Unk			11/2/07	Bison Flats	622963	4823049			S	V
Unk			4/1/08	Bison Flats	621871	4821880			N	
Unk			4/1/08	Bison Flats	622692	4822671			N	
Unk			4/1/08	Bison Flats	622801	4821800			N	
Unk			4/15/08	Bison Flats	623291	4821977			S	F
Unk			4/16/08	Bison Flats	621821	4822781			S	F
Unk			4/16/08	Bison Flats	622506	4821524			S	F
Unk			4/17/08	Bison Flats	623028	4822543			S	V
Unk			4/19/08	Bison Flats	622773	4822343			S	F
Unk			10/5/08	Bison Flats	621603	4821488			S	F
Unk			10/6/08	Bison Flats	621905	4822203			S	F
Unk			10/7/08	Bison Flats	622681	4822327			S	F
Unk			10/7/08	Bison Flats	623827	4822692			S	F

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/7/08	Bison Flats	623603	4822556			S	F
Unk			10/7/08	Bison Flats	622382	4822247			S	F
Unk			10/7/08	Bison Flats	622759	4822725			S	V
Unk			10/8/08	Bison Flats	624017	4822324			S	F
Unk			10/8/08	Bison Flats	622574	4822895			S	V
Unk			10/9/08	Bison Flats	622996	4823129			S	V
Unk			9/16/09	Bison Flats	623410	4822198			S	F
Unk			9/16/09	Bison Flats	623418	4822203			S	F
Unk			9/16/09	Bison Flats	623420	4822202			S	F
Unk			9/16/09	Bison Flats	624160	4821455			S	F
Unk			9/16/09	Bison Flats	622934	4823079			S	V
Unk			9/17/09	Bison Flats	622346	4821712			S	F
Unk			9/17/09	Bison Flats	623412	4822192			S	F
Unk			9/17/09	Bison Flats	623412	4822192			S	F
Unk			9/17/09	Bison Flats	623620	4821876			S	F
Unk			9/17/09	Bison Flats	623624	4821871			S	F
Unk			9/17/09	Bison Flats	622422	4822217			S	V
Unk			9/17/09	Bison Flats	622973	4822998			S	V
Unk			9/18/09	Bison Flats	623522	4821974			S	F
Unk			9/18/09	Bison Flats	624160	4821455			S	F
Unk			9/18/09	Bison Flats	623260	4822184			S	F
Unk			9/18/09	Bison Flats	623415	4822193			S	F
Unk			2/6/10	Bison Flats	622744	4822843			N	
Unk			3/17/10	Bison Flats	622301	4822170			S	V
Unk			3/30/10	Bison Flats	621884	4821934			S	V
Unk			3/30/10	Bison Flats	622241	4822182			S	V
Unk			9/20/10	Bison Flats	622100	4822051			S	F
Unk			9/20/10	Bison Flats	623865	4821337			S	F
Unk			9/20/10	Bison Flats	623954	4821968			S	F
Unk			9/20/10	Bison Flats	624119	4821767			S	F

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			9/21/10	Bison Flats	621944	4821700			S	F
Unk			9/21/10	Bison Flats	623161	4822540			S	F
Unk			9/21/10	Bison Flats	623520	4821958			S	F
Unk			9/21/10	Bison Flats	623528	4821951			S	F
Unk			9/21/10	Bison Flats	623534	4821963			S	F
Unk			9/21/10	Bison Flats	623722	4822400			S	F
Unk			9/21/10	Bison Flats	624254	4821851			S	F
Unk			9/21/10	Bison Flats	621841	4821940			S	V
Unk			9/22/10	Bison Flats	623250	4821246			S	F
Unk			9/22/10	Bison Flats	623517	4821972			S	F
Unk			9/24/10	Bison Flats	621785	4821602			S	F
Unk			9/24/10	Bison Flats	622429	4821275			S	F
Unk			9/24/10	Bison Flats	623085	4821821			S	F
Unk			9/24/10	Bison Flats	623408	4822120			S	F
Unk			9/24/10	Bison Flats	623516	4821972			S	F
Unk			9/24/10	Bison Flats	623902	4822023			S	F
Unk			9/24/10	Bison Flats	621824	4821905			S	V
Unk			10/18/10	Bison Flats	623744	4821532			S	F
Unk			10/18/10	Bison Flats	621526	4821546			S	V
Unk			10/19/10	Bison Flats	621829	4821578			S	F
Unk			10/19/10	Bison Flats	622229	4821478			S	F
Unk			10/19/10	Bison Flats	621463	4821441			S	V
Unk			10/19/10	Bison Flats	621517	4821553			S	V
Unk			10/20/10	Bison Flats	622239	4821501			S	F
Unk			10/20/10	Bison Flats	622557	4822333			S	F
Unk			10/20/10	Bison Flats	622574	4822325			S	F
Unk			10/20/10	Bison Flats	623001	4822340			S	F
Unk			10/20/10	Bison Flats	623233	4822345			S	F
Unk			10/20/10	Bison Flats	621426	4821677			S	V
Unk			10/21/10	Bison Flats	621400	4821669			S	F

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/21/10	Bison Flats	622238	4821489			S	F
Unk			10/21/10	Bison Flats	622569	4822353			S	F
Unk			9/12/11	Bison Flats	622320	4822989			S	V
Unk			9/13/11	Bison Flats	621672	4821456			S	F
Unk			9/13/11	Bison Flats	621683	4821447			S	F
Unk			9/13/11	Bison Flats	621923	4822145			S	V
Unk			9/13/11	Bison Flats	622108	4822106			S	V
Unk			9/13/11	Bison Flats	622142	4822288			S	V
Unk			9/13/11	Bison Flats	622825	4822960			S	V
Unk			9/13/11	Bison Flats	622826	4822243			S	V
Unk			9/14/11	Bison Flats	623630	4822408			S	F
Unk			9/14/11	Bison Flats	622948	4823093			S	V
Unk			9/14/11	Bison Flats	623041	4823130			S	V
Unk			9/14/11	Bison Flats	623076	4822800			S	V
Unk			9/14/11	Bison Flats	623078	4822793			S	V
Unk			9/15/11	Bison Flats	623088	4822800			S	V
Unk			10/12/11	Bison Flats	622151	4822194			S	V
Unk			10/12/11	Bison Flats	622164	4822207			S	V
Unk			10/13/11	Bison Flats	622162	4822193			S	V
Unk			10/13/11	Bison Flats	622724	4822146			S	V
Unk			10/13/11	Bison Flats	622726	4822175			S	V
Unk			10/13/11	Bison Flats	622931	4822890			S	V
Unk			10/14/11	Bison Flats	622722	4822160			S	V
Unk			10/14/11	Bison Flats	622930	4822908			S	V
Unk			10/24/12	Bison Flats	621696	4821858			S	V
Unk			2/10/10	Corrals	625945	4831903			N	
Unk			9/15/11	Corrals	626102	4831857			S	V
Unk			10/11/11	Corrals	625912	4831856			S	V
Unk			10/12/11	Corrals	626157	4831795			S	V
Unk			10/12/11	Corrals	626174	4831813			S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/12/11	Corrals	626401	4831680			S	V
Unk			10/14/11	Corrals	626160	4831841			S	V
Unk			9/20/12	Corrals	626069	4831832			S	V
Unk			10/23/12	Corrals/North Boundary	625927	4831913			S	V
Unk			10/23/12	Corrals/North Boundary	626277	4831800			S	V
Unk			10/25/12	Corrals/North Boundary	625858	4831721			S	V
Unk			10/8/08	Custer State Park	624042	4833573			S	V
Unk			9/18/09	Custer State Park	624361	4833400			S	V
Unk			2/5/10	Custer State Park	625465	4832419			N	
Unk			2/10/10	Custer State Park	625778	4831940			N	
Unk			3/30/10	Custer State Park	624127	4833427			S	V
Unk			4/9/10	Custer State Park	624197	4833221			S	V
Unk			4/9/10	Custer State Park	624212	4833986			S	V
Unk			9/21/10	Custer State Park	624006	4833105			S	V
Unk			9/21/10	Custer State Park	624023	4833353			S	V
Unk			9/22/10	Custer State Park	624006	4833105			S	V
Unk			9/22/10	Custer State Park	624056	4833958			S	V
Unk			9/22/10	Custer State Park	624107	4833848			S	V
Unk			9/24/10	Custer State Park	624068	4833953			S	V
Unk			9/24/10	Custer State Park	624192	4834178			S	V
Unk			10/18/10	Custer State Park	623892	4833313			S	V
Unk			10/18/10	Custer State Park	623892	4833313			S	V
Unk			10/18/10	Custer State Park	623997	4833706			S	V
Unk			10/18/10	Custer State Park	624113	4834009			S	V
Unk			10/18/10	Custer State Park	624207	4833594			S	V
Unk			10/19/10	Custer State Park	623824	4833399			S	V
Unk			10/19/10	Custer State Park	623883	4833711			S	V
Unk			10/19/10	Custer State Park	623994	4833391			S	V
Unk			10/19/10	Custer State Park	624188	4833639			S	V
Unk			10/19/10	Custer State Park	624226	4833196			S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/20/10	Custer State Park	624165	4833161			S	V
Unk			10/21/10	Custer State Park	624148	4833192			S	V
Unk			10/21/10	Custer State Park	624160	4833243			S	V
Unk			9/13/11	Custer State Park	625334	4832527			S	V
Unk			9/13/11	Custer State Park	625528	4832223			S	V
Unk			9/13/11	Custer State Park	625719	4832137			S	V
Unk			9/14/11	Custer State Park	624115	4834035			S	V
Unk			9/14/11	Custer State Park	624167	4833170			S	V
Unk			9/14/11	Custer State Park	624231	4833175			S	V
Unk			9/14/11	Custer State Park	625044	4832974			S	V
Unk			9/14/11	Custer State Park	625058	4832970			S	V
Unk			9/14/11	Custer State Park	625225	4832615			S	V
Unk			9/14/11	Custer State Park	625239	4832636			S	V
Unk			9/14/11	Custer State Park	625970	4831970			S	V
Unk			9/15/11	Custer State Park	624117	4834386			S	V
Unk			9/15/11	Custer State Park	624237	4833166			S	V
Unk			9/15/11	Custer State Park	624437	4833132			S	V
Unk			9/15/11	Custer State Park	625060	4832962			S	V
Unk			9/15/11	Custer State Park	625231	4832632			S	V
Unk			10/11/11	Custer State Park	624243	4833866			S	V
Unk			10/12/11	Custer State Park	623984	4833232			S	V
Unk			10/12/11	Custer State Park	624046	4833257			S	V
Unk			10/12/11	Custer State Park	624090	4833747			S	V
Unk			10/12/11	Custer State Park	624246	4833851			S	V
Unk			10/12/11	Custer State Park	625041	4833025			S	V
Unk			10/13/11	Custer State Park	623070	4833100			S	F
Unk			10/13/11	Custer State Park	624030	4833354			S	F
Unk			10/13/11	Custer State Park	623984	4833228			S	V
Unk			10/13/11	Custer State Park	624092	4833747			S	V
Unk			10/13/11	Custer State Park	624213	4833992			S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/13/11	Custer State Park	624243	4833834			S	V
Unk			10/13/11	Custer State Park	624249	4833837			S	V
Unk			10/14/11	Custer State Park	622676	4833836			S	F
Unk			10/14/11	Custer State Park	622713	4833728			S	F
Unk			10/14/11	Custer State Park	623018	4833104			S	F
Unk			10/14/11	Custer State Park	624390	4833228			S	F
Unk			10/14/11	Custer State Park	624001	4833636			S	V
Unk			10/14/11	Custer State Park	624033	4833355			S	V
Unk			10/14/11	Custer State Park	624035	4834524			S	V
Unk			9/18/12	Custer State Park	624392	4833487			S	F
Unk			9/18/12	Custer State Park	623977	4833609			S	V
Unk			9/18/12	Custer State Park	624165	4833882			S	V
Unk			9/19/12	Custer State Park	624437	4833504			S	F
Unk			9/19/12	Custer State Park	623827	4833510			S	F
Unk			9/19/12	Custer State Park	623686	4833245			S	F
Unk			9/19/12	Custer State Park	623892	4833411			S	F
Unk			9/19/12	Custer State Park	622985	4833525			S	F
Unk			9/19/12	Custer State Park	623141	4833424			S	F
Unk			9/19/12	Custer State Park	622899	4833452			S	F
Unk			9/19/12	Custer State Park	623692	4833250			S	F
Unk			9/19/12	Custer State Park	624065	4834282			S	V
Unk			9/19/12	Custer State Park	624252	4833859			S	V
Unk			9/19/12	Custer State Park	624237	4833805			S	V
Unk			9/19/12	Custer State Park	624228	4833985			S	V
Unk			9/19/12	Custer State Park	625151	4832735			S	V
Unk			9/19/12	Custer State Park	625849	4831946			S	V
Unk			9/20/12	Custer State Park	624390	4833487			S	F
Unk			9/20/12	Custer State Park	624387	4833510			S	F
Unk			9/20/12	Custer State Park	622929	4833472			S	F
Unk			9/20/12	Custer State Park	624725	4833224			S	F

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			9/20/12	Custer State Park	624162	4833877			S	F
Unk			9/20/12	Custer State Park	625776	4832054			S	V
Unk			9/20/12	Custer State Park	623822	4833502			S	V
Unk			9/20/12	Custer State Park	624238	4833799			S	V
Unk			9/20/12	Custer State Park	625125	4832713			S	V
Unk			9/20/12	Custer State Park	624067	4834251			S	V
Unk			9/20/12	Custer State Park	624077	4834280			S	V
Unk			9/20/12	Custer State Park	621829	4831549			S	V
Unk			9/20/12	Custer State Park	624111	4834240			S	V
Unk			9/20/12	Custer State Park	625810	4832023			S	V
Unk			9/21/12	Custer State Park	623891	4833442			S	F
Unk			9/21/12	Custer State Park	625025	4832824			S	F
Unk			9/21/12	Custer State Park	624724	4833213			S	F
Unk			9/21/12	Custer State Park	622842	4833628			S	F
Unk			9/21/12	Custer State Park	622979	4833440			S	F
Unk			9/21/12	Custer State Park	624751	4833220			S	F
Unk			9/21/12	Custer State Park	623184	4833783			S	F
Unk			9/21/12	Custer State Park	623202	4833769			S	F
Unk			9/21/12	Custer State Park	624710	4833232			S	F
Unk			9/21/12	Custer State Park	625855	4831988			S	V
Unk			9/21/12	Custer State Park	623861	4833675			S	V
Unk			9/21/12	Custer State Park	624148	4834235			S	V
Unk			9/21/12	Custer State Park	625813	4832017			S	V
Unk			9/21/12	Custer State Park	623705	4835100			S	V
Unk			10/23/12	Custer State Park	623915	4833917			S	F
Unk			10/23/12	Custer State Park	623943	4833842			S	F
Unk			10/23/12	Custer State Park	624116	4834360			S	V
Unk			10/23/12	Custer State Park	624106	4834383			S	V
Unk			10/24/12	Custer State Park	625022	4832774			S	V
Unk			10/24/12	Custer State Park	624996	4832860			S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/25/12	Custer State Park	624177	4834386			S	V
Unk			10/25/12	Custer State Park	624092	4833921			S	V
Unk			10/25/12	Custer State Park	624179	4833978			S	V
Unk			10/31/07	Norbeck	621966	4825616			S	V
Unk			11/1/07	Norbeck	622012	4825531			S	V
Unk			11/1/07	Norbeck	622186	4825419			S	V
Unk			11/2/07	Norbeck	622202	4825410			S	V
Unk			11/16/07	Norbeck	622869	4825361			S	F
Unk			4/8/08	Norbeck	622553	4825536			N	
Unk			4/8/08	Norbeck	622686	4825101			N	
Unk			10/7/08	Norbeck	622806	4825664			S	F
Unk			10/8/08	Norbeck	622579	4825020			S	V
Unk			9/18/09	Norbeck	622097	4825292			S	F
Unk			2/10/10	Norbeck	622307	4825641			N	
Unk			2/10/10	Norbeck	622563	4824862			N	
Unk			2/10/10	Norbeck	622865	4825207			N	
Unk			3/17/10	Norbeck	622489	4825139			I	V
Unk			3/30/10	Norbeck	622562	4825308			S	F
Unk			10/20/10	Norbeck	622225	4825359			S	F
Unk			9/13/11	Norbeck	622909	4825217			S	F
Unk			9/13/11	Norbeck	622559	4825044			S	V
Unk			2/10/10	North Boundary	625467	4832254			N	
Unk			2/23/10	North Boundary	624928	4832788			N	
Unk			3/30/10	North Boundary	623128	4832827			S	V
Unk			3/31/10	North Boundary	622853	4832651			S	V
Unk			3/31/10	North Boundary	623467	4832886			S	V
Unk			9/21/10	North Boundary	624170	4833093			S	V
Unk			9/21/10	North Boundary	624403	4833004			S	V
Unk			9/22/10	North Boundary	624395	4832963			S	V
Unk			9/24/10	North Boundary	623165	4832899			S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/20/10	North Boundary	625207	4832592			S	V
Unk			1/12/11	North Boundary	624914	4832765			N	
Unk			1/12/11	North Boundary	625635	4832056			N	
Unk			4/11/11	North Boundary	624017	4832787			S	V
Unk			9/14/11	North Boundary	625226	4832561			S	V
Unk			10/12/11	North Boundary	624967	4832747			S	V
Unk			10/12/11	North Boundary	624987	4832765			S	V
Unk			10/12/11	North Boundary	624989	4832756			S	V
Unk			10/12/11	North Boundary	625015	4832744			S	V
Unk			10/12/11	North Boundary	625759	4831838			S	V
Unk			10/13/11	North Boundary	624997	4832751			S	V
Unk			10/13/11	North Boundary	625011	4832741			S	V
Unk			10/13/11	North Boundary	625726	4831844			S	V
Unk			10/14/11	North Boundary	623490	4832771			S	V
Unk			10/14/11	North Boundary	624979	4832763			S	V
Unk			9/19/12	North Boundary	624636	4832844			S	V
Unk			9/19/12	North Boundary	625695	4831955			S	V
Unk			9/19/12	North Boundary	625831	4831954			S	V
Unk			9/19/12	North Boundary	624545	4833053			S	V
Unk			9/20/12	North Boundary	624801	4832887			S	V
Unk			9/20/12	North Boundary	625696	4831944			S	V
Unk			9/20/12	North Boundary	621684	4830954			S	V
Unk			9/21/12	North Boundary	625793	4831902			S	F
Unk			9/21/12	North Boundary	626009	4831904			S	V
Unk			9/21/12	North Boundary	624658	4832837			S	V
Unk			9/21/12	North Boundary	624641	4832813			S	V
Unk			10/22/12	North Boundary	623915	4832748			S	V
Unk			10/22/12	North Boundary	625240	4832522			S	V
Unk			10/23/12	North Boundary	624174	4833028			S	V
Unk			10/23/12	North Boundary	625000	4832764			S	V

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/23/12	North Boundary	627088	4831370			S	V
Unk			10/24/12	North Boundary	624162	4833040			S	V
Unk			10/24/12	North Boundary	624833	4832727			S	V
Unk			10/24/12	North Boundary	624830	4832790			S	V
Unk			10/24/12	North Boundary	625573	4832183			S	V
Unk			10/24/12	North Boundary	625585	4832137			S	V
Unk			10/24/12	North Boundary	626088	4831793			S	V
Unk			10/24/12	North Boundary	623852	4832761			S	V
Unk			10/24/12	North Boundary	624262	4833048			S	V
Unk			10/25/12	North Boundary	624264	4833052			S	V
Unk			10/25/12	North Boundary	624997	4832661			S	V
Unk			10/25/12	North Boundary	625014	4832637			S	V
Unk			10/25/12	North Boundary	623925	4832785			S	V
Unk			10/25/12	North Boundary	624987	4832647			S	V
Unk			10/25/12	North Boundary	625001	4832657			S	V
Unk			1/12/11	NPS 5	627445	4831231			N	
Unk			2/29/12	NPS 5	627259	4831414			N	
Unk			9/21/12	NPS 5	627457	4831100			S	V
Unk			10/23/12	NPS 5	627269	4831136			S	V
Unk			10/23/12	NPS 5	627279	4831108			S	V
Unk			10/25/12	NPS 5	626920	4831461			S	V
Unk			10/25/12	NPS 5	627213	4831307			S	V
Unk			3/31/10	Pringle	621623	4831022			S	V
Unk			9/20/12	Pringle	621635	4831167			S	V
Unk			9/20/12	Pringle	621572	4831148			S	V
Unk			9/20/12	Pringle	621868	4831540			S	V
Unk			9/21/12	Pringle	621868	4831556			S	F
Unk			10/23/12	Pringle	621613	4831277			S	F
Unk			10/23/12	Pringle	621589	4830552			S	F
Unk			10/23/12	Pringle	622097	4831750			S	F

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			10/23/12	Pringle	621994	4831930			S	V
Unk			10/24/12	Pringle	621611	4830557			S	F
Unk			10/24/12	Pringle	621504	4830840			S	F
Unk			10/24/12	Pringle	621974	4831886			S	V
Unk			10/25/12	Pringle	621566	4831227			S	V
Unk			10/25/12	Pringle	621993	4831909			S	V
Unk			1/12/11	Red Valley	630564	4828648			N	
Unk			1/12/11	Red Valley	630773	4828410			N	
Unk			1/12/11	Red Valley	631024	4829008			N	
Unk			4/12/11	Red Valley	630562	4828642			S	V
Unk			4/29/11	Red Valley	630597	4828696			S	V
Unk			2/29/12	Red Valley	630916	4829311			N	
Unk			11/14/07	Research Reserve	623838	4825855			S	F
Unk			11/14/07	Research Reserve	623921	4825735			S	F
Unk			11/14/07	Research Reserve	624072	4825703			S	F
Unk			11/15/07	Research Reserve	623793	4825533			S	F
Unk			11/15/07	Research Reserve	624635	4825396			S	F
Unk			11/16/07	Research Reserve	623799	4825555			S	F
Unk			4/8/08	Research Reserve	624007	4825517			N	
Unk			4/8/08	Research Reserve	624191	4825403			N	
Unk			4/8/08	Research Reserve	624824	4825577			N	
Unk			4/8/08	Research Reserve	625010	4825434			N	
Unk			4/8/08	Research Reserve	625134	4825459			N	
Unk			10/6/08	Research Reserve	624513	4826125			S	F
Unk			10/8/08	Research Reserve	623625	4826197			S	F
Unk			10/8/08	Research Reserve	624239	4826005			S	F
Unk			10/8/08	Research Reserve	624477	4825293			S	F
Unk			10/9/08	Research Reserve	623970	4825765			S	F
Unk			10/9/08	Research Reserve	624440	4825416			S	F
Unk			4/21/09	Research Reserve	625482	4825953			S	F

ID #	Sex	PIT tag (head)	Date	Colony	Easting	Northing	Age (days)	Origin	Type	Method
Unk			4/22/09	Research Reserve	625456	4825955			S	F
Unk			1/20/10	Southeast	629824	4826040			N	
Unk			9/14/11	Southeast	630166	4825632			S	F
Unk			4/6/12	Southeast	630169	4825276			S	F
Unk			9/18/12	Southeast	629171	4824872			S	F

ID # is the studbook number given to the animal in captivity or the number assigned by the park to wild-born kits. For wild-born kits a 5-digit number is assigned denoting the year of birth followed by a dash and the chronological sequence in which it was captured. For instance, 09-005 was the 5th kit caught in 2009. "Unk" denotes that a ferret was sighted but was not identified, indicating it could have been a marked or unmarked animal. Animals with ID# starting with 05-, 06-, and 07- were born in the wild at Conata Basin, South Dakota and translocated to Wind Cave.

Colony * indicates the animal moved to a different prairie dog colony.

Easting and **Northing** are the UTM (Universal Transverse Mercator) coordinates of the ferret location in the NAD1983 Datum.

Age (days) is known exactly for captive-born animals and for wild-born kits the birth date is estimated as June 1 of that year. For instance, 09-005 was estimated to be born on 6/1/09.

Origin is the site, facility or zoo the ferret was born. FCC = National Black-footed Ferret Conservation Center, Carr, CO; LZG = Louisville Zoological Gardens, KY; NZP = National Zoological Park, Front Royal, VA; Conata = wild-born ferret translocated from Conata Basin, SD; WICA = wild-born in Wind Cave National Park.

Type is the type of survey or action to obtain the location. R = release location; S = spotlighting location; N = snowtracking location; I = incidental location.

Method is the type of spotlight survey used. F = foot; V = vehicle.

Appendix B: Spotlight Surveys by Colony, Season, and Year

Season	Colony	# Nights	Method	Acres Surveyed	Spotlight Hours	Minutes per acre Surveyed	# of Ferret Sightings	# Ferrets Identified
Fall 2007	Bison Flats	5	Vehicle	239.0	70.75	17.8	17	6
Fall 2007	Bison Flats	5	Foot	753.0	61.0	4.9	7	0
Fall 2007	Research Reserve	2	Foot	518.6	46.5	5.4	10	2
Fall 2007	Norbeck	5	Vehicle	128.2	6.0	2.8	5	1
Fall 2007	Norbeck	1	Foot	180.4	1.5	0.5	1	0
Spring 2008	Bison Flats	3	Foot	753.0	90.0	7.2	7	2
Spring 2008	Bison Flats	3	Vehicle	239.0	17.75	4.5	1	0
Spring 2008	Norbeck	1	Vehicle	128.2	9.25	4.3	0	0
Spring 2008	Norbeck	1	Foot	181.0	9.25	3.1	0	0
Fall 2008	Bison Flats	4	Foot	753.0	139.75	11.1	10	3
Fall 2008	Bison Flats	4	Vehicle	239.0	36.75	9.2	18	12
Fall 2008	North Boundary	1	Vehicle	91.4	11.0	7.2	2	0
Fall 2008	Norbeck	1	Foot	181.0	20.25	6.7	3	1
Fall 2008	Norbeck	1	Vehicle	128.2	3.0	1.4	1	0
Fall 2008	Research Reserve	3	Foot	518.6	47.5	5.5	9	2
Spring 2009	Bison Flats	2	Vehicle	239.0	27.0	6.8	1	1
Spring 2009	Bison Flats	1	Foot	718.5	62.5	5.2	5	1
Spring 2009	Norbeck	1	Both	180.4	8.0	2.7	0	0
Spring 2009	Research Reserve	2	Foot	518.6	24.75	2.9	3	1
Fall 2009	Bison Flats	3	Vehicle	239.0	54.5	13.7	9	3
Fall 2009	Bison Flats	3	Foot	661.0	139.25	12.6	16	3
Fall 2009	Sanctuary	3	Foot	120.0	4.25	2.1	0	0
Fall 2009	North Boundary / Pringle / CSP	3	Vehicle	525.4	23.25	2.7	2	1
Fall 2009	Norbeck	3	Both	160	29.5	11.1	1	0
Fall 2009	Research Reserve	3	Foot	500.0	60.5	7.3	0	0
Spring 2010	Bison Flats	2	Vehicle	239.0	23.5	5.9	7	4
Spring 2010	Bison Flats	2	Foot	661.0	68.5	6.2	6	2
Spring 2010	North Boundary / Pringle / CSP	2	Vehicle	525.4	27.5	3.1	7	0
Spring 2010	Norbeck	2	Both	160.0	12.5	4.7	3	1

Season	Colony	# Nights	Method	Acres Surveyed	Spotlight Hours	Minutes per acre Surveyed	# of Ferret Sightings	# Ferrets Identified
Fall 2010	Bison Flats	6	Vehicle	239.0	80.75	20.3	12	5
Fall 2010	Bison Flats	6	Foot	661.0	308.25	28.0	39	5
Fall 2010	North Boundary / Corrals / CSP	6	Vehicle	482.6	56.0	7.0	39	12
Fall 2010	Norbeck	3	Both	160.0	32.25	12.1	2	1
Fall 2010	Research Reserve	1	Foot	500.0	19.75	2.4	0	0
Spring 2011	Southeast / Red Valley	2	Foot	213.8	24.75	7.0	4	3
Spring 2011	Southeast / Red Valley / North Boundary	1	Vehicle	152.5	13.0	5.1	3	0
Fall 2011	Bison Flats	6	Vehicle	239.0	76.0	19.1	26	5
Fall 2011	Bison Flats	6	Foot	261	99.5	22.9	3	0
Fall 2011	North Boundary / Corrals / CSP / NPS5	6	Vehicle	515.4	117.25	13.7	67	17
Fall 2011	North Boundary / Corrals / CSP / NPS5	6	Foot	179.6	16.5	5.5	8	1
Fall 2011	Norbeck	6	Foot	180.4	31.75	10.6	2	0
Fall 2011	Southeast / Red Valley / Apple Orchard	3	Both	326.0	29.5	5.4	1	0
Spring 2012	Red Valley	2	Both	90.0	19.0	12.7	1	0
Spring 2012	Southeast	2	Foot	230.0	32.0	8.4	2	1
Spring 2012	CSP Wildlife Loop	1	Vehicle	4.0	1.0	15.0	0	0
Spring 2012	Apple Orchard	1	Vehicle	5.6	0.5	5.4	0	0
Fall 2012	North Boundary / CSP	6	Both	666.2	228.5	20.6	128	31
Fall 2012	Pringle	6	Both	89.6	57.75	38.7	22	7
Fall 2012	NPS5	6	Vehicle	32.8	25.5	46.7	8	3
Fall 2012	Southeast	2	Both	230.0	40.0	10.4	2	1
Fall 2012	Sanctuary	1	Foot	80.0	12.0	9.0	0	0
Fall 2012	Bison Flats / Norbeck	4	Vehicle	367.2	32.5	5.3	2	1
Fall 2012	Corrals	1	Foot	50.0	2.0	2.4	1	0
Fall 2012	Red Valley	2	Both	90.0	4.5	3.0	0	0
Fall 2012	Apple Orchard	2	Vehicle	5.6	1.0	10.7	0	0

Appendix C: Outreach Activities

2005

- February 1, 2005 – A public meeting was held in Rapid City, SD to solicit input on prairie dog management plan being developed.
- February 2, 2005 – A public meeting was held in Custer, SD to solicit input on prairie dog management plan being developed.
- Press Releases:
 - January 12, 2005 - Park Seeks Comments to Begin Prairie Dog Management Plan. Wind Cave National Park is initiating the planning process to prepare an Environmental Assessment (EA) for managing the black-tailed prairie dog population found within the park.
 - January 20, 2005 - Public Meetings Set for Park's Prairie Dog Management Plan. Wind Cave National Park will be hosting two public meetings as part of the planning process for developing an Environmental Assessment (EA) to manage the park's black-tailed prairie dog population.

2006

- February 16, 2006 – An open house was held to discuss the draft prairie dog management plan.
- November 28, 2006 – An open house was held to discuss the draft black-footed ferret management plan.
- Press Releases:
 - January 19, 2006 - Wind Cave Seeks Comments on Draft Prairie Dog Management Plan. Wind Cave National Park is soliciting comments on an environmental assessment (EA) and plan written to manage the park's black-tailed prairie dog population.
 - February 01, 2006 - Wind Cave to Host Open House for Draft Prairie Dog Management Plan. Wind Cave National Park will host an informal open house to discuss the park's draft prairie dog management plan and environmental assessment on Thursday, February 16.
 - June 07, 2006 - Park Releases Final Prairie Dog Management Plan. Acreage of prairie dogs at Wind Cave National Park will remain in the 1,000 to 3,000 acre range as a result of a recently completed environmental assessment.
 - July 13, 2006 - Park Seeks Comments on Black-footed Ferret Reintroduction. Wind Cave National Park is initiating the planning process to prepare an Environmental Assessment (EA) written for the reintroduction of Black-footed ferrets.
 - November 16, 2006 - Wind Cave to Host Open House for Draft Ferret Management Plan. Wind Cave National Park will host an informal open house to discuss the park's Draft Black-footed Ferret Management Plan and Environmental Assessment on Tuesday, November 28.

2007

- Press Releases:
 - April 13, 2007 - Wind Cave to Reintroduce Black-footed Ferrets. Wind Cave National Park, SD – One of the rarest animals in North America is returning to Wind Cave National Park.

- July 4, 2007 - Black-footed Ferrets Return to Wind Cave National Park. After a thirty-year absence, black-footed ferrets, one of the rarest animals in North America, have returned to Wind Cave National Park.

2008

- April 26, 2008 - Black-footed ferret / Junior Ranger Day was conducted at Wind Cave National Park. Approximately 200 visitors took part in the daylong and evening activities. Two PowerPoint presentations talking about ferret re-introduction efforts were given by resource staff, book signing by Andrew Licht (“The Ferret Capture”), live ferret borrowed from the captive breeding facility in northern Colorado (thanks to Paul Marinari) and night walks were conducted to look for ferrets. No ferrets observed, but groups did see other prairie wildlife species.
- Summer of 2008 - 16 Night Walks (reaching 337 visitors) were led by Wind Cave National Park interpretive / education rangers. The walks were conducted from July 8th until August 18th, 2008. The focus of the night walks was to take visitors across the prairie dog towns to experience the prairie world at night and to look for the elusive, endangered black-footed ferret. On August 14th, a group of 19 visitors had an opportunity to see a ferret (the next to last walk of the summer). The visitors (from Rapid City, Denver, England, etc.) were excited and felt blessed that they actually got to see a black-footed ferret. The visitors from Denver were on their way from Michigan back to Colorado and they specifically stopped at Wind Cave NP to take part in the night walk in hopes of seeing a ferret, in the wild, for their first time. In general the hikes were a huge success.
- An exhibit dealing with black-footed ferrets and reintroduction efforts was set up in the park visitor center main lobby where over 100,000 visitors a year assemble for information and cave tours.
- The Wind Cave NP reintroduction effort was the front page article on the 2008 park newspaper that was distributed to over 35,000 visitors in 2008.
- Press Releases:
 - July 10, 2008 - Wind Cave Celebrates Ferret Anniversary with Special Night Hikes. In honor of the one-year anniversary of the reintroduction of black-footed ferrets to Wind Cave National Park, rangers are offering night hikes through prairie dog town in hopes of seeing this rare animal.
 - October 16, 2008 - Ferret Population Growing at Wind Cave National Park. A year after the reintroduction of black-footed ferrets into Wind Cave National Park, the program is showing signs of success. Fourteen kits, baby ferrets, were trapped and released in the park’s primary reintroduction area last week during four nights of surveying

2009

- The Park conducted 9 “Prairie Night Walk” programs for 211 people. The night walks were well received averaging 23 people on each program that started at 9:00 and ended at 10:30. One ferret was observed during a hike in June and ~40 people (two groups) were able to see it. A transponder reader was set, left over night and a reading obtained (female born in 2008). Though the main draw of the prairie night walks is for visitors to see a ferret, visitors do not seem to be disappointed if they don’t see a ferret since there are so many wonderful sights and sounds to experience at night on the prairie. There are visitors that travel to the park specifically to have an opportunity to see a ferret.

- The Park offered daytime ferret/prairie dog talk/hikes about once a week. They were offered 10 times but hikes are not real popular so it was only presented four times to a total of 19 people. The Interpretive Division also presented 2 separate discovery programs about ferrets that were presented an average of 3 times per week, averaging 25 people on each program for a total of about 1,000 people. The ferret is an integral part of the Parks Environmental Education Program that reaches 800-1000 K-8th grade students. The “interactive” black-footed ferret exhibit developed in 2008 remained a very popular exhibit with younger groups and adults as well. The main lobby ferret display is visited by the majority of visitors.
- Resource staff provided a mentorship for a local high school student working on his senior project. Student updated ferret monitoring equipment inventory and also took part in a fall spotlight survey. In his thank you note that was sent to the park he stated "I enjoyed every minute of it. It was an experience that I have taken to heart and has really helped me find an interest and a possibility of what I want to do in college".

2010

- May 21, 2010 – The NPS Midwest Regional Biologist gave an Endangered Species Day presentation in Rapid City to about 100 people. The title was “Black-footed Ferret Reintroduction at Wind Cave National Park.”
- The Park conducted 10 Prairie Night Hikes throughout the summer, with a total of 197 people attending. These are ranger led hikes that allow visitors to experience the sights and sounds of the prairie at night, with hopes of seeing a ferret.
- The Interpretive Division Discovery Program on black-footed ferrets was presented 6 times over the summer months to 145 visitors.
- The park also conducted daytime prairie hikes and a nighttime campfire program devoted entirely to ferrets. An additional 50 visitors attended these programs.
- The Interpretive Division reached 1142 people during their spring Environmental Education Program. Black-footed ferrets are an important component of this program.
- Ferrets were also discussed in the park newspaper (35,000 copies printed).
- The park press release of the November addition of 12 kits from the National Black-footed Ferret Conservation Center made the front page of the InsideNPS website.
- Park staff gave a brief interview for KEVN TV on the November 2010 release.
- Press Releases:
 - July 01, 2010 - Wind Cave Begins Night Hikes In Search of Ferrets. Rangers at Wind Cave National Park will be offering special night hikes this summer in hope of seeing a black-footed ferret, the rarest animal in North America.
 - November 05, 2010 - Twelve Additional Black-footed Ferrets Released at Wind Cave Wind Cave National Park, S.D Twelve additional black-footed ferrets were recently released in Wind Cave National Park. The ferrets, seven males and five females, were bred in captivity at the National Black-Footed Ferret Conservation Center in northern Colorado.

2011

- The Park conducted 10 Prairie Night Hikes throughout the summer, with a total of 188 people attending. These are ranger-led hikes that allow visitors to experience the sights and sounds of the prairie at night, with hopes of seeing a ferret.

- The Interpretive Division Discovery Program on black-footed ferrets was presented 14 times over the summer months to 490 visitors.
- Two additional Discovery programs were devoted to the prairie, including ferrets. Nineteen of these programs were given reaching 665 visitors.
- The park also conducted daytime prairie hikes and a nighttime campfire program devoted to the prairie and ferrets. An additional 147 visitors attended these programs.
- The Interpretive Division reached 1147 people during their spring Environmental Education Program. Black-footed ferrets are an important component of this program.
- Ferrets were featured in an article in the park's newspaper, of which 37,000 copies were printed.
- The park reached approximately 37,000–38,000 people regarding ferrets during 2011.

2012

- The Park conducted 8 Prairie Night Hikes throughout the summer, with a total of 151 people attending. These are 2 hour ranger-led hikes that allow visitors to experience the sights and sounds of the prairie at night, with hopes of seeing a ferret.
- The Interpretive Division Discovery Program on black-footed ferrets was presented 19 times over the summer months to 520 visitors.
- Two additional Discovery programs were devoted to the prairie, including ferrets. Twenty-three of these programs were given reaching 585 visitors.
- The park also conducted a nighttime campfire program devoted to the prairie and ferrets. An additional 490 visitors attended these programs.
- The Interpretive Division reached 776 people during their spring Environmental Education Program. Black-footed ferrets are an important component of this program.
- The park participated in a Scouting program at Jewel Cave NM and presented a program about ferrets and the prairie reaching about 50 scouts and their parents
- Ferrets were the front page article in the park's newspaper, of which 37,000 copies were printed.
- The park reached approximately 39,000–40,000 people regarding ferrets during 2012.
- The park worked with a taxidermist from Scotts Bluff, NE to develop a ferret and prairie dog display that will be placed in the Park Visitor Center. The display will be completed in 2013 and will have a male and female black-footed ferret depicted in prairie dog habitat.
- Resource Management staff discussed prairie ecology and wildlife management issues with emphasis on black-footed ferrets to 5 university classes, 1 high school ecology class, and to Wind Cave employees.

Appendix D: Related Research and Publications Conducted at the Park

Principal Investigators / Authors	Project Title or Activity	Publication, Report, Presentation or Status
Gitzen, Robert, and Lenora Dombro	Effects of Flea-reduction Treatments on Small Mammals in Prairie Dog Communities at Wind Cave National Park, South Dakota	Ongoing
Smith, Brian, and Joseph McAllister	Effects of deltamethrin on the tiger salamander (<i>Ambystoma mavortium</i>) at Wind Cave National Park.	Ongoing
Britten, Hugh, and Erica Mize	Risk of plague to prairie dog populations	Ongoing
Cully, Jack	Community and landscape dynamics of sylvatic plague in black-tailed prairie dogs.	Ongoing
Hinkelman, Travis	Is the colony-size distribution discontinuous for black-tailed prairie dogs.	Ongoing
Licht, Daniel S.	Observations from the park were part of the publication.	Licht, D. S. 2010. Observations of bobcats, <i>Lynx rufus</i> , hunting black-tailed prairie dogs, <i>Cynomys ludovicianus</i> , in Western South Dakota. <i>The Canadian Field-Naturalist</i> . 124(3):204-208
Licht, Daniel S.	To determine if dusting prairie dog towns with deltamethrin (Delta Dust) for purposes of preventing plague in prairie dogs has any non-target impacts on small mammal abundance.	Licht, D. S. 2013. A preliminary study of small mammal presence and response to plague control at Wind Cave National Park. Natural Resource Technical Report NPS/WICA/NRTR – 2013/697. National Park Service, Fort Collins, CO.
Rocke, Tonie	Field study to determine the efficacy of sylvatic plague vaccine (SPV) delivered via oral baits in wild prairie dogs and the potential impact of SPV on prairie ecosystems	Ongoing
Mosby, Cory	Evaluating habitat suitability, population size, and prey use of bobcats (<i>Lynx rufus</i>) in South Dakota	Mosby, C. E. 2011. Habitat selection and population ecology of bobcats (<i>Lynx rufus</i>) in South Dakota, USA. M.S. Thesis. South Dakota State University, Brookings SD.
Chronert, Jamie	Ecology of the Coyote (<i>Canis latrans</i>) at Wind Cave National Park	Chronert, J. M., Jenks, J. A., Roddy, D. E., Wild, M. A. and Powers, J. G. (2007), Effects of Sarcoptic Mange on Coyotes at Wind Cave National Park. <i>The Journal of Wildlife Management</i> , 71: 1987–1992. doi: 10.2193/2006-225
Licht, Daniel S., D. Roddy, and B. Muenchau	Reintroduction of the black-footed ferret to a small prairie dog complex.	Presentation at the Defenders of Wildlife Carnivores 2009 conference, November 15-18, 2009, Denver CO
Livieri, Travis M. and Daniel S. Licht	Prairie dog and black-footed ferret behavior	Livieri, T. M., D. S. Licht, B. J. Moynahan and P. D. McMillan. 2013. Prairie dog aboveground aggressive behavior towards black-footed ferrets. <i>American Midland Naturalist</i> 169:422-425. http://dx.doi.org/10.1674/0003-0031-169.2.422

Appendix E: Ferret Program Participants 2007-2012

A special thanks to all who participated in the project, particularly those who took part in the planning phase, ferret release efforts, spotlighting and snow tracking surveys. Thanks also to the veterinarians who assisted with the captures and the processing of animals.

Kevin Castle, Marie Curtin, Vidal Davila, Tom Farrell, Dan Foster, Rick Mossman, Marc Ohms, Greg Schroeder, Linda Stoll, Duane Weber, Elizabeth Wheeler, Jamie Wheeler, (National Park Service), Pete Gober, Scott Larson, Mike Lockhart, Paul Marinari, Randy Matchett (U.S. Fish and Wildlife Service), Randy Griebel, Bill Perry, Doug Sargent (U.S. Forest Service), Badlands National Park Wildlife Staff, Black Hills State University, Chadron State College.

Thanks to spotlight survey participants and veterinary staff including:

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Apologies to any participants we may have missed.

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