

The Prairie Dog: A Century of Confusion and Conflict in Park Management

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OF ALL OF THE NATIVE SPECIES FOUND ON NATIONAL PARK SERVICE (NPS) LANDS, perhaps none have been as maligned by park managers as the various species of prairie dog (*Cynomys* spp.). Conversely, no native species has tormented as many park managers as the prairie dog. Arguably, throughout the agency's long history the management of the prairie dog, and especially that of the black-tailed prairie dog (*C. ludovicianus*), has been one of its most difficult, discordant, and acrimonious wildlife issues. Even today, the perception of prairie dogs, both within and outside the agency, ranges from a charismatic keystone species worthy of conservation to a pest worthy of extermination. In this paper we document the history, current status, and management of black-tailed (*C. ludovicianus*), Gunnison's (*C. gunnisoni*), white-tailed (*C. leucurus*), and Utah (*C. parvidens*) prairie dogs within the national park system (a fifth species, the Mexican prairie dog, *C. mexicanus*, is not found in NPS units). Most wildlife issues that challenge park managers can be found embedded in prairie dog management.

History of prairie dog management in the National Park Service

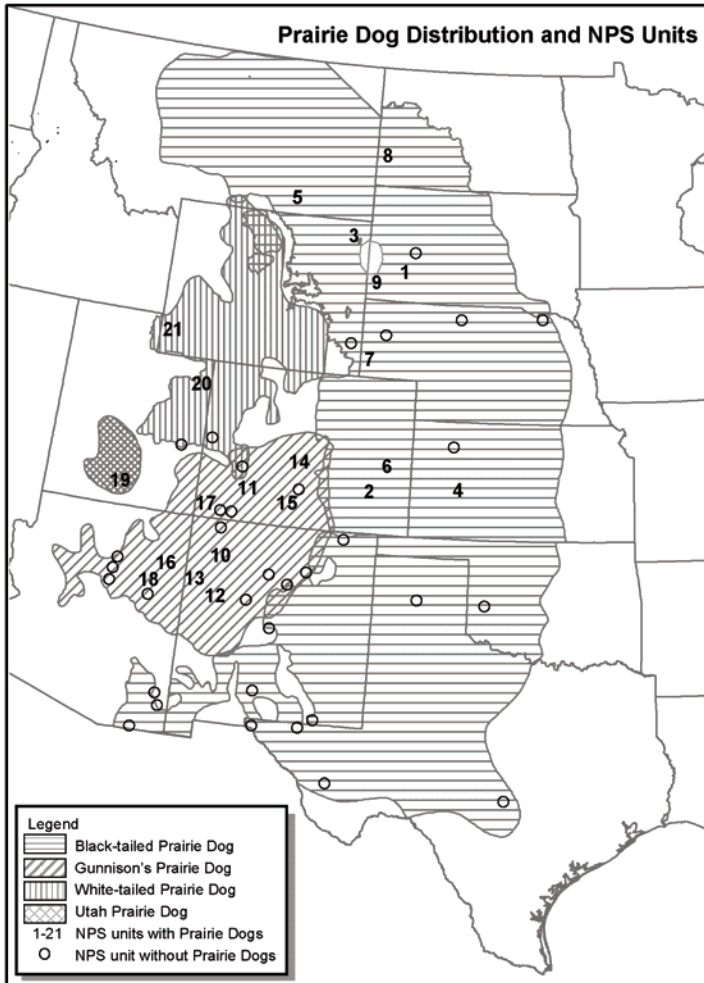
Despite laws and policies to conserve native wildlife, the NPS has often struggled to achieve such goals (Sellars 1997). Prairie dog conservation is no exception. At the time the agency was established in 1916 there was little public support for prairie dogs and the prairie dog ecosystem. The general consensus was that the animals competed with cattle for forage and that they had no redeeming value. As a result, prairie dog eradication was widespread and on-going (Knowles et al. 2002; Forrest and Luchsinger 2006). Yet the NPS was charged with preserving all wildlife. Inevitably, the federal agency was pitted against neighboring landowners, county and state governments, farm and ranch lobbies, and others.

For example, in 1952 the South Dakota state legislature requested that Congress exterminate all prairie dogs within Badlands National Park (Ulrich and Lee 1993). A compromise was eventually reached whereby sanctioned poisoning within the park was restricted to within one-half mile of the boundary; however, in reality most of the park population was eradicated, apparently due to illegal poisoning by lessees (there were existing grazing leases within the park at that time). The famed biologist Adolph Murie speculated that the near-eradication of prairie dogs at the park may have caused the extirpation of black-footed ferrets (*Mustela nigripes*), which later were declared an endangered species (cited in Ulrich and Lee 1993). Unauthorized poisoning, most likely by neighboring landowners, also occurred with-

in Theodore Roosevelt National Memorial Park (later redesignated as Theodore Roosevelt National Park) about the same time (Norland and Bradybaugh, n.d.).

A turning point in prairie dog conservation was the 1958 publication of Carl Koford's landmark monograph *Prairie Dogs, Whitefaces, and Blue Grama* (Koford 1958). Koford documented the rich biological diversity associated with prairie dogs, and he questioned the claims that prairie dogs destroyed vegetation and made the land unfit for livestock. A large portion of Koford's research was conducted in NPS units in the northern Great Plains. His report generally sheds a positive light on the agency (e.g., the frontispiece is a photograph of prairie dogs in front of Devils Tower National Monument); however, he does describe NPS poisoning of prairie dogs. He also noted that state legislatures often pressured the agency to eradicate prairie dogs in the belief that park units were a source for prairie dog infestations,

Figure 1 Distribution of prairie dogs and locations of NPS units. See Table 1 for key to identification numbers of parks.



an argument that is still common today. As further evidence that some things don't change, Koford noted that at Devils Tower people put out "peanuts, bread, popcorn, potato chips, and other goodies for the prairie dogs" and therefore the animals are "grotesquely fat" (p. 60).

Although Koford's monograph initiated a change in the scientific and conservation communities' attitudes toward prairie dogs, it did not sway ranchers, park neighbors, and agricultural lobbies. For example, in 1980 Badlands National Park was at the center of a lawsuit filed by the American Farm Bureau Federation against the departments of Agriculture and Interior whereby the plaintiffs sought relief from depredation by prairie dogs (it was settled out of court in 1994). State laws continued to be anti-prairie dog and therefore complicated or thwarted NPS efforts to conserve the species and fueled the state-federal controversy over the jurisdiction of wildlife (see Buono 1997).

Pressured by the conflicting and incompatible demands from ranchers, neighbors, and state legislatures on the one hand, and from the scientific and conservation community on the other, NPS often found itself contorting its management principles to satisfy both groups. For example, in the early 1980s staff at Wind Cave National Park shot and poisoned prairie dogs in response to outside pressure. Yet when park staff was questioned about the need for the control they said the poisoning was necessary to conserve the park's biological diversity, a scientifically insupportable claim given that the black-tailed prairie dog is recognized as a keystone species (Kotliar 2006; Miller et al. 2007). Furthermore, park staff said that reducing prairie dog distribution from 1,800 acres to 700 acres would still provide "adequate" habitat for black-footed ferrets (Fisher 1982), an assertion which was well below the minimum established by the scientific community at the time (US Fish and Wildlife Service 1978).

Roemer and Forrest (1996) researched federal and state prairie dog control programs in the northern Great Plains during the period 1982-1992. They found that lethal control (i.e., poisoning, shooting) of prairie dogs occurred at Badlands (5,423 acres treated), Devils Tower (trace amounts of poison used), Theodore Roosevelt (trace amounts), and Wind Cave (1,922 acres). However, the actual acreage treated was likely less because some of the control actions were probably re-treatments.

As the 20th century came to a close, the public's attitudes toward prairie dogs had become more positive, scientists had better documented the ecological value of the species, and NPS was becoming more confident in its conservation mission. As a result, the agency began showing more support for prairie dogs and more restraint in control programs (Supernaugh 1999). In some cases, NPS units not only conserved existing prairie dog populations, they also reintroduced prairie dogs where they had been extirpated. For example, Bryce Canyon National Park reintroduced the endangered Utah prairie dog.

Prairie dog management entered a new phase on July 31, 1998, when the National Wildlife Federation (NWF) petitioned the US Fish and Wildlife Service (USFWS) to list the black-tailed prairie dog as threatened throughout its range. Although the Utah prairie dog had been listed under the Endangered Species Act (ESA) for some time, that was a comparatively low-profile listing because that species was found only in one NPS unit. In contrast, the black-tailed prairie dog is found in several NPS units and has a much more significant

impact on plant communities and farm and ranch operations. As a result of the petition, on January 14, 1999, the regional director of the NPS Midwest Region signed a memorandum halting all prairie dog control on NPS lands in the region (with the exception for human “health and safety”; Schenk 1999). The memo stated that the 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 USFWS 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 (Soukup 1999). The narrow scope of “threats to cultural resources” may have been unintentional because most agency justifications for control used a broader criterion about impacts to other park resources. The “good neighbor” policy has never been defined in detail, but it is generally interpreted to mean that if an abutting neighbor complains about prairie dogs moving onto his or her property, or having the potential to do so, the park may take control actions to mitigate the neighbor’s concerns. The memorandum requested that—if the species were listed—USFWS allow NPS to continue the aforementioned control policies.

On February 4, 2000, USFWS 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 (USFWS 2000). At that time lethal control for black-tailed prairie dogs ceased on NPS lands. However, on August 18, 2004, the species was removed from the candidate list, with USFWS justifying the removal on evidence that the distribution, abundance, and trend data were not as dire as earlier believed (USFWS 2004). As a result of the revised status, and the acrimony surrounding the species, the Midwest Regional Office of NPS issued a new and more lenient policy on black-tailed prairie dogs (Quintana 2004). The memorandum re-opened the door to lethal control; however, it stated that “any park with prairie dog conservation issues must complete a park prairie dog conservation plan.” On December 2, 2008, USFWS once again elevated the status of the species by issuing a 90-day finding that a new petition to list the species presented substantial information, thereby initiating another 12-month review as to whether the species warrants listing under the ESA (USFWS 2008b).

Current status

There are at least 21 NPS units with prairie dogs (Table 1). The area occupied by prairie dogs on NPS lands is estimated at 14,576 acres, with 83% of those acres being inhabited by black-tailed prairie dogs. Because black-tailed prairie dog densities are much greater than those of the white-tailed group (Gunnison’s, Utah, and white-tailed prairie dogs), black-tailed prairie dogs are by far the most numerous.

Black-tailed prairie dogs

Although black-tailed prairie dog populations have declined 98% from pre-Columbian lev-

NPS unit ¹	Park size ² (acres)	Area occupied (acres)	Management Plan	Plague in Past 10 Years	Control Actions	Comments
<i>Black-tailed prairie dog</i>						
Badlands NP, S.Dak. • Map ID #1 ³	232,822	7,131 ⁴	Yes	No, but near park	Live trapping, zinc phosphide	Complaints from neighbors. Plague documented near park in 2008 so park dusted one large colony. Park has ferrets.
Bent's Old Fort NHS, Colo. • Map ID #2	736	49	Yes	Yes	Live trapping, gas cartridges	Has a history of plague and dusting to control plague.
Devils Tower NM, Wyo. • Map ID #3	1,347	42	No	No	Live trapping, visual barriers, gas cartridges	A single isolated colony. Occasional encroachment into campground and visitor areas.
Fort Larned NHS, Kans. • Map ID #4	680	33	No	No	Rozol	Prairie dog burrows located in historic trail ruts generating concerns from cultural resources. Complaints from neighbors.
Little Bighorn Battlefield NHS, Mont. • Map ID #5	765	<1	No	Unknown	No	Prairie dog colony adjacent to park. Only occasional occurrences of animals in the park.
Sand Creek Massacre NHS, Colo. • Map ID #6	2,400	120	In preparation	Yes	No	Park was recently established.
Scotts Bluff NM, Nebr. • Map ID #7	2,952	59	No	No	No	Park abuts urban area. One colony died out in 2008, another decreased in size and abundance, the other appears stable.

Table 1 Status of prairie dogs in National Park Service units as of 2009. Occupied acres, status of plans, control actions, and comments provided by park staff.

NPS unit ¹	Park size ² (acres)	Area occupied (acres)	Management Plan	Plague in Past 10 Years	Control Actions	Comments
Theodore Roosevelt NP, N.Dak. • Map ID #8	69,702	1,880	In preparation	No	Lethal trapping, barriers	Plague detections in 1986 and 1993. Suspicious colony die-off detected in 2005. Plague recently detected in mountain lions. Potential ferret reintroduction site.
Wind Cave NP, S.Dak. • Map ID #9	28,295	2,800	Yes	No, but near park	Live trapping, zinc phosphide, shooting	Some complaints from neighbors. Although plague not detected, park proactively dusted 1,100 acres in 2008 in part to protect a reintroduced black-footed ferret population.
<i>Gunnison's prairie dog</i>						
Chaco Culture NHP, N.Mex. • Map ID #10	32,840	80	No	No	No	No management issues reported, but lack of staff makes it not feasible to monitor population.
Curecanti NRA, Colo. • Map ID #11	41,971	36	Yes, but dated 1982	Yes	Live-trapping, barriers, zinc phosphide	History of periodic plague events. Some colonies close to visitor areas. Site may be designated by state as Management Emphasis Area.
El Malpais NM, N.Mex. • Map ID #12	109,612	85	No	No	No	No issues reported.
El Morro NM, N.Mex. • Map ID #13	1,040	3	No	No	No	No issues reported.

Table 1 (cont'd) Status of prairie dogs in National Park Service units as of 2009. Occupied acres, status of plans, control actions, and comments provided by park staff.

NPS unit ¹	Park size ² (acres)	Area occupied (acres)	Management Plan	Plague in Past 10 Years	Control Actions	Comments
Florissant Fossil Beds NM ³ , Colo. • Map ID #14	5,992	1	No	Yes	No	Plague in 2008 reduced population from 3 acres to 1 acre.
Great Sand Dunes NPP, Colo. • Map ID #15	85,932	<3	No	Unknown	No	On-going land exchange would add a few acres of habitat.
Hubbell Trading Post NHS, Ariz. • Map ID #16	160	10	No	No	Shoveling	Prairie dogs considered a "nuisance." Impact historic landscape and agricultural efforts.
Mesa Verde NP, Colo. • Map ID #17	52,216	3	No	Yes	Repellent	Were more abundant in the past.
Petrified Forest NP, Ariz. • Map ID #18	109,002	100+	No, but pursuing funding	Yes	No	Plague outbreaks have killed off most colonies. Person got plague from handling a dead prairie dog. Acreage estimate is a guess, i.e., no surveys conducted.
<i>Utah prairie dog</i>						
Bryce Canyon NP, Utah • Map ID #19	35,833	290	No, but in preparation	Yes	Barriers	Species is listed as threatened. Periodic plague outbreaks. Dust towns as needed.
<i>White-tailed prairie dog</i>						
Dinosaur NM, Colo./Utah • Map ID #20	203,031	1,700	No	Yes	No	History of plague. Ferret reintroduction site near the park.

Table 1 (cont'd) Status of prairie dogs in National Park Service units as of 2009. Occupied acres, status of plans, control actions, and comments provided by park staff.

NPS unit ¹	Park size ² (acres)	Area occupied (acres)	Management Plan	Plague in Past 10 Years	Control Actions	Comments
Fossil Butte NM, Wyo. • Map ID #21	8,198	150	No	No	No	No management issues.

¹ NP=National Park, NM=National Monument, NHS=National Historic Site, NRA=National Recreation Area, NPP=National Park and Preserve.

² Acres consist only of federal acres within park boundary.

³ ID number corresponds to location on Figure 1.

⁴ Prairie dog acreage excludes the South Unit of the park, which is within the Pine Ridge Indian Reservation.

⁵ The species in Florissant Fossil Beds NM was identified as white-tailed prairie dogs in Ulrich and Lee (1992).

Table 1 (cont'd) Status of prairie dogs in National Park Service units as of 2009. Occupied acres, status of plans, control actions, and comments provided by park staff.

els, the species still occupies about 1.89 million acres across its range (USFWS 2004). We found that there are 12,115 acres of black-tailed prairie dog colonies on NPS lands, or less than 1% of the range-wide acreage occupied by the species. The NPS population comprises about 11% of the population on federal lands (see Sidle et al. 2006). About 98% of the acreage occupied by black-tailed prairie dogs on NPS lands are at just three units: Badlands, Theodore Roosevelt, and Wind Cave; the other six units with the species all have 120 or fewer acres. Two of the units, Sand Creek Massacre and Bent's Old Fort national historic sites, are well within the zone where sylvatic plague (referred to as bubonic plague when humans contract the disease) has been documented. Theodore Roosevelt is outside of the established plague zone; however, the disease was documented at the park in 1986 and 1993. In 2008, plague was documented just a few miles from Badlands.

Knowles et al. (2002) estimated that the black-tailed prairie dog may have naturally occupied up to 15% of the suitable habitat in the northern Great Plains. Considering the imperiled status of the species, it seems reasonable that parks with black-tailed prairie dogs should strive for at least that percentage, and most appear to be at or above that level. For example, the 2,800 acres of prairie dog colonies at Wind Cave occupy 33% of the suitable habitat for the species (National Park Service 2006a). Other parks are close to the 15% level; at Badlands, for example, prairie dogs occupy 11% of the suitable habitat (National Park Service 2007). Unfortunately, even the large parks within the range of the species contain a very low percentage of "suitable" prairie dog habitat as much of the land comprises forests, badlands topography, or otherwise unsuitable terrain.

Guadalupe Mountains National Park does not currently have black-tailed prairie dogs, but did attempt to reintroduce the species during the period 1998–2000; however, the effort was unsuccessful, perhaps due to predation. The park is interested in trying again with a larger effort; however, lack of resources is hampering the project. Several other parks without black-tailed prairie dogs appear to have suitable habitat, but no reintroductions are currently underway.

The white-tail group: Gunnison's, Utah, and white-tailed prairie dogs

There are at least nine parks with Gunnison's prairie dogs, two with white-tailed prairie dogs, and one (Bryce Canyon) with the Utah prairie dog (Table 1). Other parks may also have small populations, but the large size and remoteness of some parks and the more secretive nature of the white-tailed group makes confirmation difficult. The 1,700 acres of white-tailed prairie dog colonies at Dinosaur National Monument are by far the largest population. Bryce Canyon supports 290 acres of colonies of the threatened Utah prairie dog. The Gunnison's prairie dog is currently listed as a candidate species within Colorado and New Mexico, further elevating its conservation status (USFWS 2008a).

Capitol Reef National Park introduced Utah prairie dogs in 1979, but the population winked out after only a few years (Player and Urness 1982). The park now questions whether the species is native to the site. Other parks, such as Canyonlands National Park and Colorado National Monument, appear to have had prairie dogs historically, but they are now absent. Aztec Ruins National Monument had Gunnison's prairie dogs until recently, but a plague epizootic eliminated the population.

Management of prairie dogs by the National Park Service

NPS's Species of Management Concern (SOMC) database attempts to catalogue all species of management concern in NPS units (excluding species listed under the ESA). The data are entered by park staff and therefore constitute a survey of park perceptions of prairie dogs. Eight of the nine parks with black-tailed prairie dogs responded to the call for data; all eight identified black-tailed prairie dogs as an SOMC. Of the 11 parks with Gunnison's or white-tailed prairie dogs, five parks listed prairie dogs as an SOMC while the other six did not. In addition, three parks where the species were extirpated listed them as an SOMC.

In early 2009 we sent out a questionnaire to all parks with prairie dogs asking them to rate prairie dogs as a management concern on a scale of "very low," "low," "moderate," "high," or "very high." We converted the responses to numerical scores from 1 to 5 with a 1 being "very low" and 5 being "very high." The mean response for the nine parks with black-tailed prairie dogs was 4.6, i.e., they judged the black-tailed prairie dog as a species of very high management concern. The mean response for the 11 parks that responded from the white-tailed group was 3.1, or "moderate," significantly lower than the responses for the black-tailed group ($P < .001$). The parks were also asked to use the same measures to rate the levels of complaints they get from neighbors, visitors, and others regarding prairie dogs. The nine parks with black-tailed prairie dogs scored a mean of 3.2, or a moderate level of complaints, whereas the respondents from the white-tailed group had a mean response of 1.8, or "low," also a significant difference ($P < .05$). The parks were also asked to report on the number of person-days spent annually on prairie dog management (field work, planning, meetings, outreach, etc., where prairie dogs were the primary emphasis). The nine parks with black-tailed prairie dogs spent an estimated 1,281 person-days annually, or a mean of 142 person-days per park, whereas the 11 parks that supported the white-tailed group spent an estimated 198 person-days annually, or a mean of 17 person-days per park, a significant dif-

ference ($P < .05$). Interestingly, three parks with black-tailed prairie dogs responded that they spent over 250 person-days annually, which is the equivalent of more than one employee working on the issue full-time.

We believe that prairie dogs are generally of high management concern to NPS units because: (1) their populations have substantially declined from historical levels; (2) they continue to be persecuted on private and public lands; (3) they are a keystone species (especially black-tailed prairie dogs); (4) they are impacted by plague (an exotic disease), which is also a risk to human health; (5) some species are currently listed, or proposed to be listed, under the ESA; (6) they can cause conflicts with other park objectives; and (7) they are often perceived as pests by neighbors and other agencies. The primary NPS activities related to prairie dog management can be categorized as planning, control activities, plague management, monitoring, research, and outreach. We discuss these activities here in more detail.

NPS units typically write species-specific management plans for only the most contentious or significant species. Therefore, it is not surprising that five of the nine parks with black-tailed prairie dogs have or are developing management plans specific to the species. In contrast, only two parks from the white-tailed group have prairie dog management plans: Bryce Canyon for the federally listed Utah prairie dog and Curecanti National Recreation Area for the Gunnison's prairie dog (however, that plan is from 1982 and viewed by park staff as being outdated).

NPS policy calls for restoring native species to natural conditions (e.g., with respect to abundances and distribution) and for allowing natural processes to continue unfettered by human intervention (National Park Service 2006b). However, agency policies also allow for intervention and control under certain circumstances and, when necessary, lethal removal. Paradoxically, according to NPS policies a species such as the prairie dog can simultaneously be defined and managed as a species of conservation concern and a pest. Perhaps more than any other species the prairie dog finds itself in this Jekyll-and-Hyde dichotomy. The justification for controlling prairie dogs on NPS units is often distilled down to one of three reasons: (1) human safety, (2) reducing conflicts with other park objectives (e.g., cultural resources), and (3) "good neighbor" purposes (Soukup 1999). Outside interests often try to influence prairie dog management within parks. For example, Kansas and South Dakota have laws requiring control of prairie dogs by property owners. The states have tried to impose these regulations on NPS; however, the agency asserts jurisdiction of wildlife within NPS units (Buono 1997). Ironically, at least one NPS unit with prairie dogs has been pressured to control their prairie dogs by a neighboring state-operated wildlife management area.

There are a variety of tools available for prairie dog management (Hygnstrom and Virchow 1994). Most parks prefer to use non-lethal tools such as habitat manipulation, fencing/barriers, and live capture and relocation. In some cases live-trapped animals have been transported to the Black-footed Ferret Conservation Center (Fort Collins, Colorado) for use by that program in rearing ferrets. Poisoning and shooting are viewed as tools of last resort. Zinc phosphide mixed with oats is the most commonly used poison. Although it requires pre-baiting to be most effective, the poison is efficient and appears to have few effects on non-target species when properly applied (Witmer and Fagerstone 2003). At least one NPS unit has used the anticoagulant chlorophacinone (sold under the trade name Rozol) since the

year 2000, a much more controversial rodenticide due to potential impacts on non-target species (Erickson and Urban 2004; Nesler 2006). However, a 2008 memo from the NPS Midwest regional director placed a moratorium on the use of that rodenticide (Quintana 2008).

Habitat management in the form of grazing or trampling (by various species, most commonly bovines) can be used in some cases to influence prairie dog distribution and abundance. For example, lighter grazing levels lessen the likelihood of prairie dog expansion. Conversely, heavy grazing or trampling creates conditions conducive to prairie dog establishment (Licht and Sanchez 1993). In at least one case, park management inadvertently created conditions conducive for prairie dog establishment. A northern Great Plains park mowed a campground located adjacent to a prairie dog town, thereby creating conditions favorable for colonization. The result was prairie dogs and prairie dog holes in the campground. Incidents such as these can be avoided with a better understanding of prairie dog ecology. Unfortunately, many smaller park units do not have natural resource programs, and therefore prairie dog management is a collateral duty for non-natural resource staff who may have limited scientific understanding of prairie dogs.

Plague has been, and will likely continue to be, a challenge for park managers for the foreseeable future (Aguirre et al. 1993). At least eight NPS units with prairie dogs have experienced plague in the past ten years and even parks with no evidence of the disease can be impacted. For example, in 2008 both Badlands and Wind Cave invested considerable resources to prophylactically treat prairie dog towns for plague even though the disease was not documented there. Plague is a high-profile issue because (1) it can decimate prairie dog colonies, (2) it can directly or indirectly affect other wildlife species such as black-footed ferrets, and (3) it poses a risk to human health. The plague bacterium (*Yersinia pestis*) is exotic to North America, probably having arrived via San Francisco at the beginning of the twentieth century (see Cully et al. 2006). Therefore, there is no dispute that plague should be eliminated from NPS units. However, the most common way to control plague is to “dust” prairie dog burrows with the insecticide deltamethrin to kill fleas, a host of the plague bacterium (Seery et al. 2003). Unfortunately, little is known about the non-target impacts of the insecticide on tiger salamanders (*Ambystoma tigrinum*) and other species that reside in prairie dog burrows.

A prerequisite for a defensible prairie dog management program is the implementation of a rigorous monitoring program. Every park with black-tailed prairie dogs monitors the acreage occupied by the species; however, the frequency of the monitoring ranges from annual to periodic. Systematic annual monitoring becomes problematic at large parks due to logistical reasons (e.g., Badlands, Theodore Roosevelt, and Wind Cave); but may become more feasible in the future using remote imagery and GIS. With the exception of the federally listed Utah prairie dog at Bryce Canyon, the white-tailed group is monitored much less, if at all.

Although the agency’s efforts at long-term monitoring of prairie dogs are spotty, NPS has a rich history of hosting short-term research. Koford’s 1958 publication notwithstanding, the most important publication on prairie dog ecology was a book by John Hoogland based on a 16-year study at Wind Cave (Hoogland 1995). Other notable prairie dog research



Figure 2 The black-tailed prairie dog, *Cynomys ludovicianus*. Photos courtesy of Daniel S. Licht.

at the park investigated social behavior and population dynamics (King 1955), the effects on above-ground biomass and nutrient dynamics (Krueger 1986), habitat use and spatial distribution (Wydeven and Dahlgren 1985), influence on grassland processes (Whicker and Detling 1993), ontogeny of behaviors (Loughry and Lazari 1994), ecosystem-level effects (Detling 1998), and population genetics (Dobson et al. 1998). Wind Cave, Badlands, Bryce Canyon, and Theodore Roosevelt have the richest research histories based on the NPS Nature-Bib database. We believe that long-term monitoring and studies of prairie dogs should be a high priority. Consider that black-tailed prairie dog populations, under natural conditions, are almost certainly cyclical. They are known to expand in drought periods and appear to contract in wet periods, cycles that could take decades. Yet there are no good long-term datasets uncompromised by control actions (e.g., poisoning, shooting) in which to test, analyze, and document these patterns. NPS units are well suited to provide this long-term information, providing they can leave populations unfettered.

NPS may be in a better position than any other agency to promote and educate the public about prairie dogs. The parks with resident black-tailed prairie dog populations hosted 2.4 million visitors in 2007 (<http://www.nature.nps.gov/stats/index.cfm>; the figure excludes Sand Creek Massacre National Historic Site for which visitation data are not available). At Devils Tower, the prairie dog is second only to the tower itself in terms of visitor attention (Jim Cheatham, pers. comm.). However, the flip side is that some visitors have preconceived negative ideas about prairie dogs, requiring innovative efforts by park interpretive programs to explain the benefits of the species. In some cases, the education and interpretation of prairie dogs needs to begin within the agency, as some park staff do not fully understand prairie dog ecology and may have inherent negative biases.

Conclusion

To paraphrase Charles Dickens, prairie dogs are one of the most loved species in NPS units and one of the most reviled. The NPS mission includes preserving prairie dogs for future generations; however, the agency's track record has been mixed. On the one hand there's the 100-year-old prairie dog colony at Devils Tower (Koford 1958); on the other, there are parks where the species has been extirpated. The environmental group Forest Guardians gave NPS a "B" grade for its conservation of prairie dogs—as good as or better than all other federal and state agencies, but not perfect (McCain 2009).

Prairie dog management will likely continue to confound park managers for the foreseeable future. Paradoxically, the agency oftentimes finds itself having to kill prairie dogs to appease neighbors in the belief that by doing so the park will be better able to conserve prairie dogs. So challenging is prairie dog management that parks sometimes find themselves investing considerable funds and time to protect prairie dogs (e.g., treating burrows with deltamethrin to prevent plague) in the same year that they invest considerable funds and time to control prairie dogs (e.g., killing prairie dogs with zinc phosphide), as was the case at Wind Cave in 2008.

Perception and personal values play a significant but poorly studied role in prairie dog management. For example, black-tailed prairie dogs can create relatively denuded areas pre-

dominately comprising forbs or bare ground. These areas are often viewed as unhealthy by neighbors, visitors, politicians, and even park staff, who have been taught for decades that heavy grazing is bad. However, such conditions are often within the range of natural variation and provide habitat for some species of wildlife, including species of conservation concern. Likewise, vegetation managers often blame prairie dogs for the spread of exotic plants and argue for prairie dog poisoning, yet the prairie dog is a native species, and therefore management efforts should focus on removing the exotic plants, not the prairie dog. Another problem of perception is that prairie dog populations often fluctuate in accordance with wet and dry cycles that can last for decades, yet park managers and decision-makers are often at a park for only a few years, which can lead to a lack of understanding of the process, overreacting to current conditions, and mismanagement of the resource.

Articulating and defending the ecological and keystone role of prairie dogs—and the NPS policies of natural conditions and processes—continues to be a challenge for park managers. Perhaps in the big picture the most important thing NPS can do for prairie dog conservation is to increase our understanding of the species' ecology and provide opportunities for the public to enjoy and appreciate the prairie dog ecosystem.

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