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URBAN-SUBURBAN PRAIRIE DOG MANAGEMENT: OPPORTUNITIES AND CHALLENGES

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ABSTRACT: The historic range of the black-tailed prairie dog has undergone dramatic declines in the last century, prompting concern about the species' long-term viability. While considered a pest by many, others believe that the species is a "keystone" element of prairie ecosystems. Urban-suburban land managers are challenged with preserving colonies of prairie dogs on public lands while dealing with many conflicting interests, social costs, and risks. We review the management plans that municipalities have designed to reduce conflicts by using public input, zoned management, and a variety of management techniques. Areas of difficulty and research needs are also discussed.

KEY WORDS: damage, *Cynomys ludovicianus*, prairie dog, urban wildlife, wildlife management

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INTRODUCTION

Black-tailed prairie dogs (*Cynomys ludovicianus*) were originally a widespread species in the central plains of North America, although we do not know how much of that range was actually occupied. They were associated with grasslands where, along with bison (*Bison bison*) and fire, they probably played important roles in maintaining sub-climax prairie vegetation (Kotliar et al. 1999; Sieg 1996; Weltzin et al. 1997; Whicker and Detling 1988). Prairie dogs contributed to this vegetative state by their foraging, plant clipping, and burrowing, having a dramatic influence on the composition and structure of vegetation (Bonham and Lerwick 1976; Cincotta et al. 1989; Hansen and Gold 1977). Prairie dogs are considered by many to be a "keystone" species because so many other wildlife species are associated with their colonies (Kotliar et al. 1999; Stapp 1998). Only black-footed ferrets (*Mustela nigripes*), mountain plovers (*Charadrius montanus*), and burrowing owls (*Athene cucularia*), however, appear to be obligate species. Prairie dog populations have endured many decades of persecution for real and perceived conflicts with humans (Barko 1997; Roemer and Forrest 1996). Conflicts include forage competition with livestock, damage from burrowing activities, crop damage, disease hazards, and encroachment into areas of human settlement (Hygnstrom and Virchow 1994). These rodents have a moderate-to-high reproductive potential and good dispersal capabilities. Colonies can expand relatively rapidly and use many different vegetation types, including non-native species (Crosby and Graham 1986; Fagerstone and Ramey 1996; Knowles 1985; Reading et al. 1989). The ecological role and management of prairie dogs has been the subject of numerous special conferences and publications. The history, biology, ecology, and status of prairie dogs has been reviewed by Clippinger (1989), Fagerstone and Ramey (1996), Hoogland (1996), Mulhern and Knowles (1996), and U.S. Fish and Wildlife Service (2000).

Prairie dogs pose severe challenges to resource managers in highly disturbed settings such as urban-

suburban areas where conflicting interests persist regarding the presence of prairie dogs. There is a need to better monitor colonies and the changes that they undergo as well as a need to plan for future events. Municipalities have designed management plans to reduce conflicts by using public input, zoned management areas, and a variety of management techniques and tools. Individual populations must often be managed very differently. In this paper, we review the general structure and elements of the urban-suburban prairie dog plans for two Colorado cities, Boulder and Fort Collins. We conclude with a consideration of some of the uncertainties and challenges that resource managers face.

DEVELOPMENT OF AN OVERALL MANAGEMENT STRATEGY

The prairie dog management plans of two Colorado cities, Boulder (City of Boulder 1996) and Fort Collins (City of Fort Collins 1998), with sizeable prairie dog populations, illustrate an integrated approach to managing those populations and reducing conflicts. Each city established an advisory committee to address and resolve the management issues. The general structure and some key elements of the approach are presented in Table 1. Many elements and techniques can be used in an integrated pest management (IPM) strategy and, usually, the application of multiple techniques is warranted (Giles 1980). Habitat management, population management, and people management are all aspects of IPM that are employed in the management of urban-suburban prairie dog populations (Table 1). It should be noted, however, that the possible techniques can vary greatly in their effectiveness, cost, and public acceptability. Resource managers are often limited in their management options by budgetary, legal, and sociopolitical constraints.

Public Involvement

Resource managers have become acutely aware of the need for public involvement in planning and decision-making processes. Public input can be acquired through

Table 1. Development of a management strategy for urban-suburban prairie dogs.

I. Advisory Committee Tasks	II. Management Techniques to Consider
A. Establish with appropriate, diversified representation	A. Habitat management
B. Review background information, hold discussions	1. Land acquisition and protection
C. Survey public, agencies	2. Landscape/site management
D. Develop policy statements, guidelines	3. Barriers
E. Develop management plan after discussions about techniques, suitability and benefit:cost assessment	4. Natural Control
F. Public and agency review, revisions	B. Population management
G. Implementation	1. Population/colony monitoring
H. Monitoring, feedback, modification	2. Relocation
	3. Lethal control
	4. Disease control
	C. People management
	1. Public attitudes, involvement
	2. Landowner cooperation
	3. Public education

various means, including scoping meetings and surveys. Unfortunately, views can vary immensely and people tend to hold strong views on wildlife. For example, in a survey (Gershman and Sanders 1995) of Boulder Valley residents sponsored by the City of Boulder, 76% of the respondents stated that they did not want prairie dogs nearby, while only 17% said they would not mind having prairie dogs nearby (but only under certain conditions); 6% of respondents would tolerate prairie dogs nearby, while only 1% of respondents said that the presence of prairie dogs should be encouraged. In a more recent survey, Zinn and Andelt (1999) found that 70% of Fort Collins' residents with land adjacent to prairie dogs had problems with the animals. These same residents were more knowledgeable about prairie dogs, more likely to support the use of poisoning over relocation, and more supportive of management that involved combining preservation and control than were residents not living near prairie dog colonies. Clearly, residents can espouse a wide spectrum of views and many tend to hold their views strongly.

Habitat Management

An additional difficulty of managing urban-suburban prairie dogs is landownership complexities: multiple jurisdictions and large numbers of landowners that border public land with prairie dogs and the range in sizes of land holdings. In planning for prairie dogs on open space lands, the city may conduct a suitability analysis to

allocate some of their open space properties into a natural area system. A portion of the natural area system will be appropriate for prairie dogs and a portion will not, based on considerations of ecological and cultural factors. This results in a "zoned" management approach. Populations often need to be managed differently, depending upon the specific setting and overall goals of the open space/natural area plan. Each area can be placed in one of four categories: 1) prairie dogs present and wanted; 2) prairie dogs present, but not wanted; 3) prairie dogs not present, but wanted; and 4) prairie dogs not present and not wanted.

Land acquisition and protection are important starting points for a natural area program. Once the areas are secured and specific objectives are in place as part of the planning process, landscape/site management can begin. With real estate prices as high as \$10,000 per acre and rapid residential and commercial development underway, city resource managers are challenged in their efforts to maintain existing, or acquire new, open space lands.

Prairie dogs are quite vigilant and spend considerable time watching for predators. They are accustomed to having an expansive view and will clip vegetation to help maintain that view. Consequently, researchers have studied barriers, both artificial and vegetative, as a means of slowing or preventing colony expansion. Although these barriers are not yet proven to be highly effective (Franklin and Garrett 1989; Hygnstrom 1995), cities are currently using barriers of various types. Plastic barriers

two to three feet high are used, often while an attempt is made to establish permanent, tall and dense vegetative barriers behind them.

Many agencies are working under increasing fiscal constraints. Increasing costs and a lower availability of public funds could make it difficult to implement a well-planned and effective management plan. Barriers are a popular management tool, yet they can cost upwards of \$20,000 per mile, not including maintenance costs. Plastic barriers especially require considerable upkeep because of animal damage, wind damage, and vandalism. In addition, the public may be concerned with the "naturalness" of the appearance of artificial barriers.

Vegetative barriers are an appealing alternative to plastic barriers, but are difficult to establish, especially on what are often harsh sites. Site preparation, watering (drip irrigation), and protection from herbivory and the antler rubbing of suburban deer are usually required. These difficulties may be exacerbated when only native plants can be used because of natural area regulations. Many species of nonnative plants would be easier to establish as is commonly done on mining reclamation sites. Where non-native plants have become well established at a site, however, it may be necessary to remove prairie dogs for a period of years so that native prairie plant species can be reestablished. Prairie dogs can be brought back in at a later date.

Population Management

Live-trapping and relocation are important tools to achieve the desired outcome for the four zone management categories. Prairie dogs are removed from areas in which they are not wanted, or that are slated for development, and are relocated to areas where they are desired. The latter areas may be unstocked or understocked. At times, there may be difficulty in finding suitable sites to put "excess" prairie dogs. Additionally, jurisdictions respond differently to prairie dog relocation. For example, the City of Boulder has an ordinance requiring developers to refrain from poisoning prairie dogs before proceeding with development until a good faith effort to relocate them has been made and the City has been given 15 months' notice of the proposed poison application. On the other hand, the state of Colorado recently passed legislation making it illegal to relocate prairie dogs to another county without the approval of that county's commission. Additionally, prairie dog relocation is not always successful (Robinette et al. 1995). Before relocation, the site can be "prepped" by mowing vegetation if it is very tall, using an auger to "start" burrow systems, dusting burrows with an insecticide, and, in some cases, controlling predators. Additionally, relocation efforts should focus on adequate numbers of healthy animals (Coffeen and Pederson 1993; Robinette et al. 1995).

Prairie dogs, like many species of rodents, have a moderate-to-high reproductive potential and colonies can expand relatively rapidly. In the urban-suburban setting, this means that they often will begin occupying backyards or other private lands where they are not welcome. Consequently, the city must establish and maintain a "buffer" zone around the periphery of all its properties containing prairie dogs. Typically, this involves removal

of prairie dogs and their mounds in the buffer zone and the establishment of some form of barrier to colony expansion. Removal consists of relocation, if suitable sites are available, or fumigation (Hygnstrom and Virchow 1994). The latter, or any lethal approach, is usually very controversial in the urban-suburban setting. Fumigation is often preferred to the use of surface rodenticide baits to reduce hazards to children, pets, livestock, and non-target animals, although impacts to non-target species are usually short-term (Apa et al. 1991; Deisch et al. 1990). Burrows in the buffer zone are sometimes destroyed in an effort to slow the rapid reinvasion so common with rodent populations (Gilson and Salmon 1990).

Lethal techniques (kill-traps or rodenticides) are regulated at many governmental levels, and their use is restricted or prohibited in many settings. Because prairie dog colonies tend to expand with time and because relocation sites are not always available, the killing of some prairie dogs will occasionally be necessary to reduce or prevent conflicts with other resource needs or desired outcomes. Hygnstrom and Virchow (1994) discussed the use of traps, rodenticides, and other methods for prairie dog control. Recreational shooting is allowed in some settings and can help reduce the expansion of colonies (Vosburgh and Irby 1998), but is rarely an option in the suburban setting.

An additional aid to population control is to encourage the use of these areas by predators. Raptor use is increased by the placement of artificial perch poles where large trees are absent. The Colorado Front Range has experienced substantial increases in raptor use with much of it centered on occupied prairie dog colonies (Gietzen et al. 1997; Mancini 1992). We have documented use of the artificial perch poles by numerous species of raptors. Hay bales or native shrub plantings can be used to provide cover for terrestrial predators. The use of hay bales, however, may introduce weed seeds. The suburban properties are, in some cases, used by coyotes (*Canis latrans*), red foxes (*Vulpes vulpes*), weasels (*Mustela* spp.), and badgers (*Taxidea taxus*) as well as pet or feral dogs and cats.

In many areas, prairie dog colonies are susceptible to plague (*Yersinia pestis*) outbreaks (Cully 1989; Barnes 1993). Many species of mammals, including humans, are susceptible to this endemic disease. The endemic nature of plague means that many prairie dog colonies are transient in nature. An area may have to be restocked with animals every few years. After a plague outbreak in a prairie dog colony, raptor use declines dramatically (Cully 1991; Jones et al. 1999). Additionally, the disease poses a health hazard to humans, pets, and livestock. For example, in Colorado there are several human cases of plague reported each year. It is important for a city to have a public education program about plague and contingency plans for outbreaks. Often an outbreak in a colony can be prevented, stopped, or at least slowed by the application of an insecticide powder to each burrow opening.

Contingency plans should allow for unpredictable events, such as changes in public attitudes and disease (plague) outbreaks. An oral bait containing a plague vaccine may be tested soon in South Dakota (Robert

McLean, pers. comm.). The availability of this vaccine would help reduce the uncertainty of outbreaks and could change public attitudes about having prairie dogs near their homes.

People Management

Any prairie dog management plan requires considerable people management if it is to stand a chance of success. We have already mentioned public surveys, public meetings, and public review as important inputs. A careful assessment of the benefits and costs of the agency's activities is important to show sound fiscal use of public funds and to maintain public support for the management program. Costs can be kept lower by the use of volunteers or low-cost personnel. Additionally, landowner cooperation is important to assure easy and ready access to public lands via private property for management activities. With a good public relations program, landowners may even get enthusiastic about the city's efforts and volunteer to help or, importantly, provide water for vegetative barrier establishment. A final point about people management is public education. Prairie dog colonies provide an excellent opportunity for educating the general public about aspects of prairie ecosystems, predator-prey interactions, and human-wildlife interactions, among other topics. This effort can, and should, use a variety of media and outlets (e.g., kiosks, brochures, naturalist talks, and television and radio segments).

FUTURE MANAGEMENT AND UNCERTAINTIES

While the prairie dog management strategy described above may appear reasonably straightforward, there are many difficulties to overcome to make it successful and many areas in need of improvement (Table 2). Additionally, many unforeseen events can occur, such as the passage of new legislation or regulations. Public attitudes can change over time as well. In some cases, research can provide solutions or improvements. In other cases, difficult decisions must be made by legislators, commissioners, and managers and they must stand by those decisions and seek public acceptance of the necessary ordinances, regulations, and laws.

Future options for the management of prairie dogs in disturbed settings may be more restricted and more complicated by reintroductions of the endangered black-footed ferret (*Mustela nigripes*) and by the possible federal listing of the black-tailed prairie dog under the Endangered Species Act. Ferret reintroductions are scheduled to begin soon in Colorado, but will not likely involve urban-suburban settings. The National Wildlife Federation petitioned the U.S. Fish and Wildlife Service recently to list the black-tailed prairie dog as a threatened species (Graber and France 1999). The U.S. Fish and Wildlife Service deferred a decision on listing the black-tailed prairie dog, preferring to allow states and federal agencies to develop cooperative management programs for the species' protection and range expansion (U.S. Fish and Wildlife Service 2000). The U.S. Fish and Wildlife Service will monitor progress on an annual basis. A cooperative conservation assessment and strategy is being worked on by a multi-state (11 states) and federal agency (four agencies) task force (VanPelt 1999). Montana has also established a conservation plan (Montana Prairie Dog Working Group 1999). These plans, in general, call for development of: 1) working groups to develop, coordinate, and implement the plan; 2) a legal status consistent with management needs; 3) prairie dog abundance standards and monitoring for each region within original prairie dog range; 4) management incentives and actions for prairie dog management and achieving social acceptance; 5) a prairie ecosystem education program; and 6) a research strategy to form solutions to biological and social problems.

Miller et al. (1993) summarized a workshop on prairie dog complexes for the reintroduction of black-footed ferrets by identifying many management and research questions, including the management of disease and habitats, a better understanding of population dynamics, and better public relations programs. Research underway in many of those areas may provide answers and additional methods for prairie dog management. Methods are being tested to better monitor colonies and population densities. Research findings may allow us to better predict colony viability and improve relocation success. Genetic and DNA analyses are providing new

Table 2. Future uncertainties and challenges of urban-suburban prairie dog management.

Public Attitudes	Research and Development
Legal Status	Colony viability
Prairie dog listing	Plague vaccine
Ferret reintroduction	Fertility control
Voter initiatives	Genetics/DNA analyses
Plague Outbreaks	Barriers, traps, repellents
Costs, Funding	Monitoring methods

insights into population fragmentation and viability and into dispersal capabilities. Other studies may identify new or better repellents, trapping devices, or barriers. An assessment of the effectiveness of combinations of methods is also needed. Finally, research is underway to identify effective and practical fertility control compounds for prairie dog population management.

LITERATURE CITED

- APA, A., D. URESK, and R. LINDER. 1991. Impacts of black-tailed prairie dog rodenticides on nontarget passerines. *Great Basin Naturalist* 51:301-309.
- BARKO, V. 1997. History of policies concerning the black-tailed prairie dog: a review. *Proc. Okla. Acad. Sci.* 77:27-33.
- BARNES, A. 1993. A review of plague and its relevance to prairie dog populations and the black-footed ferret. Pages 28-37 in *Management of prairie dog complexes for the reintroduction of the black-footed ferret*, J. Oldemeyer, D. Biggins, and B. Miller, eds. Biological Report 13. U.S. Fish and Wildlife Service, Washington, D.C. 96 pp.
- BONHAM, C., and A. LERWICK. 1976. Vegetation changes induced by prairie dogs on shortgrass prairie. *J. Range Manage.* 29:221-225.
- CINCOTTA, R., D. URESK, and R. HANSEN. 1989. Plant compositional change in a colony of black-tailed prairie dogs in South Dakota. *Proc. Great Plains Wildlife Damage Control Workshop* 9:171-177.
- CITY OF BOULDER. 1996. Black-tailed prairie dog habitat conservation plan. City of Boulder Open Space/Real Estate Department, Boulder, Colorado. 75 pp.
- CITY OF FORT COLLINS. 1998. Prairie dog policy for city natural areas. Department of Natural Resources, Fort Collins, Colorado. 17 pp.
- CLIPPINGER, N. 1989. Habitat suitability index models: black-tailed prairie dog. Biological Report 82(10.156). U.S. Fish and Wildlife Service, Washington, D.C. 21 pp.
- COFFEEN, M., and J. PEDERSON. 1993. Techniques for the transplant of Utah prairie dogs. Pages 60-66 in *Management of prairie dog complexes for the reintroduction of the black-footed ferret*, J. Oldemeyer, D. Biggins, and B. Miller, eds. Biological Report 13. U.S. Fish and Wildlife Service, Washington, D.C. 96 pp.
- CROSBY, L., and R. GRAHAM. 1986. Population dynamics and expansion rates of black-tailed prairie dogs. *Proc. Vertebr. Pest Conf.* 12:112-115.
- CULLY, J. 1989. Plague in prairie dog ecosystems: importance for black-footed ferret management. Pages 47-55 in *The prairie dog ecosystem: managing for biological diversity*, T. Clark, D. Hinckley, and T. Rich, eds. Montana BLM Wildlife Technical Bulletin No. 2. U.S. Bureau of Land Management, Billings, Montana. 55 pp.
- CULLY, J. 1991. Response of raptors to reduction of a Gunnison's prairie dog population by plague. *Amer. Midland Naturalist* 125:140-149.
- DEISCH, M., D. URESK, and R. LINDER. 1990. Effects of prairie dog rodenticides on deer mice in western South Dakota. *Great Basin Naturalist* 50:347-353.
- FAGERSTONE, K., and C. RAMEY. 1996. Rodents and lagomorphs. Pages 83-132 in *Rangeland Wildlife*, P. Krausman, ed. The Society for Range Management, Denver, Colorado. 440 pp.
- FRANKLIN, W., and M. GARRETT. 1989. Nonlethal control of prairie dog colony expansion with visual barriers. *Wildl. Soc. Bull.* 17:426-430.
- GERSHMAN, M., and M. SANDERS. 1995. Boulder Valley comprehensive planning area prairie dog attitudes citizen survey. Report for City of Boulder Open Space Department, Boulder, Colorado. 11 pp.
- GIETZEN, R., S. JONES, and R. MCKEE. 1997. Hawks, eagles, and prairie dogs: population trends of wintering raptors in Boulder County, 1983-1996. *J. Colorado Field Ornithologists* 31:75-86.
- GILES, R. 1980. Wildlife and integrated pest management. *Environmental Manage.* 4:373-374.
- GILSON, A., and T. SALMON. 1990. Ground squirrel burrow destruction: control implications. *Proc. Vertebr. Pest Conf.* 14:97-98.
- GRABER, K., and T. FRANCE. 1999. Petition for listing the black-tailed prairie dog as threatened throughout its range. Submission by the National Wildlife Federation to the U.S. Fish and Wildlife Service. 66 pp.
- HANSEN, R., and I. GOLD. 1977. Black-tailed prairie dogs, desert cottontails, and cattle trophic relations on shortgrass range. *J. Range Manage.* 30:210-214.
- HOOGLAND, J. 1996. *Cynomys ludovicianus*. *Mammalian Species* 535:1-10.
- HYGNSTROM, S. 1995. Plastic visual barriers were ineffective at reducing recolonization rates of prairie dogs. *Proc. Great Plains Wildlife Damage Control Workshop* 12:74-76.
- HYGNSTROM, S., and D. VIRCHOW. 1994. Prairie dogs. Pages B-85 - B-92 in *Prevention and control of wildlife damage*, S. Hygnstrom, R. Timm, and G. Larson, eds. Cooperative Extension Service, University of Nebraska, Lincoln.
- JONES, S., H. DEVAUL, R. GIETZEN, and R. MCKEE. 1999. Hawks, prairie dogs, and subdivisions: wintering raptor population trends in Boulder County. *J. Colorado Field Ornithologists* 33:167.
- KNOWLES, C. 1985. Observations on prairie dog dispersal in Montana. *Prairie Naturalist* 17:33-40.
- KOTLIAR, N., B. BAKER, A. WHICKER, and G. PLUMB. 1999. A critical review of assumptions about the prairie dog as a keystone species. *Environmental Manage.* 24:177-192.
- MANCI, K. 1992. Winter raptor use of urban prairie dog colonies. *J. Colorado Field Ornithologists* 26:132.
- MILLER, B., D. BIGGINS, and R. CRETE. 1993. Workshop summary. Pages 89-96 in *Management of prairie dog complexes for the reintroduction of the black-footed ferret*, J. Oldemeyer, D. Biggins, and B. Miller, eds. Biological Report 13. U.S. Fish and Wildlife Service, Washington, D.C. 96 pp.

- MONTANA PRAIRIE DOG WORKING GROUP. 1999. Draft conservation plan for black-tailed and white-tailed prairie dogs in Montana. Unpublished Draft Report. Montana Department of Fish, Wildlife, and Parks, Missoula, Montana. 69 pp.
- MULHERN, D., and C. KNOWLES. 1996. Black-tailed prairie dog status and future conservation planning. Pages 19-29 in *Conserving biodiversity on native rangelands*, D. Uresk, G. Schenbeck, and J. O'Rourke, eds. USDA Forest Service General Technical Report RM-GTR-298. Fort Collins, Colorado. 38 pp.
- READING, R., S. BEISSINGER, J. GRENSTEN, and T. CLARK. 1989. Attributes of black-tailed prairie dog colonies in northcentral Montana, with management recommendations for the conservation of biodiversity. Pages 13-27 in *The prairie dog ecosystem: managing for biological diversity*, T. Clark, D. Hinckley, and T. Rich, eds. Montana BLM Wildlife Technical Bulletin No. 2. U.S. Bureau of Land Management, Billings, Montana. 55 pp.
- ROBINETTE, K., W. ANDEL, and K. BURNHAM. 1995. Effect of group size on survival of relocated prairie dogs. *J. Wildl. Manage.* 59:867-874.
- ROEMER, D., and S. FORREST. 1996. Prairie dog poisoning in the northern Great Plains: an analysis of programs and policies. *Environmental Manage.* 20:349-359.
- SIEG, C. 1996. The role of fire in managing for biological diversity on native rangelands of the Great Plains. Pages 31-38 in *Conserving biodiversity on native rangelands*, D. Uresk, G. Schenbeck, and J. O'Rourke, eds. USDA Forest Service General Technical Report RM-GTR-298. Fort Collins, Colorado. 38 pp.
- STAPP, P. 1998. A reevaluation of the role of prairie dogs in Great Plains grasslands. *Conserv. Biology* 12:1253-1259.
- U.S. FISH AND WILDLIFE SERVICE. 2000. Endangered and threatened wildlife and plants: 12-month finding for a petition to list the black-tailed prairie dog as threatened. *Fed. Register* 65(24):5476-5488.
- VANPELT, W. (Ed.). 1999. The black-tailed prairie dog conservation assessment and strategy. Final Draft Report. Arizona Game and Fish Department, Phoenix, Arizona. 55 pp.
- VOSBURGH, T., and L. IRBY. 1998. Effects of recreational shooting on prairie dog colonies. *J. Wildl. Manage.* 62:363-372.
- WELTZIN, J., S. ARCHER, and R. HEITSCHMIDT. 1997. Small mammal regulation of vegetation structure in a temperate savanna. *Ecology* 78:751-763.
- WHICKER, A., and J. DETLING. 1988. Ecological consequences of prairie dog disturbances. *BioScience* 38:778-785.
- ZINN, H., and W. ANDEL. 1999. Attitudes of Fort Collins, Colorado, residents toward prairie dogs. *Wildl. Soc. Bull.* 27:1098-1106.