Managing Conflict and Biotic Diversity in the Prairie Dog Ecosystem

by

Brian Miller and Gerardo Ceballos

The worldwide destruction of habitat and decline in biodiversity have been the focus of numerous publications in the last fifteen years (Myers 1979, Wilcox and Murphy 1985, Wilson 1988). Environmental degradation in tropical regions has been especially well documented. Yet, the problems of habitat degradation and loss of biodiversity are not confined to the tropics, as the destruction of the North American short and mixed-grass prairies graphically illustrates. This highly specialized ecosystem, which once covered nearly 20 percent of North America, has undergone a decline for several reasons, including the following: agricultural manipulation, introduction of exotic species, water management, and prairie dog (*Cynomys spp.*) poisoning campaigns. In this paper, the origin of these poisoning programs and their ecological and fiscal consequences will be discussed, and an integrated and ecologically sound approach to traditional conservation and conflict management efforts in the prairie dog ecosystem will be proposed.

Poisoning Programs

At the beginning of this century, colonies of five species of prairie dogs (*Cynomys leucurus, C. ludovicianus, C. gunnisoni, C, mexicanus*, and *C. parvidens*) covered over 40,000,000 hectares of native short and mixed grass prairies across the Great Plains of southern Canada, the United States, and northern Mexico. By 1960, this area had been reduced by 98 percent to approximately 600,000 hectares (Marsh 1984). State and federally sponsored prairie dog poisoning programs in the United States, the heart of the prairie dog's range, were largely responsible for this reduction of grassland habitat. These programs were intended to benefit the livestock industry.

Prairie dog poisoning occurred as early as the late 1800s, but was conducted in a haphazard manner. Pressure to eradicate prairie dogs intensified after Merriam (1902) estimated that these animals reduced range productivity by 50 to 75 percent (an overestimation by an order of magnitude). In 1915, the federal government began appropriating money to the Biological Survey for the purpose of poisoning prairie dogs (Bishop and Culbertson 1976). By 1929, these poisoning activities were substantial enough to merit the formation of a new division – the Predatory Animal and Rodent Control (PARC) division. The Animal Damage Control Act of 1931 provided statutory authority to the poisoning of prairie dogs and sanctioned the partnership between public and private interests in these poisoning efforts (Bean 1983). This act remains the primary statute for animal damage control. In 1939, the PARC division was transferred to the newly created U.S. Fish and Wildlife Service (FWS) (DiSilvestro 1985); in 1986, animal control efforts were transferred to the Department of Agriculture.

Current Poisoning Efforts

Millions of acres of grassland in North America have been poisoned as a result of these programs (Bell 1921, Day and Nelson 1929, Anderson et al. 1986, and Dunlap 1988), and despite studies indicating minimal resource competition between prairie dogs and livestock and economic analyses demonstrating that these programs operate at a net financial loss (Collins et al. 1984), the federally sponsored eradication of prairie dogs has continued to this day. From 1980 to 1984, the U.S. government spent $6,200,000 US to poison 185,600 hectares of prairie dog habitat in South Dakota. In 1986 and 1987, a poisoning program eliminated the largest black-tailed prairie dog (*Cynomys ludovicianus*) complex (approximately 110,000 hectares) in North America (Tschetter 1988). Recently, large areas of northeastern Colorado were officially approved for poisoning (U.S. Fish and Wildlife Service 1991).

Only a few small, isolated prairie dog colonies remain as a result of these poisoning programs. These highly fragmented colonies are susceptible to extirpation by disease, especially sylvatic plague (*Yersinia pestis*), demographic events, genetic problems, and natural catastrophes. In addition, habitat alteration between colonies and loss of sources of immigration have decreased possibilities of recolonization or genetic exchange (Wilcox and Murphy 1985). Because of these factors, the risk of extinction from habitat disruption is not linearly proportional to the reduction of habitat, but may in fact increase disproportionately (Wilcox and Murphy 1985, Wilcove et al. 1986).

Effects of Prairie Dog Declines on Other Species

Prairie dogs have been determined to be ecosystem regulators that influence soil chemistry, soil structure, primary productivity, species composition, and species diversity (Sieg 1988, Detling and Whicker 1988, Reading et al. 1989). Compared to surrounding areas, prairie dog colonies support higher numbers of arthropods, small mammals, and terrestrial predators, and a higher avian species diversity and density (Hansen and Gold 1977, O'Meilia et al. 1982, Agnew et al. 1986, Kreuger 1986, Reading et al. 1989). Plant diversity also is increased in the presence of prairie dogs. Because their presence and biological activities result in the creation of food and habitat upon which many other species depend,

prairie dogs can be considered a keystone species. The loss of prairie dog populations, then, threatens biodiversity throughout the entire prairie dog ecosystem (Clark et al. 1989 Sharps and Ureak 1990).

Currently, several species that utilize prairie dog colonies are in the process of being listed under the Endangered Species Act (ESA). These species include the Mountain Plover (*Charadrius montanus*), Ferruginous Hawk (*Buteo regalis*), and swift fox (*Vulpes velox*). The Burrowing Owl (*Athene cunnicularia*), which also utilizes prairie dog colonies, is listed as rare by several states.

Prairie Dog Benefits to Ranchers

Despite reports that prairie dogs reduce range productivity, recent studies indicate that prairie dogs are actually beneficial to ranchers in a number of ways. The nutrient content and digestibility of forage is greater in the presence of prairie dogs (O'Meilia et al. 1982, Coppock et al. 1983, Krueger 1986). In fact, domestic cattle and bison prefer to graze in prairie dog towns because the grass is more succulent (Coppock et al. 1983, Wydeven and Dahlgren 1985, Krueger 1986, Knowles 1986, Detling and Whicker 1988). Additionally, perennial grasses and forbs grazed by livestock are more abundant in prairie dog colonies than in surrounding areas (Bonham and Lerwick 1976). Thus, conclusions that prairie dogs reduce the amount of forage available to livestock and result in financial losses to ranchers are simply false. OVERLOOKED

Prairie dogs benefit ranchers in other ways as well. Prairie dogs in the southwest naturally control mesquite (Scientific name?), a plant that reduces the availability of grass for livestock and makes roundups difficult (Miller 1991). Additionally, prairie dogs eat prickly pear cactus (*Opuntia polycantha*), a plant that is not eaten by cattle, but that proliferates in areas overgrazed by livestock (Summer and Linder 1978).

Conservation of Prairie Dogs

U.S. government sponsored prairie dog poisoning programs initiated in an effort to reduce conflict between livestock interests and prairie dogs have served only to destroy habitat and decrease biodiversity in the North American grasslands. As a result, managers are now spending increasing amounts of money and time trying to rescue species that depend on prairie dogs. Unfortunately, these conservation efforts have met with little success, perhaps because they have traditionally focused only on biological aspects of the biodiversity decline. This decline, however, is intricately intertwined with history, economics, politics, and social and cultural attitudes and values. In order to successfully conserve valuable resources, all of these factors must be addressed. In this article, we propose a strategy for conserving biological diversity on the North American grasslands that employs legal action, ecosystem management, sustainable use of protected prairie dog habitat, positive economic incentives, education, flexible planning, interdisciplinary advisory groups, and international cooperation (Miller et al. 1994a, 1994b).

The Law and Ecosystem Management. Legal experts and biologists have recently advocated a move from managing individual species to managing entire systems (Smith 1984, Scott et al. 1987, Rohlf 1991). Historically, protecting each species individually served an important purpose in slowing the decline toward extinction. During the early years of environmental action, a number of species were already in crisis situations and action was necessary to prevent further loss. However, acting after a full-blown crisis exists diminishes opportunities for success, increases costs, and escalates conflict between conservation and local interests (Wemmer and Derrickson 1987).

Handling species individually is also a slow process. Approximately 650 species currently are listed as threatened or endangered under the ESA; another 600 U.S. candidate species are being reviewed for possible inclusion on the list (U.S. General Accounting Office 1992). Because the FWS has only placed an average of 44 species a year on the

A forum for information exchange on endangered species issues
Month 1993 Vol. X No. XX

Judy Tasse .....Editor
Otto Gonzalez .....Associate Editor
Terry Root .....Faculty Advisor

Instructions for Authors:
The *Endangered Species UPDATE* welcomes articles related to species protection in a wide range of areas including but not limited to: research and management activities and policy analyses for endangered species, theoretical approaches to species conservation, and habitat protection. Book reviews, editorial comments, and announcements of current events and publications are also welcome.

Readers include a broad range of professionals in both scientific and policy fields. Articles should be written in an easily understandable style for a knowledgeable audience. For further information, contact the editor.

Subscription Information:
The *Endangered Species UPDATE* is published approximately ten times per year by the School of Natural Resources and Environment at The University of Michigan. Annual rates are $23 for regular subscriptions, and $18 for students and senior citizens (add $5 for postage outside the US). Students please enclose advisor's signature on university letterhead. Send check or money order (payable to The University of Michigan) to:

Endangered Species UPDATE
School of Natural Resources
and Environment
The University of Michigan
Ann Arbor, MI 48109-1115
(313) 763-3243

Cover: Photo description (Genus species).
Photo by

The views expressed in the *Endangered Species UPDATE* are those of the author and may not necessarily reflect those of the US Fish and Wildlife Service or The University of Michigan.

Production of this issue was made possible in part by support from the Chevron Corporation and the International Association of Fish and Wildlife Agencies.

Recent studies have reported

list, it could take years to individually address these candidate species even if no other species are added (US GAO 1992). Additionally, according to available data, between 3000 and 5000 other species in the U.S. may be threatened (US GAO 1992). Managing entire systems would handle plants and animals in groups and speed the process of protection. However, such an assertion necessitates a caveat. Ecosystem management is a current "buzzword," but what will be managed, by whom, and how is rarely defined. This ambiguity could just as easily be used to weaken single species protection before any other form of protection is in place.

The prairie dog, as a keystone species, provides an excellent opportunity to forge a transition from traditional single species management to management of a system. The ESA can play an enormous role in broad scale preservation of biodiversity by offering some level of protection to keystone species, and consequently, to species dependent upon the keystone animal (Rohlf 1991).

Protecting a threatened keystone species would provide educational, biological, and fiscal benefits. By focusing educational efforts on keystone species, managers would have a means of teaching the public about the value of ecosystem conservation and the links between animals and their habitat. The biological integrity of the ecosystem would quickly benefit from the protection afforded the keystone species. Also, the federal government would be spared the financial burden of maintaining an expensive support system for other species that would become imperiled if the keystone species continued to decline.

Protection of a keystone species, no matter how politically controversial the situation, would be far more cost-effective than trying to protect each individual species that depends on it. For example, the government financially subsidizes both the poisoning of prairie dogs and the preservation of species dependent upon the prairie dog for survival. As a result of expenditures in the former category, expenditures in the latter category will continue to rise as more species reach threatened status.

Habitat Protection and Sustainable Use. Conservation of most species depends on more than legal action. Habitat conservation and the sustainable use of that habitat are also necessary components of any species conservation effort. The value of initiating sustainable usable areas on the grasslands of Canada, the U.S., and Mexico cannot be overemphasized. Currently, plans exist to establish a protected area in northern Chihuahua, Mexico. This area would include a 55,000 hectare black-tailed prairie dog complex, the largest colony remaining in North America (Ceballos et al. 1993).

Habitat conservation and protection does not preclude human land uses. Arid grassland regions can be sustainably used for economic benefit by harnessing the potential as it exists rather than trying to impose exotic agricultural manifestations or over-exploitive practices (Cloudsley-Thompson 1988). With an integrated plan, the economic needs of the local population and preservation of biodiversity could both be potentially enhanced.

Establishing sustainably usable areas of protected habitat on the grasslands could prevent further decline of the prairie dog ecosystem as well as integrate ecologically-sound agricultural opportunities with conservation goals. This proactive integration could address both long-term resource preservation as well as the present economic needs of the local human population, and could be a large step in the elimination of conflicts that arise when legal protection is initiated after a species is on the verge of extinction (e.g., the Northern Spotted Owl, *Strix occidentalis caurina*).

Positive Economic Incentives and Education. Protected areas alone are not sufficient to preserve most declining species. Reduced habitat and effects of fragmentation often do not permit the existnce of viable populations of large or highly specialized species (Ceballos and Navarro 1992). An alternative to the conflicting directives of federally sponsored prairie dog poisoning policies and endangered species management has been proposed that is designed to restore ecological integrity without harming local livestock interests (Miller et al. 1990). This proposal basically calls for the conversion of U.S. federal funds allocated to the poisoning of prairie dogs into a positive incentive for ranchers who manage for both wildlife and livestock. If a provision for this incentive were written into the ESA, managers could supply a level of "user-friendly" legal protection to the prairie dog and its ecosystem.

Education is another important component of conservation plans. However, because the attitudes of the western agricultural community are entrenched in the issue of prairie dogs, a positive incentive will be necessary before educational efforts can be successful. In Montana, Reading (1993) demonstrated that knowledge was only one part of attitude, and that different levels of knowledge alone did not change negative perceptions of black-footed ferrets and prairie dogs. Similar results were obtained from other wildlife studies (Arthur et al. 1977, Kellert 1990).

The traditional agricultural community holds strong beliefs about competition between prairie dogs and livestock, but another important factor influences those values — federally sponsored poisoning programs. Education efforts will not be able to address misconceptions about the prairie dog ecosystem while the U.S. government continues to subsidize prairie dog poisoning. By providing poison to ranchers, the U.S. government is reinforcing misconceptions about the prairie dog ecosystem. The continuation of federally subsidized poisoning programs will undermine all other efforts to conserve biological diversity on the western grasslands.

Planning, Interdisciplinary Teams, and International Cooperation. Just as political, social, economic, legal, educational, and biological features are important to conservation efforts, so are the organizational aspects of species management bodies. Addressing all variables in conservation requires an efficient, flexible, and effective planning process. Switching the emphasis from individual species to the ecological system allows us to rethink traditional

procedures.

We propose establishing advisory teams that integrate the best expertise into the conservation planning process. Representation from the biological disciplines can contribute technical skills to the team, but equally importantly, social scientists can assess attitudes, economists can predict economic benefits and costs, and education/public relations experts can present the program to the public and raise necessary funds. Responsibilities should be dispersed from a national level with contractual accountability for actions undertaken by implementing organizations (Miller et al. in press). Although decisions may be made across a broad geographic area, local goals and circumstances differ. Formation of policies should not exclude local concerns, but rather integrate them into a national and international context.

Because the prairie dog ecosystem spans several international borders, international cooperation will be necessary in conservation planning processes. Indeed, many sensitive species are presently managed separately in each country, and they all could benefit from the cooperative bonds formed from this single venture. Many people recognize this fact, and the opportunity has never been better to jointly promote preservation of hemispheric biodiversity.

Conclusion

Conservation is a multi-faceted discipline that extends far beyond the mere technical aspects of biology. Without addressing social, attitudinal, political, and economic issues surrounding destruction of the prairie dog, we will only continue to degrade the western grasslands, reduce biotic diversity, and impose unnecessary expenses on government budgets. Protection of the prairie dog, a keystone species, will provide a gradual and defined transition from single species management to management of all animals and plants dependent upon the prairie dog ecosystem.

However, management of this system will fail unless the conflict between prairie dogs and livestock interests is adequately addressed. As long as the government subsidizes prairie dog poisoning programs, any attempts at education will fail, negative attitudes toward the prairie dog ecosystem will remain unchanged, and the conflict between ranchers and prairie dogs will continue.

Literature Cited

Agnew, W., D.W. Uresk, and R.M. Hansen. 1986. Flora and fauna associated with prairie dog colonies and adjacent ungrazed mixed grass prairie in western South Dakota. Journal of Range Management 39:135-139.

Anderson, E., S.C. Forrest, T.W. Clark, and L. Richardson. 1986. Palio-biology, biogeography, and systematics of the black-footed ferret, Mustela nigripes (Audubon and Bachman), 1851. Great Basin Naturalist Memoirs 8:11-62.

Arthur, L.M., R.L. Gunn, E.H. Carpenter, and W.W. Shaw. 1977. 1977. Predator control: the public view. Transactions of the North American Wildlife and Natural Resources Conference 42:137-145.

Bell, W.R. 1921. Death to the rodents. USDA Yearbook 1920:421-438.

Bonham, C.D. and A. Lerwick. 1976. Vegetation changes induced by prairie dogs on shortgrass range. Journal of Range Management 29:221-225.

Ceballos, G. and D. Navarro. 1992. Diversity and conservation of Mexican mammals. Pages 167-198 in M.A. Marcs and D.J. Schmidly, editors. Topics in Latin American Mammals: Ecology, Evolution, and Education. University of Oklahoma Press, Norman, OK.

Ceballos, G., E. Mellink, and L.R. Hanebury. 1993. Distribution and conservation status of prairie dogs (Cynomys mexicanus and Cynomys ludovicianus) in Mexico. Biological Conservation 63:105-112.

Clark, T.W., D. Hinckley, and T. Rich (editors). 1989. The prairie dog ecosystem: Managing for biodiversity. Montana Bureau of Land Management Wildlife Technical Bulletin 2. Billings, MT.

Cloudsley-Thompson, J.L. 1988. Desertification or sustainable yields from arid environments. Environmental Conservation 15:197-204.

Collins, A.R., J.P. Workman, and D.W. Uresk. 1984. An economic analysis of the black-tailed prairie dog (Cynomys ludovicianus) control. Journal of Range Management 37:358-361.

Coppock, D.L., J.K. Detling, J.E. Ellis, and M.I. Dyer. 1983. Plant herbivore interactions in a mixed grass prairie: I. Effects of black-tailed prairie dogs on intraseasonal aboveground plant biomass and nutrient dynamics and plant species diversity. Oecologia 56:1-9.

Day, A.M. and A.P. Nelson. 1929. Wildlife conservation and control in Wyoming under the leadership of the United States Biological Survey. U.S. Biological Survey, Wyoming Game and Fish Department, Wyoming Department of Agriculture. Cheyenne, WY.

Detling, J.K., and A.D. Whicker. 1988. A control of ecosystem processes by prairie dogs and other grassland herbivores. Pages 23-29 in Eighth Great Plains Wildlife Damage Control Workshop Proceedings, Rapid City, South Dakota. USDA Forest Service. Washington, D.C.

Dunlap, T.R. 1988. Saving America's Wildlife. Princeton University Press. Princeton, N.J. 222 pp.

Hansen, R.M. and I.K. Gold. 1977. Black-tailed prairie dogs, desert cottontails and cattle trophic relations on shortgrass range. Journal of Range Management 30:210-214.

Kellert, S.R. 1990. Public attitudes and beliefs about the wolf and its restoration in Michigan. Yale University School of Forestry and Environmental Studies. New Haven, CT. 105 pp.

Knowles, C. 1986. Some relationships of black-tailed prairie dogs to livestock grazing. Great Basin Naturalist 46:198-203.

Krueger, K. 1986. Feeding relationships among bison, pronghorn, and prairie dogs: an experimental analysis. Ecology 67:760-770.

Marsh, R.E. 1984. Ground squirrels, prairie dogs and marmots as pests on rangeland. Pages 195-208 in Proceedings of the conference for organization and practice of vertebrate pest control. August 30-September 3, 1982, Hampshire England. ICI Plant Protection Division. Fernhurst, England.

Merriam, C.H. 1902. The prairie dog of the Great Plains. Pages 257-270 in Yearbook of the United States Department of Agriculture 1901. U.S. Government Printing Office. Washington, D.C.

Miller, B., C. Wemmer, D. Biggins, and R. Reading. 1990. A proposal to conserve blck-footed ferrets and the prairie dog ecosystem. Environmental Management 14:763-769.

Miller, J.A. 1991. Research updates. Bioscience 41:750-753.

Myers, N. 1979. The Sinking Ark: A New Look at Disappearing Species. Pergamon Press. Oxford and New York.

O'Meilia, M.E., F.L. Knopf, and J.C. Lewis. 1982. Some consequences of competition between prairie dogs and beef cattle. Journal of Range Management 35:580-585.

Reading, R.P. 1993. Toward an endangered species reintroduction paradigm: A case study of the black-footed ferret. Ph.D. Dissertation. Yale Universtiy, New Haven, CT.

Reading, R.P., J.J. Grenston, S.R. Beissinger, and T.W. Clark. 1989. Attributes of black-tailed prairie dog colonies in north-central Montana, with management recommendations for the coonservation of biodiversity. Pages 13-28 in T.W. Clark, D. Hinckley, and T. Rich (editors). The prairie dog ecosystem: Managing for biodiversity. Montana Bureau of Land Management Wildlife Technical Bulletin 2. Billings, MT.

Rolhf, D.J. 1991. Six biological reasons why the Endangered Species Act doesn't work—and what to do about it. Conservation Biology 5:273-282.

Scott, J.M., B. Csuti, J.D. Jacobi, and J. Estes. 1987. Species Richness: a geographical approach to protecting future biodiversity. Bioscience 37: 782-788.

Sharps, J. and D. Uresk. 1990. Ecological review of black-tailed prairie dogs and associated species in western South Dakota. Great Basin