
The Prairie Dog and Biotic Diversity

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Abstract: *Since the turn of this century, prairie dog populations have declined as much as 98% throughout North America, largely as a result of prairie dog eradication programs. The prairie dog is a keystone species that plays an important role in maintaining the biotic integrity of the western grasslands that stretch from southern Canada to northern Mexico. The fragmentation of prairie dog distribution has degraded diversity on those prairies, and several species depending on prairie dogs have achieved listing status under the Endangered Species Act. We propose that managing the prairie dog would provide an effective avenue from single-species management to management of a system. Because prairie dogs have declined so profoundly, some form of legal protection will be required. In addition, protected areas can preserve habitat and integrate ecologically sound agricultural opportunities. Positive incentives for ranchers to manage in the interests of both livestock and wildlife will enhance the attitude change necessary for grassland conservation. These management options hinge critically on an end to U.S. government subsidies for prairie dog eradication programs. The subsidies are financially and ecologically unsound, and they only contribute to the prevailing misconceptions about the role of the prairie dog on the grasslands.*

El perro de las praderas y la diversidad biótica

Resumen: *Desde el comienzo de este siglo, los perros de las praderas han declinado hasta en un 98% a lo largo de América del Norte, principalmente como resultado de los programas de erradicación. El perro de las praderas es una especie clave que juega un rol importante en el mantenimiento de la integridad biótica de las praderas del oeste que se extienden desde el sur de Canadá hasta el norte de México. La fragmentación de la distribución del perro de las praderas ha degradado la diversidad de esas praderas, y varias especies que dependen de los perros de las praderas han alcanzado el estatus para ser listadas bajo el Acta de Especies en Peligro. Nosotros proponemos que el manejo del perro de las praderas sería un medio efectivo para pasar de un manejo de especies particulares al manejo de un sistema. Dado que el perro de las praderas ha declinado en forma tan profunda, se necesitará algún tipo de protección legal. En forma adicional, las áreas protegidas pueden preservar el hábitat e integrar oportunidades agrícolas buenas desde un punto de vista ecológico. Incentivos positivos para los rancheros que manejan sus campos tratando de favorecer tanto el ganado como la vida salvaje mejorarán el cambio de actitud necesario para la conservación de las praderas. Estas opciones de manejo dependen en forma crítica del fin de los subsidios del gobierno de EEUU para los programas de erradicación de los perros de las praderas. El subsidio es financiera y ecológicamente insano y sólo contribuye al mantenimiento de las ideas erróneas que prevalecen acerca del rol de los perros de las praderas en las praderas.*

Prairie Dog Distribution and Poisoning

At the beginning of this century, prairie dog (*Cynomys* spp.) colonies covered between 40 (Marsh 1984) and 100 million ha (Anderson et al. 1986) of native short- and mixed-grass prairies in western North America, but by 1960 that area had been reduced to about 600,000 ha (Marsh 1984). At the most conservative estimate, this represents a 98% decline for the five species of prairie dogs. A significant part of that reduction was the direct result of federal- and state-sponsored prairie dog control programs intended to benefit the U.S. livestock industry (Miller et al. 1990).

Merriam (1902) once estimated that prairie dogs reduced range productivity 50–75%. Subsequently, millions of acres were poisoned (Bell 1921; Day & Nelson 1929; Anderson et al. 1986; Dunlap 1988). Those programs continue today. Between 1980 and 1984, the Pine Ridge Reservation eradicated 185,600 ha of prairie dogs at a cost of \$6,200,000 U.S. (Hanson 1988; Sharps 1988). Between 1986 and 1987, South Dakota destroyed the largest remaining black-tailed prairie dog (*Cynomys ludovicianus*) complex (110,000 ha) in North America (Tschetter 1988). Recently, a large area of northeastern Colorado was approved for poisoning (U.S. Fish and Wildlife Service 1991). U.S. public lands, including several National Parks, are poisoned (Schenbeck 1986), even though less than 5% of the U.S. beef weight is produced on federally owned lands (U.S. General Accounting Office 1988). In total, the Environmental Protection Agency and the Animal Plant Health Inspection Service (the present name for the federal Animal Damage Control unit) estimated that 80,000 ha of prairie dogs are eliminated annually as a result of their permitting authority and activities (Captive Breeding Specialist Group 1992).

Eradication programs continue despite modern research showing only a 4–7% level of competition between livestock and prairie dogs; in other words, about 300 prairie dogs eat as much as one cow with a calf (Uresk & Paulson 1988). Other studies have reported no significant difference in market weight whether or not steers lived with prairie dogs (Hansen & Gold 1977; O'Meilie et al. 1982). Indeed, throughout history prairie dogs coexisted harmoniously with hundreds of millions of bison (*Bison bison*), elk (*Cervus elaphus*), and pronghorn antelope (*Antilocapra americana*); these ungulates, as well as domestic cattle, prefer to graze on prairie dog towns, where the grass is more succulent and nutritious (Coppock et al. 1983; Wydeven & Dahlgren 1985; Krueger 1986; Knowles 1986; Detling & Whicker 1988).

It is not surprising that a cost-benefit analysis indicated a net financial loss in poisoning efforts (Collins et al. 1984), and that analysis was conservative. It did not consider the long-term expenses of recovering a de-

graded ecosystem, the intangible value of biological diversity as a public benefit, or the loss of potential or actual wealth from the depletion of biotic resources.

As a result of the poisoning programs, the few remaining prairie dog colonies are smaller and more isolated. These fragmented colonies are more susceptible to extirpation, particularly by sylvatic plague (*Yersinia pestis*). Yet some individuals argue that prairie dog populations are safe because prairie dogs can still be found throughout a geographical region between Canada and Mexico. That analysis masks the severity of habitat fragmentation. Fragmented habitat jeopardizes populations by several avenues: (1) demographic units are eliminated, reduced, or subdivided, increasing the probability of extinction by other means such as disease, genetic problems, demographic events, or natural catastrophes; (2) sources of immigration are lost; and (3) habitat alteration between occupied colonies obstructs recolonization or genetic exchange (Wilcox & Murphy 1985). As a result of these factors, the risk of extinction from habitat disruption is not linearly proportional to the reduction of habitat, but in fact may increase disproportionately (Wilcox & Murphy 1985; Wilcove et al. 1986).

In some cases, reductions of one species may cause a wave of secondary extinctions that affects species diversity (Wilcox & Murphy 1985; Wilcove et al. 1986). The five species of prairie dog are all considered keystone species, and the loss of prairie dog populations is threatening vertebrate biodiversity in the prairie ecosystem (Koford 1958; Clark et al. 1989; Reading et al. 1989; Miller et al. 1990; Sharps & Uresk 1990). Compared to surrounding grasslands without prairie dogs, the prairie dog ecosystem supports higher numbers of small mammals and arthropods, more terrestrial predators, higher avian species diversity, and higher avian density (Hansen & Gold 1977; O'Meilie et al. 1982; Agnew et al. 1986; Krueger 1986; Reading et al. 1989). Approximately 170 vertebrate species rely at some level on prairie dog activity for survival (Reading 1993), and the presence of prairie dogs favors plant diversity and increases grasses and forbs grazed by livestock and big game (Bonham & Lerwick 1976). So the five species of prairie dog, through their burrowing and grazing activities, are ecosystem regulators that augment primary productivity, species densities, species diversity, soil structure, and soil chemistry (Sieg 1988; Detling & Whicker 1988; Reading et al. 1989).

Highly specialized animals are most vulnerable to the negative effects of habitat fragmentation. For example, the eradication of prairie dogs has caused the near extinction of black-footed ferrets (*Mustela nigripes*). Recently, Mountain Plovers (*Charadrius montanus*), Ferruginous Hawks (*Buteo regalis*), and swift foxes (*Vulpes velox*) have been proposed as candidate species under the U.S. Endangered Species Act, and their listing proposals cited prairie dog poisoning as a factor

in their decline. Mountain Plovers require open, short-grass nesting sites, so prairie dogs are particularly important to their nesting requirements in areas where sagebrush is present. In addition, Ferruginous Hawks and swift foxes exploit the abundant prey resources of the prairie dog colonies. Because the poisoning continues, other species that rely on prairie dogs will eventually need federal aid for survival. The term "ecological trainwreck" could soon be a reality on the western prairies.

Managing Conflict and Biodiversity on the Grasslands

Past methods of reducing conflict between livestock interests and prairie dogs have failed. As a result, the western Great Plains have lost biodiversity, and managers are spending increasing amounts of money and time to rescue species that depend on prairie dogs.

Historically, managing each threatened species individually served a useful purpose in slowing the decline toward extinction. During the early years of environmental action, there were already a number of species in a crisis situation, and single-species management was necessary to prevent further loss. Recently, however, legal experts and biologists have advocated moving from the single-species approach toward managing entire systems of species (e.g. Smith 1984; Scott et al. 1987; Rohlf 1991). We propose a solution that combines legal protection, habitat preservation, conservation incentives, and education into an integrated approach toward conservation of the prairie dog ecosystem.

(1) *Legal Intervention via the Endangered Species Act.* As a keystone species, the prairie dog provides an excellent opportunity to forge a gradual transition from historical single-species management to management of a system. It would be preferable to manage the keystone species proactively before legal intervention is necessary. However, prairie dog populations have already declined too severely to avoid legal recognition, particularly with the causes of decline still active (prairie dog poisoning programs and sylvatic plague). The Endangered Species Act can play an enormous role in broad-scale preservation of biodiversity by protecting keystone species and, therefore, all species that are in some way dependent on them (Rohlf 1991).

Protecting a threatened keystone species would provide educational, biological, and fiscal benefits. By protecting a keystone species such as the prairie dog, the public could be educated about the value of ecosystem conservation and the links between animals and their habitat. The transition from species to system would be straightforward because the keystone species controls a

system. Biologically, the ecological integrity of the western prairie grasslands would quickly benefit from the protection afforded the prairie dog. Fiscally, governments would be spared the financial burden of maintaining an expensive support system for other species that will become imperiled as the prairie dog continues to decline. The captive breeding and reintroduction program for the black-footed ferret cost \$1,524,870 U.S. in 1991 alone (U.S. Fish and Wildlife Service 1992). Because there was only one reintroduction site in 1991, that total is certain to rise as the program expands.

Protection of the keystone species, no matter how political the situation, would be far more cost-effective than trying to protect each individual species that depends upon it. This is particularly true for the prairie dog. The U.S. government financially subsidizes both the poisoning of the prairie dog and the preservation of species that depend on the prairie dog for survival.

(2) *Habitat.* Conservation of most species, however, depends on more than legal action. Many species are protected by law, but enforcement in the field can sometimes be difficult, and legal maneuvers can circumvent the intentions of most endangered species legislation (Salwasser 1990). In addition, legal efforts alone often create unproductive conflict.

The value of creating protected areas on the grasslands of Canada, the United States, and Mexico can not be overemphasized. There are presently plans to initiate such a protected area in northern Chihuahua, Mexico, that would include a 55,000-ha black-tailed prairie dog complex, which is the largest remaining in North America (Ceballos et al. 1993).

Establishing areas of protected habitat could prevent the further decline of the prairie dog and of the many life forms that depend on its system, as well as integrate ecologically sound agricultural opportunities with conservation goals. This proactive integration would be a large step toward elimination of the conflict that arises when a species is on the verge of extinction (as with the Northern Spotted Owl).

(3) *Education and Positive Incentives.* Protected areas alone are not sufficient to preserve most declining species. Size constraints combined with the effects of fragmentation often do not permit viable populations of large or highly specialized species (Ceballos & Navarro 1991). An alternative to the conflicting directives of federally sponsored prairie dog poisoning and endangered species management has been proposed. This program is designed to restore ecological integrity without harming local livestock interests (Miller et al. 1990). The proposal basically converts federal funds allocated to the destruction of prairie dogs into a positive incentive for ranchers who manage for both livestock and wildlife.

Because attitudes of the western agricultural commu-

nity are entrenched on the issue of prairie dogs, it will take a positive incentive before education can work. In Montana, Reading and Kellert (1993) showed that knowledge was only one part of attitude and that different levels of knowledge alone did not change negative perceptions about black-footed ferrets and prairie dogs.

It is not possible for education to address misconceptions about the prairie dog ecosystem when poisoning is still federally subsidized. Words may say one thing, but actions quickly override their content. As long as the U.S. government provides poison, ranchers will use it, and their misconceptions about the role of the prairie dog in grassland maintenance will only be reinforced instead of changed. To continue this subsidy, and the present poisoning policies, will undermine all efforts to conserve biological diversity on the western grasslands.

Conclusion

Without addressing the issues surrounding the destruction of the prairie dog, we will only continue to degrade the western grasslands, reduce biotic diversity, and drain government budgets. Protection of this keystone species will provide the best transition from single-species management to management of all animals and plants depending on the system. Because the prairie dog ecosystem stretches across three North American countries, the responsibility for preservation of its unique lifeforms must be a coordinated international effort. The Great Plains Initiative is one recent document that provides an avenue for this cooperation, and we should seize the opportunity. The conservation of biotic diversity in this hemisphere cannot afford less.

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Note Added in Proof

Since this article was written, the U.S. Fish and Wildlife Service, Region 6, has rejected an internal petition to list the black-tailed prairie dog as a candidate species. In our opinion this is very unfortunate for two reasons. (1) Prairie dogs have declined precipitously throughout this century and the causes of the decline (poisoning programs and plague) are still active. Candidate status would have focused attention and money on the problem and, because of the prairie dog's reproductive potential, candidate status may have reversed the downward trend in biodiversity without the restrictions of full endangered status. (2) The Department of Interior has been trumpeting a need to manage ecosystems instead of individual species. As a keystone species, candidate status for the prairie dog would have been an excellent step in that direction, but it appears that the U.S. Fish and Wildlife Service has chosen instead to list species individually that depend on prairie dogs and not recognize the root cause of lost biodiversity. We understand that there is tremendous political pressure from the agricultural community on this issue, yet the historical alternatives have so far done little to alter the biological trend or the attitudes behind it. We may be heading directly toward the "ecological train wreck" on the prairie that the Department of Interior says it wants to avoid.