October 1981

A Review of Prairie Dog Diet and Its Variability Among Animals And Colonies

Kathleen A. Fagerstone
Denver Wildlife Research Center, Denver, Colorado

A REVIEW OF PRAIRIE DOG DIET AND ITS VARIABILITY AMONG ANIMALS AND COLONIES

KATHLEEN A. FAGERSTONE, Denver Wildlife Research Center, Building 16, Federal Center, Denver, Colorado 80225

ABSTRACT: After almost 70 years of decline, prairie dog numbers are increasing in many western states. As populations expand, it becomes increasingly important to clarify the degree of competition between prairie dogs and livestock. A review of studies on prairie dog food habits shows variable results. Prairie dogs frequently eat the same plant species as cattle and their activities may cause a decrease in grasses normally considered good livestock forage and an increase in forb cover. However, in some instances, prairie dogs may be beneficial to rangeland; plant species diversity and protein content of forage are often greater on prairie dog colonies than off. It is important to assess each area of prairie dog-cattle interaction separately because prairie dog diet (and competition with cattle) can be extremely variable among geographical areas, colonies, and even animals within colonies.

INTRODUCTION

Prairie dogs (Cynomys spp.) have been the focus of over 400 investigations (Hassien 1976), many of which have involved food habits. Although considerable information has accumulated, no general concensus has emerged about the degree of competition which exists between prairie dogs and livestock. This lack of concensus is due to the extreme variation in conclusions reached by investigators who studied diet and food preferences of prairie dogs. This paper presents a brief historical account of the conflict between black-tailed prairie dogs (Cynomys ludovicianus) and livestock and reviews the existing food habits literature.

HISTORICAL OVERVIEW

The black-tailed prairie dog is a medium-sized herbivorous rodent that inhabits short grass and mixed grass prairies of central North America (Lechleitner 1969). Its distribution encompasses the Great Plains region of the western United States. Prairie dogs were widespread on the Great Plains throughout the 1800's, but they probably reached peak abundance around 1900 after many of their natural predators were eliminated and after cattle grazing had become well established. Merriam (1901) estimated their numbers at over 5 billion and the area covered by their colonies at 283 million ha (700 million acres). One colony in Texas covered 65,000 km^2 (25,000 mi^2).

The conflict between man and the prairie dog began with the settlement of the plains. On converted rangelands prairie dogs began to damage agricultural crops extensively. Early researchers reported that prairie dogs also competed directly with livestock for rangeland forage. Merriam (1901) calculated that 32 prairie dogs ate as much as 1 sheep and 256 prairie dogs ate as much as 1 cow. The widespread concern about the competition between prairie dogs and livestock for rangeland caused settlers to begin extermination efforts during the late 1880's. Their shooting and trapping efforts had little effect on prairie dog populations. However, the development of rodenticides used in federal, state, and local poisoning programs, in con-

junction with changing land practices, significantly reduced prairie dog populations and eliminated most large colonies. Millions of hectares were treated with poisoned grains after 1900. By 1919 after 20 years of control efforts, Nelson (1919) estimated that prairie dogs occupied only 40 million ha (100 million acres). By 1971, only 0.6 million ha (1.4 million acres) were still occupied by prairie dogs (U.S. Dept. Interior 1971).

Prairie dog populations have been increasing since 1972 when Presidential Executive Order #11643 banned the use of secondary poisons on public lands and eliminated most uses of 1080 and strychnine, the principal rodenticides. For example, the area occupied by prairie dog colonies has increased 20% per year between 1968 and 1978 on a 1,036 ha (400 mi^2) area south of the Badlands on Buffalo Gap National Grassland, South Dakota. Prairie dogs occupied 1,307 ha (3,230 acres) of rangeland in 1968, 6,172 ha (15,244 acres) in 1974, and almost 14,575 ha (36,000 acres) by 1978. As prairie dog populations continue to expand, the issue of their competition with livestock becomes increasingly important.

PRAIRIE DOG-LIVESTOCK COMPETITION FOR FORAGE

A number of investigators have examined the impact of prairie dogs on rangeland and the extent to which they compete with cattle for forage. Some studies have shown that prairie dogs feed mostly on annual forbs and therefore do not compete with cattle. Bond (1945) found that areas from which prairie dogs were excluded contained a high percentage of annual forbs and he concluded that forbs were preferred by prairie dogs. Clements et al. (1940) reported that prairie dogs on mixed prairie habitat ate 15 species of forbs but no grasses and concluded that grasses were not primary foods. King (1955) also suggested that prairie dogs relied mostly on forbs for food. However, the results of these studies are difficult to interpret because diet was not related to plant species availability. Forbs dominated the habitat in all these studies so it is possible that their choice by prairie dogs was based on abundance of the forbs rather than preference.

Other studies have demonstrated a similarity in the diets of prairie dogs and cattle. Taylor and Loftfield (1924) found that Zuni prairie dogs (C. gunnisoni zuniensis) utilized 69% of the wheatgrass (Agropyron sp.) and 99% of the dropseed (Sporobolus sp.) in their experimental exclosures, thus eliminating 80% of the total annual production. In some places, they destroyed all of the forage and were forced to emigrate. Taylor and Loftfield concluded that prairie dogs have no beneficial food habits; they compete with cattle by eating similar foods in the same order of preference.

Kelso (1939) provided the first quantitative data on prairie dog diet. He concluded that 76.2% of their diet was herbage of value to sheep and cattle, and included 62% grass and 34% forbs; western wheatgrass (Agropyron smithii-12%) and six-weeks fescue (Festuca octoflora-9%) were the most important grasses. Koford (1958) also considered western wheatgrass, blue grama (Bouteloua gracilis) and buffalograss (Buchloe dactyloides), all important livestock forage, to be the most important foods for prairie dogs. He suggested that prairie dog grazing caused an increase in buffalograss and blue grama in the habitat but a decrease in wheatgrass, which is generally considered better livestock forage than blue grama or buffalograss. Smith (1967), Tileston and Lechleitner (1966), and Fagerstone et al. (1981) also listed wheatgrass, blue grama and buffalograss as the most important prairie

dog foods. Summers and Linder (1978) found these grass species important but also found significant amounts of scarlet globemallow (Sphaeralcea coccinea) and threadleaf sedge (Carex filifolia) in the prairie dog diet.

In studies where prairie dog diet was compared to availability, prairie dogs usually preferred grasses over forbs (Bonham and Lerwick 1976, Fagerstone et al. 1977, Summers and Linder 1978, Fagerstone et al. 1981). Smith's (1967) findings supported those of Kelso (1939) and Koford (1958) who showed that important livestock forage made up 75% of the prairie dog diet. Vallentine (1971), Hansen and Cavender (1973), and Lerwick (1974) suggested that prairie dogs and livestock consume mostly the same plants. Hansen and Gold (1977) calculated a 64% similarity in annual diets of prairie dogs and cattle and showed that prairie dogs and cattle selected foods in a similar order ($P < 0.01$) during every season ($r = 0.8$).

Although there appears to be little doubt that prairie dogs often compete with cattle for forage, prairie dogs may have other beneficial effects on rangeland that would offset this competition. Although Bonham and Lerwick (1976) found that prairie dogs grazed on plants important to livestock such as blue grama, sand dropseed (Sporobolus cryptandrus), and needleleaf sedge (Carex eleocharis), they concluded that prairie dogs are not always destructive to rangeland and do not always adversely affect forage important to livestock. Bonham and Lerwick (1976), Gold (1976), and Coppock (1980) found greater plant diversity in prairie dog colonies than off colonies and an increase in the density of perennial forbs and grasses useful as livestock forage on colonies. Bonham and Lerwick (1976) concluded that prairie dogs altered the composition of rangeland toward plants more tolerant to their grazing, but this alteration was not always detrimental to livestock. Despite considerable dietary overlap of prairie dogs and cattle, O'Meilia (1980) concluded that sufficient forage was available to meet the demands of both steers and prairie dogs even under heavy feeding pressure.

Prairie dogs may cause an increase in nutritional quality of range forage. Prairie dog activity often appears to increase forb production (Koford 1958, Bonham and Lerwick 1976, O'Meilia 1980). Because forbs generally have a higher protein content and a higher digestion coefficient than grasses (Cable and Shumway 1966, Hoehne et al. 1968), their presence on prairie dog towns may be beneficial to livestock. O'Meilia (1980) found that although steers had a higher forage intake on pastures without prairie dogs, they did not show significantly higher weight gains than steers grazing on pastures with prairie dogs. O'Meilia (1980) believed that the greater use of high protein forbs and blue grama by cows on pastures with prairie dogs may have compensated for the lower forage intake of cattle on those pastures.

VARIABILITY IN PRAIRIE DOG DIET

The literature on prairie dog and livestock competition demonstrates the large differences in viewpoint between investigators who feel that the food habits of prairie dogs are harmful to livestock and investigators who feel that prairie dogs have no effect or are even beneficial. The dilemma in interpreting prairie dog diet studies results from the great amount of variation that occurs in vegetative composition and diet within prairie dog colonies, among colonies, and between seasons. Although seasonal variation in diet has been investigated by several researchers (Kelso 1939, King 1955, Tileston and Lechleitner 1966, Smith 1967, Costello 1970, Klatt 1971, Summers

and Linder 1978, Fagerstone et al. 1981), few have attempted to relate forage use to availability; only a few of the recent studies have examined the statistical variation occurring in range vegetation and prairie dog diet. In these recent studies, significant differences occurred in vegetation and diet both within and between colonies. Fagerstone et al. (1977) found that prairie dog diets in Montana were highly variable ($P < 0.001$) between colonies. In one colony, prairie dogs consumed 5% grass and 73% forbs, but in another colony, they consumed 83% grass and 9% forbs. There was no apparent reason for the diet difference, because forbs formed between 82% and 85% of the vegetation of both colonies and the vegetative composition was not significantly different between the 2 colonies. However, there was a significant difference ($P < 0.01$) in the percentage of bare ground (52% and 70%) between the 2 colonies. Fagerstone et al. (1977) speculated that the greater vegetative cover on the first colony allowed prairie dogs to eat a wider variety of food items, including more forb species.

Summers and Linder (1978), in their study of the diets of prairie dogs from 2 colonies in 4 vegetative types in South Dakota, found significant variation in vegetative composition between burrows within one vegetative type, and between vegetative types within colonies, and between colonies. Summers and Linder (1978) found no significant differences in diet of prairie dogs collected from burrows within a vegetative type or between vegetative types within colonies. However, diet was significantly different ($P < 0.05$) between colonies.

In a study conducted on the Buffalo Gap National Grassland, South Dakota, the variation in diet was examined for 158 prairie dogs collected from 12 colonies during 6 periods of the year (Fagerstone et al. 1981). Vegetation was surveyed wherever a prairie dog was collected. Within each colony the vegetation was fairly homogeneous; no significant differences occurred among sampling sites within colonies for any major plant species. However, there was significant variation ($P < 0.01$) in vegetative composition among colonies for most of the abundant plant species, including blue grama, buffalograss, red three-awn (Aristida longiseta), tumblegrass (Schedonnardus paniculatus), prairie dogweed (Dyssodia papposa), and scarlet globemallow. Consumption varied significantly among prairie dogs within a colony ($P < 0.01$) for 2 major plant species, brome (Bromus spp.) and buffalograss, and among colonies for 2 other major plant species, red three-awn and prairie dogweed.

CONCLUSIONS

Several conclusions about prairie dog diet and dietary competition with livestock seem warranted. First, prairie dogs are generalists and will eat a broad spectrum of plant species; the supply of a particular forage is not critical (Hansen and Gold 1977, Fagerstone et al. 1981). Fagerstone et al. (1977) found that prairie dog diet switched from 73% forbs and 5% grass to 9% forbs and 82% grass after a 2,4-D treatment removed most of the forbs on the colony. The dietary change did not appear to adversely affect the weight or activity of the prairie dogs.

Second, although prairie dogs will eat whatever is available, they seem to prefer grasses over forbs when both are available. In particular, western wheatgrass, blue grama, and buffalograss appear to be the staple dietary items (Kelso 1939, Koford 1958, Smith 1967, Tileston and Lechleitner 1966, Lerwick

1974, Summers and Linder 1978, Fagerstone et al. 1981). Although buffalograss is consumed in large quantities when it is present on a colony, it appears to be eaten because it is available rather than because it is highly preferred. Bonham and Lerwick (1976), Summers and Linder (1978), and Fagerstone et al. (1981) found that consumption of buffalograss was lower than its availability in the habitat would indicate. In contrast, wheatgrass and blue grama are preferred species during most of the year (Klatt 1971, Summers and Linder 1978, Fagerstone et al. 1981).

Third, the parts of the plants prairie dogs select are largely those of high nutrient, energy, or water content (King 1955, Fagerstone et al. 1981). Prairie dogs generally first consume seeds and meristematic tissue, such as the base of a grass blade. Prairie dogs select growing rather than mature plants (Fagerstone et al. 1981), perhaps because of the higher protein content and lower fiber in growing forage (Beckstead 1977) and because succulent forage provides a water source (McKay and Verts 1978).

Fourth, there is little doubt that competition can exist between prairie dogs and livestock in terms of plant species consumed. By consuming large quantities of grass, prairie dogs can alter plant composition on a colony toward more forbs. Prairie dogs can also exert selective feeding pressure against certain favored species such as blue grama and wheatgrass, resulting in increasing abundance of buffalograss. Although these generalizations characterize most prairie dog-livestock interactions, the diets of both are strongly affected by the availability of plant species and can vary widely among geographical locations, colonies and even among animals within one colony. Therefore, the complex ecological interactions and political implications of the problem necessitate evaluating each conflict situation individually.

LITERATURE CITED

BECKSTEAD, M. 1977. Digestibility of common forage plants and energetic requirements of the black-tailed prairie dog. M.S. Thesis, South Dakota State Univ., Brookings. 39 pp.

BOND, R.M. 1945. Range rodents and plant succession. Trans. N. Am. Wildl. Conf. 10:229-234.

BONHAM, C.D., and A. LERWICK. 1976. Vegetation changes induced by prairie dogs on shortgrass range. J. Range Manage. 29:221-225.

CABLE, D.R., and R.P. SHUMWAY. 1966. Crude protein in rumen contents and in forage. J. Range Manage. 19:124-128.

CLEMENTS, S.E., F.L. LONG, and E.Z. MARTIN. 1940. The biotic significance of disturbance. Carnegie Inst. of Wash. Yearb. 39:174-175.

COPPOCK, D.L. 1980. Bison-prairie dog-plant interactions in a northern mixed-grass prairie. Bull. Ecol. Soc. Am. 61:113.

COSTELLO, D.F. 1970. The world of the prairie dog. J.B. Lippincott Co., Philadelphia and New York. 160 pp.

FAGERSTONE, K.A., H.P. TIETJEN, and G.K. LAVOIE. 1977. Effects of range treatment with 2,4-D on prairie dog diet. J. Range Manage. 30:57-60.

FAGERSTONE, K.A., H.P. TIETJEN, and O. WILLIAMS. 1981. Seasonal variation in the diet of black-tailed prairie dogs. J. Mammal. 62:In Press.

GOLD, I.K. 1976. Effects of blacktail prairie dog mounds on shortgrass vegetation. M.S. Thesis. Colo. State Univ., Ft. Collins. 40 pp.

HANSEN, R.M., and B.R. CAVENDER. 1973. Food intake and digestion by blacktail prairie dogs under laboratory conditions. Acta Theriol. 18:191-200.

HANSEN, R.M., and I.K. GOLD. 1977. Blacktail prairie dogs, desert cottontails and cattle trophic relations on shortgrass range. J. Range Manage. 30:210-214.

HASSIEN, F. 1976. Prairie dog bibliography. U.S. Dept. Int., Bur. of Land Manage. Tech. Note 279. 27 pp.

HOEHNE, O.E., D.C. CLANTON, and C.L. STREETER. 1968. Chemical composition and in vitro digestibility of forbs consumed by cattle grazing native range. J. Range Manage. 21:5-7.

KELSO, L.H. 1939. Food habits of prairie dogs. U.S. Dept. Agric. Circ. 529. 15 pp.

KING, J. 1955. Social behavior, social organization, and population dynamics in a black-tailed prairie dog town in the Black Hills of South Dakota. Contrib. Lab. Vert. Biol. 67. Univ. Michigan, Ann Arbor. 123 pp.

KLATT, L.E. 1971. A comparison of the ecology of active and abandoned black-tailed prairie dog towns. M.S. Thesis, Colo. State Univ., Ft. Collins. 66 pp.

KOFORD, C.B. 1958. Prairie dogs, whitefaces, and blue grama. Wildl. Monogr. 3, The Wildl. Soc. 78 pp.

LECHLEITNER, R.R. 1969. Wild mammals of Colorado: Their appearance, habits, distribution and abundance. Pruett Publishing Co., Boulder, Colo. 254 pp.

LERWICK, A.C. 1974. The effects of the black-tailed prairie dog on vegetative composition and their diet in relation to cattle. M.S. Thesis. Colo. State Univ., Ft. Collins. 106 pp.

McKAY, D.O., and B.J. VERTS. 1978. Estimates of some attributes of a population of Nuttall's cottontails. J. Wildl. Manage. 42:159-168.

MERRIAM, C.H. 1901. The prairie dog of the great plains. U.S. Dept. Agric. Yearb. 1901:257-270.

NELSON, E.W. 1919. Annual report of chief of Bureau of Biological Survey. Pages 275-298 In Annual Reports of the Dept. of Agric. for the year ended June 30, 1919.

O'MEILIA, M.E. 1980. Competition between prairie dogs and beef cattle for range forage. M.S. Thesis. Okla. State Univ., Stillwater. 33 pp.

SMITH, R.E. 1967. Natural history of the prairie dog in Kansas. Univ. Kansas Mus. Nat. Hist. and State Biol. Survey. Misc. Publ. 49. 39 pp.

SUMMERS, C.A., and R.L. LINDER. 1978. Food habits of the black-tailed prairie dog in western South Dakota. J. Range Manage. 31:134-136.

TAYLOR, W.P., and J.V.G. LOFTFIELD. 1924. Damage to range grasses by the Zuni prairie dog. U.S. Dept. Agric. Bull. 1227. 16 pp.

TILESTON, J.V., and R.R. LECHLEITNER. 1966. Some comparisons of the black-tailed and white-tailed prairie dogs in north-central Colorado. Am. Midl. Nat. 75:292-316.

U.S. DEPARTMENT OF THE INTERIOR. 1971. Report to the Council on Environmental Quality and the Dept. of the Interior by the Advisory Committee on Predator Control. p. 140.

VALLENTINE, J. 1971. Range development and improvements. Brigham Young Univ. Press, Provo, Utah. 516 pp.