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History of Occurrence and Present Home Territory Sizes for Black-Tailed Prairie Dogs on the Standing Rock Sioux Reservation

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On the Ground

- Past management and historic occupation by black-tailed prairie dogs will affect the vegetation responses to changes in management.
- Ecological sites have different production potential and may influence colonization by black-tailed prairie dogs.
- Thin Claypan ecological sites had the largest coterie home territory size at 1.8 ha but also had coteries among the smallest at 0.5 ha.

Keywords: black-tailed prairie dogs, coterie: home territory size, ecological sites.

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Black-tailed prairie dogs (*Cynomys ludovicianus*) are burrowing mammals that can be present throughout much of the mixed and short-grass prairie of western North America. Prairie dogs are often cited as "ecosystem engineers" or "keystone species" within the grasslands and prairies of North America because their activities influence the organization of ecological communities.[1] However, it is these same activities that can generate conflict with ranchers. Prairie dogs live in family groups known as *coteries*, which, when combined with additional coterie home territories, create prairie dog towns. Each family group defends a specific home territory, which consists of an elaborate set of burrows and tunnels, from its neighbors. The number of tunnels within a coterie differs and may be a function of coterie age and population density.[2] The holes or tunnel entrances and exits are the cause of some concern to ranchers, who fear injury to their animals. However, it is the foraging and survival strategies of prairie dogs that draw the most criticism. Like cattle, prairie dogs prefer graminoids over forbs and are perceived as competitors for forage that would otherwise be available for livestock.[3] Furthermore, prairie dogs depend on family, neighbors, their hearing and vision to stay safe. Prairie dogs expend great energy during the growing season clipping vegetation in an effort to facilitate greater detection of predators.[2] The combination of foraging and clipping by prairie dogs typically reduces the quantity of biomass available for livestock and can reduce livestock weight gains.[3,4] This competition has led to a large-scale eradication effort to remove prairie dogs from rangelands. However, the benefits they provide to other wildlife species and reduction in overall numbers warrant consideration during the development of alternative management options.

Many Native American Reservations are located in the mixed and short-grass prairie and provide habitat to prairie dogs. The Standing Rock Sioux Reservation is located in south central North Dakota and north central South Dakota. The reservation is approximately 1,011,700 ha, of which roughly 607,028 ha are considered grasslands. Lands within the reservation are primarily under tribal or private ownership. Ranching provides valuable jobs to a region with an extremely high unemployment rate and is considered a way of life by many on the reservation. In addition to providing forage for livestock, grasslands and rangelands are critical habitat for wildlife. Many species of wildlife are important components of the Native American culture; therefore, Native Americans may be more open to ranching with prairie dogs. Nonetheless, rangelands across the Reservation have become degraded from the prolonged presence of prairie dogs and overgrazing. Although ranching is an important economic engine in the region, its full potential may not be reached unless management actions are taken to improve rangeland conditions.

New management options can be more effective if past land use is considered. Past disturbances by prairie dogs can impact a site's response to different management practices. The number of years an area has been colonized can influence prairie dog populations and vegetation characteristics.[5,6] For example, prairie dogs in South Dakota, in a colony that was first colonized over 40 years ago, had smaller litters and lower survival rates compared with a population in an area more recently colonized (approximately 4 years ago).[6] Archer et al.[5] reported that 69% of differences in vegetation that occurred in a prairie dog town in South Dakota were related to the time since colonization.

Past land use and occupancy by prairie dogs may have an effect on current coterie home territory size and prairie dog population levels. The ecological site concept has grown in popularity in recent years and is recognized as a potential management tool in the Northern Great Plains.[7] Ecological sites are defined on the basis of their soil, landform, climate, and landscape position. These characteristics result in the occurrence of a distinct plant community being attributed with a specific ecological site, with the production potential differing among ecological sites. Many different ecological sites can be found in the Northern Great Plains, and some may be more susceptible to foraging by prairie dogs than others. Previous studies have evaluated the sizes of coterie home territories across the Northern Great Plains, but none to our knowledge has considered ecological sites.[2] Our purpose in this paper is to introduce the reader of this special issue of *Rangelands* to the historic and present populations of prairie dogs at the Standing Rock Sioux Reservation research site and to describe the present coterie home territory sizes among a few different ecological sites.

Data Collection

Our research site was located on privately owned land in Corson County, South Dakota, within the Standing Rock Sioux Reservation. The site was native grasslands with some encroachment by introduced species and lies in a landscape dominated by grass and crop lands. Common graminoids at the site included western wheatgrass [*Pascopyrum smithii* (Rydb.) A. Löve], needle and thread [*Hesperostipa comata* (Trin. & Rupr.) Barkworth], and green needlegrass [*Nassella viridula* (Trin.) Barkworth], whereas purple coneflower (*Echinacea angustifolia* DC.), and scarlet globemallow [*Sphaeralcea coccinea* (Nutt.) Rydb.] are common forbs. The area receives approximately 44 cm per year of precipitation and has an average summer temperature of 20°C (South Dakota Weather and Climate, 2015). The dominant soil types on the study site include Cabba-Reeder loams (6%–25% slopes), Reeder-Cabba loams (6%–9% slopes), and Wayden-Cabba complexes (9%–40% slopes).[6]

The site was divided into four pastures of roughly equal size (203 ha) with varying degrees of prairie dog presence. Pasture 1 was 18% occupied by prairie dogs, and pastures 2, 3, and 4 had 40%, 75%, and 0% prairie dog presence, respectively. Each pasture was stocked from early June to early October with yearling steers to achieve 50% elimination of vegetation.

We used photographs from 1938, 1984, and 2010 to estimate the area at the site occupied by prairie dogs over time. Photos were digitized into ArcMap 10 and minimum convex polygons were used to determine area occupied by prairie dogs for the years for which photographs were available. We considered areas that showed signs of severe erosion likely caused by prolonged prairie dog presence and evidence of prairie dog excavations as areas occupied by prairie dogs.

Death of all individuals in a neighboring coterie, landscape positioning, years since colonized, population history, and climate can all impact coterie home territory size. As the density of prairie dogs increases, the demand placed on the vegetation becomes greater, forcing prairie dogs to expand their territory if an adjacent habitat is available.[7] Coterie home territory size was estimated as part of a mark-recapture study. Coterie home territory size was estimated at eight sites currently being used as part of a study evaluating the effects of herbivory (cattle and prairie dogs) on plant community composition (see Field et al. in this issue).[8] Sites were originally selected on the basis of ecological site, landscape position, and aspect. Ecological sites included Thin Claypan (toe-slope), Loamy (mid-slope), and Shallow Loamy (shoulder). Each site consisted of a plot used to exclude cattle (exclosure) and a paired plot where herbivory by cattle was allowed. Data collection was limited to the non-exclosed areas for the purpose of our study. Coterie home territory sizes were estimated at three Thin Claypan, four Loamy, and one Shallow Loamy sites. Prairie dogs were captured by using walk-in traps baited with oats. Areas to be trapped were prebaited with oats, beginning approximately 1 to 2 months prior to trapping. Prior to the onset of trapping, traps were placed on location, and doors wired open to allow animals an opportunity to acclimate to traps. Traps were placed at each location near active burrows. During the trapping events, traps were checked at hourly intervals. Captured animals were ear tagged, sexed, weighed, and given an identifiable mark by using a dye solution consisting of water, peroxide, and Nyanzonal-D.[2] The marked animals were observed from a distance with spotting scopes and binoculars. Known locations were marked on handheld GPS units and transferred to ArcMap 10 and used to create minimum convex polygons for each coterie.

Results

Because of the limited availability of historic photographs, our estimate of area occupied by prairie dogs was restricted to what is now defined as pasture 1 and portions of pasture 2. In 1938, prairie dogs were present in pastures 1 and 2 and occupied approximately 24.2 ha. Prairie dog presence was primarily restricted to the areas now defined as a Thin Claypan ecological site (Fig. 1). Images from 1984 indicated that the town had expanded to more than 38.0 ha moving up slope into Loamy ecological sites. By 2010, prairie dogs occupied roughly 79.0 ha in pastures 1 and 2 and were present

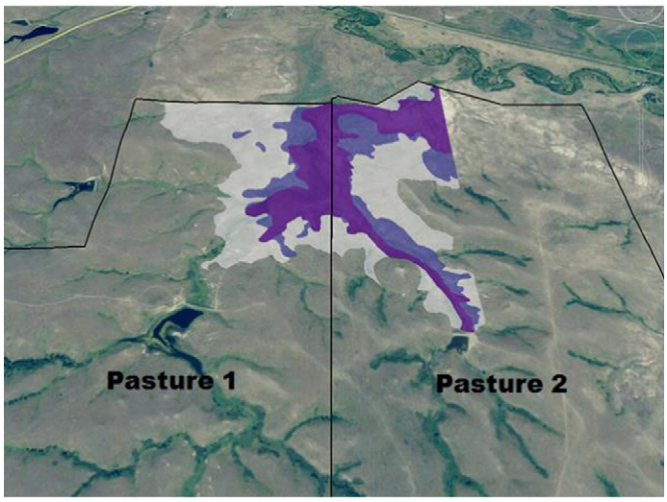

Fig. 1. Extent of area occupied by black-tailed prairie dogs in 1938 (purple), 1984 (blue), and 2010 (white) at a Site in McLaughlin, South Dakota.

on all three ecological sites. Undoubtedly, changes occurred between 1938 and 1984, but images were not analyzed for many of those years. The area occupied by prairie dogs increased by roughly 326% over the 72-year period from 1938 to 2010.

Estimates of coterie home territory size varied within the town (Table 1). In pasture 2, coterie home territory estimates were made for two non-exclosed sites that were within the area of known history based on our analysis of historic photographs. Non-exclosure 8 (NE8) was in the Thin Claypan ecological site, on the toe-slope, and within the boundaries occupied by prairie dogs in 1938. NE9 was in the Loamy ecological site, on the mid-slope, and colonized sometime after 1984. Coterie size at NE8 was roughly 1.8 ha and was estimated at 0.5 ha at NE9. NE11 and NE19 were located within the Thin Claypan ecological site, on toe-slopes, and in pastures 2 and 3; respectively. Coterie size at NE11 was 0.6 ha. The coterie at NE19 also included NE20, which was located within the Loamy ecological site, on the mid-slope, and was approximately 0.5 ha.

Discussion

As indicated by historic and present-day photographs, prairie dogs have lived at the site for more than 75 years. Undoubtedly, the local prairie dog population has been dynamic during this period, expanding overtime but likely facing turbulence as a result of climate variability and potential interactions with domestic herbivores. Areas occupied since the 1930s are expected to comprise a plant community different from those more recently colonized; how these plant communities may respond to a controlled moderate grazing regime may differ.

The historical background of a site can influence the current plant community and may affect the sites ability to respond following a change in land use or management.

Table 1. Estimates of black-tailed prairie dog coterie territory size in northcentral South Dakota.

Trap site	Pasture	Landscape position	Ecological site	Coterie size (ha)
NE8*	2	Toe-slope	Thin Claypan	1.8
NE9	2	Mid-slope	Loamy	0.5
NE1	2	Toe-slope	Thin Claypan	0.6
NE12†	2	Mid-slope	Loamy	1.1
NE13†	2	Shoulder-slope	Shallow Loamy	1.1
NE17	3	Mid-slope	Loamy	0.7
NE19‡	3	Toe-slope	Thin Claypan	0.5
NE20‡	3	Mid-slope	Loamy	0.5

* NE = Non-exclosed.
† NE12 and NE13 are part of the same coterie home territory.
‡ NE19 and NE20 are part of the same coterie home territory.

Colonization history of black-tailed prairie dogs differed across the research site, and family group home ranges also varied in size. At this site, Thin Claypan ecological sites occurred on toe-slopes with relatively flat topography and were likely first colonized partly as a result of lower production potential, which, in conjunction with flat topography, would have allowed adequate detection of predators. As the prairie dog numbers increased overtime, the growing population led to expansion up slope onto ecological sites with greater production potential.

Our estimates of coterie territory size are generally within the range of those reported by Hoogland[2] in western South Dakota. Hoogland[2] reported home territories of 0.05 to 1.01 ha and a mean of 0.31 ha. Average coterie home territories at our research site were 0.97 ha on Thin Clayplan and 0.70 ha on Loamy ecological sites. Hoogland[2] estimated home territory sizes for 273 coteries, whereas our efforts focused on fewer coteries and did not include all home territories within the town. NE8 was the largest coterie home territory found among those estimated at 1.8 ha. This area was within the area colonized in 1938. Over time, heavy erosion had occurred in this area, and a silt layer was present on much of the home territory. The area covered in silt had little vegetation, and this general lack of vegetation may have played a role in the larger home territory recorded in this area. Prairie dogs seldom travel outside their home territory and are dependent on the forage available in their territory to support the individuals within the coterie.[2]

Coterie home territories on the Thin Claypan ecological sites had little room to expand, whereas those on the shoulder in many areas had additional room to expand, although the aspect direction differs. Heavy overgrazing by livestock may create conditions favorable for prairie dog expansion because of the relatively short height and density of the vegetation that exists following grazing. Under the current moderate grazing regime, grazing pressure by cattle may not be sufficient to create favorable conditions for prairie dog dispersal into noncolonized areas because the structure of vegetation may be maintained at greater heights.

Prairie dogs have occupied portions of the site for greater than 75 years and have had a profound effect on both the soils and vegetation.[9,10] Historically, prairie dogs were restricted to areas of Thin Claypan ecological sites, which could have limited the overall negative consequences to livestock as a result of the relatively low production potential of these soils. Over time, the town expanded into areas of higher productivity and probably resulted in greater losses of forage for livestock. It is clear that many factors can influence prairie dog home territory size and that size can vary both within and among ecological sites; however, occupation history may affect territory size if erosion obstructs vegetation production. Ecological sites have varying production potential, and the vegetative response following the removal of prairie dogs will likely be affected by occupancy history, climate, and future management actions.

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