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PRAIRIE DOG ECOLOGY AND MANAGEMENT IN WYOMING

Lauren Connell, Ryan Wilbur, Lauren Porensky, John Derek Scasta

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UW College of Agriculture and Natural Resources Extension

INTRODUCTION

In Wyoming, prairie dogs evoke a range of opinions and labels as they are both species of concern and agricultural pests. The complexity of prairie dog ecology and management has resulted in contrasting concerns from stakeholders: 1) a desire to enhance populations for conservation and 2) a desire to completely eradicate prairie dogs to reduce competition with livestock (Lybecker et al. 2009, Reading et al. 2006, Zinn and Andelt 1999, Reading and Kellert 1993). Extensive research has been conducted on the impacts of prairie dogs at local scales (Sierra et al. 2015, Augustine and Baker 2013, Baker et al. 2013, Davidson et al 2012, Detling 2006). Unfortunately, the lack of research at larger scales has resulted in land management agencies making difficult decisions about prairie dog management that influences associated wildlife like burrowing owls, mountain plovers and others. These decisions also affect livestock production for ranchers (Augustine and Baker 2013, Derner et al. 2006).

In this bulletin, we discuss complex relationships between prairie dogs, humans, and Wyoming rangeland landscapes. Specifically, we address prairie dogs and their: (1) distribution and populations; (2) social behavior; (3) influence of sylvatic plague; (4) competition with livestock for forage resources; (5) role in structure, function and composition of rangeland ecosystems; and (6) management implications for both public and private lands.

Prairie Dog Distribution and Populations

There are two species of prairie dogs in Wyoming, black-tailed prairie dogs (*Cynomys ludovicianus*; Figure 1) which are primarily found in eastern Wyoming and white-tailed prairie dogs (*Cynomys leucurus*; Figure 2) which are primarily found in western Wyoming. Black-tailed prairie dogs tend to have larger and denser colonies and invoke more controversy regarding their impacts on rangeland ecosystems. Thus, we will primarily focus on the ecology and management of black-tailed prairie dogs (henceforth 'prairie dogs').

Although the range of black-tailed prairie dogs has remained largely unchanged since European settlement (Figure 3), they are estimated to occupy a fraction (<3%)

Figure 1. Black-tailed prairie dog (*Cynomys ludovicianus*) on the Thunder Basin National Grassland, WY, USA. Photo: Derek Scasta, University of Wyoming.

of historic habitat (Proctor et al. 2006). This decrease is largely due to habitat fragmentation, poisoning and disease (i.e., sylvatic plague). Prairie dogs are unique from most wildlife species because their populations are estimated by density (number of prairie dogs per acre) of occupied area rather than counts of individuals, which can vary greatly depending on season, region and climate (USFWS2015a).

The decrease in black-tailed prairie dog distribution has been a concern for conservation-oriented stakeholders. As a result, black-tailed prairie dogs were petitioned for protection under the Endangered Species Act in 1998 and again in 2007. Both times the U.S. Fish and Wildlife Service determined they were not warranted for listing, as the species was ‘unlikely’ to become endangered in the foreseeable future (USFWS 2015b). Black-tailed prairie dogs and white-tailed prairie dogs are both listed as a “Wyoming Species of Concern” (USFWS 2015b). Wyoming prairie dog populations contribute substantially to the overall persistence of prairie dogs across their North American range (USFWS 2000) (Figure 3) through available habitat and populations of black-tailed prairie dogs on landscapes like the U.S. Forest Service - Thunder Basin National Grassland. This grassland supports one of the seven remaining large (>10,000 ac) black-tailed prairie dog complexes in North America (USFWS 2000).

PRAIRIE DOG BEHAVIOR

Prairie dogs are a social wildlife species. These burrowing rodents colonize into large groups as a strategy for protection from predator species that rely on them as a food source. Burrow mounds are used as vantage points as prairie dogs spend about one-third of their time scanning for predators (Hoogland 1995). Prairie dogs live in family units called coteries, typically consisting of one male and five related females. Several burrow holes are used by a coterie for entering and exiting their below-ground den. When multiple coteries are close together in spatial proximity, they form a prairie dog colony. A complex is established when several closely-located colonies (< 4 miles) form with suitable habitat between colonies to facilitate individual movement among colonies. If the closely-located colonies are separated by barriers of unsuitable habitat that prohibit individual movement among colonies, like water,

Figure 2. White-tailed prairie dogs (*Cynomys leucurus*) near Laramie, WY, USA.
Photo: Derek Scasta, University of Wyoming.

they are considered wards. Prairie dog densities are highly variable, from 3-89 adult and yearling prairie dogs per acre (Powell et al. 1994), depending on site suitability, resource availability and fatalities from disease outbreaks.

Prairie Dog Life History

Male and female prairie dogs reach sexual maturity at two years of age, with adults typically weighing one to three pounds. Mating occurs on a single day, typically in February and March. Prairie dogs mate with a new individual each year and sometimes mate with different individuals during their single day of mating. Their litters are born in the spring with an average size of three pups. About half of the pups do not survive their first year due to predation, infanticide and harsh winter conditions (Hoogland 2006).

Prairie dogs can live up to eight years but on average females live 4.5 years and males 2.5 years. Differences in lifespan are attributed to the risky activity of young adult males. For example, young males permanently leave their birth home in search of a mate and new food resources in another coterie within the same colony - a process called dispersal. If unsuccessful, males must leave their colony in search of a mate in a separate colony, becoming a target for predators because they do not have a burrow for safety or family members to warn them of approaching predators.

Prairie Dog Activity

Prairie dogs are primarily active during daylight hours and split the time they spend above ground evenly between foraging, socializing and watching for predators. In addition to foraging near burrows,

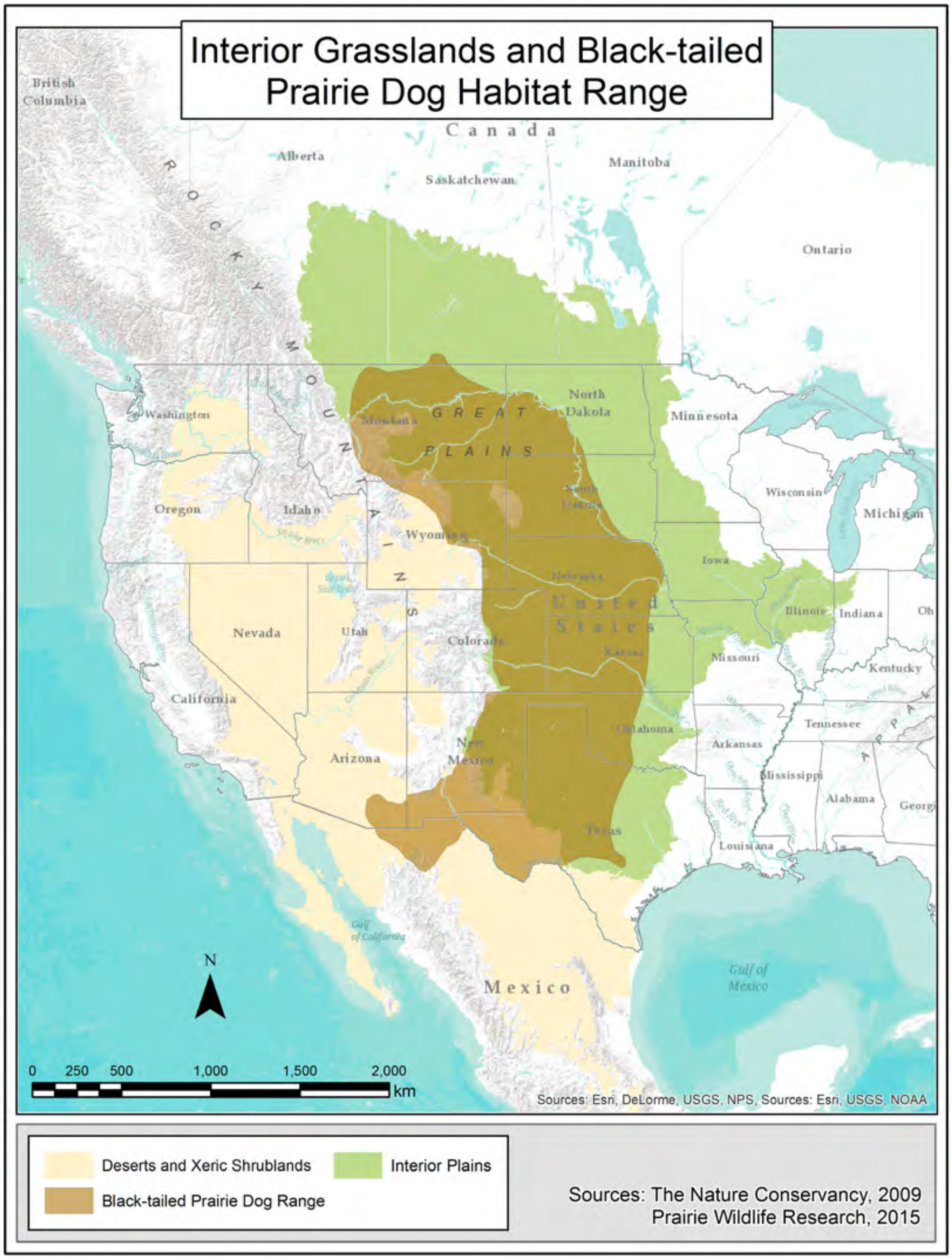

Figure 3. Historical range of the Black-tailed prairie dog (*Cynomys ludovicianus*). Although the extent of their habitat range remains unchanged from historic extents, black-tailed prairie dogs currently inhabit <3% of the land surface they once occupied. Data provided by Prairie Wildlife Research and ESRI. Map: Lauren Connell, University of Wyoming.

they also clip and remove vegetation to increase their ability to visually detect predators. Unlike other species of prairie dogs, black-tailed prairie dogs maintain these activities all year as they do not typically hibernate in the winter.

Prairie Dog Communication

Communications within a colony are essential for the survival of prairie dogs as there are many predator risks associated with being aboveground. Some prairie dogs will serve as a sentinel (i.e., guard) of the colony. If the sentinel sees a predator like a coyote (*Canis latrans*), or another threat like a human, it will issue an alarm call to alert fellow colony members. This alarm call is quickly repeated by other colony members to increase the likelihood that all members are notified and escape predation (Kiriazis et al. 2006).

To the human ear, prairie dog alarm calls might sound simple and unintelligible; however, their sophisticated and complex language (Slobodchikoff et al. 2009) can describe many different features about a threat. For example, alarm calls describe if the threat is aerial or terrestrial and the type of predator. This level of information helps prairie dogs decide how much energy to expend in response to the threat. If a coyote is the cause of alarm, prairie dogs will run to their burrow entrance but stay aboveground unless the coyote approaches. However, if a colony is threatened by an American badger (*Taxidea taxus*), prairie dogs will immediately hide belowground because badgers are capable of excavating their burrows. Similarly, if an agile predator like a hawk or eagle flies overhead, prairie dogs will immediately hide belowground.

Figure 4. Black-tailed prairie dog (*Cynomys ludovicianus*) issuing the jump-yip call. Photo: Lauren Connell, University of Wyoming.

Once the threat is gone, prairie dogs issue a second call known as the 'all clear' or 'jump-yip' (Figure 4). This call is different from the alarm call, both in sound and body language. To make this call, prairie dogs stand on their hind legs with arms in the air and head back, the 'jump,' and then emit the 'yip' (Figure 4).

PRAIRIE DOGS AND PLAGUE

An emerging issue related to managing prairie dogs is sylvatic plague, also known as the bubonic plague, which is caused by the bacterium *Yersinia pestis*. Plague bacteria are thought to have been introduced to the United States in the early 1900s (Hoogland 2006). Sylvatic plague maintains an indefinite life cycle in hosts like fleas and mice; however, the bacteria can be transmitted to new hosts through contact with fleas (Romain et al. 2013). Prairie dogs have no natural immunity to the plague bacteria; thus, exposure to plague causes almost 100 percent mortality in both small (< 3 ha) and large (> 16 ha) colonies (Biggins and Kosoy 2001; Stapp et al. 2004). As a result, the structure and population densities of prairie dog colonies are greatly altered following plague.

Plague events have been predicted in eastern Colorado by connectivity of prairie dog towns experiencing plague, coupled with periods of relatively low temperatures, soils with high moisture holding capacity and greater summer precipitation (Savage et al. 2011). Plague outbreaks were strongly correlated with El Niño Southern Oscillation climatic events, which provide favorable conditions for vegetation growth and soil moisture. Small mammal populations typically increase with El Niño events which supports the presence of more fleas, leading to an increased likelihood of plague outbreak (Stapp et al. 2004). A widespread plague outbreak occurred in prairie dog colonies in northeastern Wyoming in 2017 after strong El Niño years in 2015 and 2016.

Several products have been created to combat colony collapse associated with plague, including insecticide-dusting (Beard et al. 1992) to lethally control flea populations and vaccines to grant prairie dogs immunity to plague bacteria. Several different kinds of insecticides are used to control for fleas with varying degrees of effectiveness (Hinkle et al 1997). For example, the implementation of Pyraperm dusting on a colony in Utah resulted in an immediate halt on plague outbreaks in both 1998 and 2001 (Hoogland et al. 2004). These dusting efforts are not a long-term solution to plague but can help decrease the short-term, negative impacts to prairie dog colonies and populations. Plague vaccines are more promising in their effectiveness (Rocke et al. 2017) but can be costly and time consuming. The vaccines are administered through an edible bait that must be dispensed on-location at the prairie dog colony.

Plague is also a human health issue because it can transfer from prairie dogs to humans and pets, as evidenced by three cats contracting plague in northeastern Wyoming in 2018. Human cases of plague directly resulting from prairie dogs are relatively low (14 percent of all human cases since 1965, Seery et al. 2003) because humans rarely handle infected prairie dogs (Levy and Gage 1999, Barnes 1993, Barnes 1982). Observing simple precautionary measures like wearing gloves and insecticides (e.g. bug spray), and applying flea control products to their pets (Centers for Disease Control and Prevention 2018) will reduce the risk of contracting plague from prairie dogs.

PRAIRIE DOG-LIVESTOCK COMPETITION

In the ranching industry, black-tailed prairie dogs have long been recognized as a native wildlife species that competes with livestock for forage. This competition and reduction of available forage on rangelands is intuitive as prairie dogs are herbivores whose diet relies heavily on grass. Their effects are visually apparent as areas within prairie dog colonies may be nearly devoid of vegetation. However, the relationship between livestock and prairie dogs can be complicated - some animals show a preference for consuming grass at the edges of prairie dog colonies, including cattle (Sierra-Corona et al. 2015) and bison (*Bison bison*; Koford 1958). At the same time, prairie dogs can reduce available forage and livestock weight gains, particularly during droughts and in times or places where prairie dogs are very abundant (Derner et al. 2006). Regarding competition between livestock and prairie dogs, information is lacking on (1) direct competition for specific plant species and associated diet composition similarities and differences, (2) direct competition via removal of forage biomass by both livestock and prairie dogs and (3) indirect interactions via preferences of spatial use and distribution.

Prairie Dog and Livestock Diet Composition

Overlap in diet composition between black-tailed prairie dogs and domestic livestock, particularly beef cattle, has been estimated at 75 percent (Koford 1958) primarily due to the preference of grasses by both species. In western North Dakota from March to September, prairie dog diets were composed of 87 percent grasses (74-95 percent monthly range), 12 percent forbs (5-25 percent monthly range), and less than 1 percent shrubs, insects or seeds (Uresk 1984). The four most common grasses in prairie dog diets were sand dropseed, sun sedge, blue grama and wheatgrasses (Uresk 1984). In Colorado, summer diets of prairie dogs were comprised of 88 percent grasses and sedges. Buffalograss was not a major diet component although it was dominant (Lerwick 1974). Annual prairie dog diets were 65 percent grass and 34 percent forbs at the Buffalo Gap National Grasslands in North Dakota (Summers and Linder 1978).

A meta-analysis of seasonal (winter, spring, summer and fall) livestock diets in North America reported cattle diets were grass dominated (64-79 percent) with forbs (9-21 percent) and shrubs (7-15 percent) representing minor components (Scasta et al. 2016). For sheep, the grass composition was less than cattle (47-66 percent) but both forbs (21-29 percent) and shrubs (13-25 percent) contributed more to diets (Scasta et al. 2016). Thus, the composition of grasses and grass-likes in prairie dog diets (65-88 percent) is comparable to cattle diets (64-79 percent) suggesting that dietary overlap is high. Less overlap is present between prairie dogs and sheep. Diet competition between prairie dogs and cattle is likely most pronounced during the summer as prairie dogs consume relatively more grasses in the summer than in other times of the year and this is also the season when cattle are moved to public grazing allotments where prairie dogs more commonly occur.

Prairie Dog Animal Unit Equivalent and Removal of Forage Biomass

Livestock stocking rates typically denote 1 animal unit (AU) as a 1,000 pound cow, with animal unit equivalent (AUE) of 0.2 for sheep. Thus, five ewe sheep consume as much forage as the single 1,000 cow. It can be more difficult to develop AUEs for small mammals because some proportion of their diet is likely to include items that are not consumed by livestock. For example, Merriam (1902) suggested that 265 prairie dogs consume as much grass as one cow. However, Koford (1958) corrected that number to 335 based on the assumption that 25 percent of a prairie dog's diet does not overlap with livestock (Koford 1958). This would equate to a 0.003 AUE for prairie dogs. Nonetheless, it remains problematic to assess the true competition for forage between livestock and prairie dogs because densities of prairie dogs can be variable (Powell et al. 1994). Reports from the Great Plains indicate density of prairie dogs can be as low as three per acre and as high as 89 per acre (Table 1). Additionally, direct competition between prairie dogs and cattle for forage is dependent on rangeland productivity (Derner et al. 2006; Lauenroth and Burke 2008).

Prairie Dog Effects on Cattle Performance

Prairie dogs can negatively affect cattle weight gain when forage quantity is low. A six year study in the shortgrass steppe of eastern Colorado compared weight gains of yearling steers between pastures with black-tailed prairie dogs and those without prairie dogs. Yearling steer weights decreased by 5 percent when prairie dog colonies occupied 20 percent of a pasture, and weights decreased by 13 percent when colonies occupied 60 percent of a pasture (Derner et al. 2006). Prairie dog effects on cattle weight gain are highly dependent on scale (pasture size and colony size), site-specific differences in vegetation type, variable environmental conditions such as precipitation and prairie dog density. The authors of the shortgrass study suggested economic loss caused by prairie dogs would be greater in more productive systems like mixed-grass prairie, where the grasses are generally taller and thus more biomass is diverted from livestock grazing as a result of prairie dog clipping or grazing (Derner et al. 2006).

Prairie Dog Effects on Forage Quality

Forage quantity reductions due to prairie dogs may be partially offset by increased forage quality (Coppock et al. 1983). Effects of prairie dogs on forage quantity and quality are highly variable across space and time and competition may be evident under dry conditions but offset under wet conditions (Augustine and Spring 2013). In northern mixed grass systems, prairie dogs reduced biomass by 63-94 percent (growing versus dormant), but the magnitude of this effect was reduced in the less productive shortgrass prairie (maximum of 38 percent reduction of growing plant material). Under dry conditions improvements to forage quality were non-existent or very small, whereas forage digestibility and nitrogen content were enhanced with prairie dogs when conditions were wet. Similar findings occurred in the Thunder Basin Ecoregion of Wyoming (Connell et al. 2018a). Crude protein, phosphorus and fat were 12-44 percent greater and neutral detergent fiber was 6-10 percent lower on prairie dog colonies than at sites without prairie dogs - both for western wheatgrass samples and composite (all plant species present) samples. However, if quantity is reduced to such a level where it does become limiting for livestock the higher quality may not matter.

Indirect Prairie Dog-Livestock Interactions via Preferences of Spatial Use and Distribution

Many questions remain regarding interactions between prairie dogs and large grazers like cattle and bison. One study conducted in mixed-grass prairie at Wind Cave National Park in South Dakota found that in a wet,

Table 1. Summary of studies reporting black-tailed prairie dog densities.

Study Location	Number of Colonies	Prairie Dog Density Range (# per acre)	Source
Colorado, USA	22	13 - 49	Johnson and Collinge 2004
Colorado, USA	2	8 - 16	Derner et al. 2006
Kansas, USA	5	6 - 89	Powell et al. 1994
North Dakota, USA	15	3 - 11	Severson and Plumb 1998

productive year, prairie dogs collectively consumed as much forage biomass as bison (Cid et al. 1991). Both bison and cattle preferentially graze on the edges of black-tailed prairie dog colonies (Chipault and Detling 2013; Sierra-Corona et al. 2015). This behavior could be the result of cattle foraging to balance forage quality and forage quantity intake (Augustine and Springer 2013). For example, grazing animals may utilize areas without prairie dogs primarily for forage quantity, like bulk feeding and use prairie dog colonies to obtain more nutritious forage (Chipault and Detling 2013).

THE ROLE OF PRAIRIE-DOGS IN RANGELAND ECOSYSTEMS

The reduction of the proportion of area that prairie dogs occupy in their historical range is important as their presence and associated activities have unique and significant effects on rangeland systems. First, their foraging and burrowing activities directly influence features of the landscape (i.e., ecosystem engineer). For example, prairie dogs create low vegetation structure to increase predator detection, and these clipping activities also result in increased forage quality (Polley and Detling 1988; Connell et al. 2018a) (Figure 5). Digging and burrowing activities alter infiltration and nutrient cycling (Barth et al. 2014). Combined, prairie dog foraging and burrowing activities create a matrix of short grass and bare ground in a sea of taller grasses and shrubs (Figure 5). While these areas may be visually unattractive, they provide habitat that is critically important for certain wildlife species such as nesting habitat for mountain plovers (Table 3). Finally, prairie dogs themselves serve as a food source for many avian and mammalian grassland predators (Table 4). Despite these designations, the ways in which these disturbances influence rangeland health and sustainability (i.e., minimizing bare ground, plant community features relative to infiltration and runoff, litter amount, etc.) depend on density and duration of prairie dog colonies and may be difficult to manage concurrently.

Wildlife Species that Rely on Prairie Dogs for Habitat

Prairie dogs alter rangeland vegetation structure through burrowing and foraging activities to create islands of unique habitat. As a result, many other wildlife species commonly use prairie dog habitat at various life-stages (Table 3). Burrowing owls (*Athene cunicularia*), mountain plovers (*Charadrius montanus*), horned larks (*Eremophila*

Figure 5. Vegetation structure is altered by prairie dog activities, as indicated by the bare areas where prairie dogs are burrowing and areas with intact sagebrush and perennial grasses, on Thunder Basin National Grassland, WY., USA. Photo: Derek Scasta, University of Wyoming.

alpestris) and western meadowlarks (*Sturnella neglecta*) are just a few bird species who use prairie dog colonies for nesting and foraging habitat (Figures 6-7; Augustine and Baker 2013). Amphibians and reptiles such as tiger salamanders (*Ambystoma tigrinum*) and prairie rattlesnakes (*Crotalus viridis*) often use prairie dog burrows for shelter and feeding opportunities. Furthermore, the federally-endangered black-footed ferret (*Mustela nigripes*), whose diet is almost exclusively composed of black-tailed prairie dogs, uses prairie dog burrows after eating the inhabitants. Even birds that are typically associated with sagebrush habitat, such as the greater sage-grouse (*Centrocercus urophasianus*), have been observed to use small prairie dog colonies as strutting grounds where the males perform a mating display in the spring. However, this observation rarely occurs because there are few places where both species overlap. It is important to note in the Thunder Basin Ecoregion of Wyoming, prairie dogs and sage-grouse habitats can overlap in times of accelerated population growth by prairie dogs, and the effects of prairie dog browsing on shrubs could alter habitat structural characteristics important for greater sage-grouse. Prairie dogs modify habitat structure more than livestock grazing under light to moderate stocking rates (Connell et al. 2018b).

Wildlife Species that Rely on Prairie Dogs for Food

Avian predators in the western Great Plains such as bald eagles (*Haliaeetus leucocephalus*), golden (*Aquila chrysaetos*) eagles, ferruginous hawks (*Buteo regalis*), northern harriers (*Circus cyaneus*), peregrine falcons (*Falco peregrinus*), Cooper's hawks (*Accipiter cooperii*), red-tailed hawks (*Buteo jamaicensis*) and northern goshawks (*Accipiter gentilis*) all hunt prairie dogs. Other predators such as the black-footed ferret, coyote, red fox (*Vulpes vulpes*), swift fox (*Vulpes velox*), American badger and the bobcat (*Lynx rufus*) also commonly prey on prairie dogs. While most of these predators also eat other food items to meet their nutritional needs, prairie dogs can constitute a substantial portion of their diets. Table 4 presents a list of predators that use prairie dogs as a food source.

MANAGEMENT OF PRAIRIE DOGS

Many techniques have been tested to lethally control or manage black-tailed prairie dog populations, but the

Figure 6. Example of bare ground created on a prairie dog colony on Thunder Basin National Grassland, Wyoming, USA. Photo: Catherine Estep, Agricultural Research Service – Fort Collins, Colorado, USA.

Figure 7. A horned lark (*Eremophila alpestris*) on a prairie dog colony in the Thunder Basin National Grassland, Wyoming, USA. Photo: Derek Scasta, University of Wyoming.

Figure 8. A mountain plover (*Charadrius montanus*) on a prairie dog colony on Thunder Basin National Grassland, Wyoming, USA. Photo: Sarah Newton, Agricultural Research Services – Fort Collins, Colorado, USA.

effectiveness (defined as decreased prairie dog colony density) and economic feasibility remains unclear (Table 2). Many management techniques can also have direct consequences and secondary effects on non-target species like the federally-endangered black-footed ferret, birds, insects and small rodents, so care is required when employing lethal control techniques.

Habitat alteration, predator mimicking, trapping and translocation, gas exploding devices, visual barriers, contraception, shooting, poisoning with rodenticides and fumigants are treatment strategies for controlling prairie dogs, with varying effectiveness and affordability (Table 2). Some authors have also suggested new, innovative approaches to manage prairie dogs that leverage the animal's ecology and behavior (Connell et al. 2019). Rodenticides are typically consumed by prairie dogs via poisoned grain and can contain active ingredients of zinc phosphide or anticoagulant. These baits are also only effective when green grass is not available as a food source so timing is critical for effective application. If rodenticides are used, it is imperative to adhere to the label directions to avoid non-target or secondary impacts to associated species. Rodenticides and fumigants may require a pesticide applicator license. Your local Weed and Pest office or University of Wyoming Extension educator can provide more guidance, including commercial applicators.

Fumigants come in two types: aluminum phosphide or the USDA gas cartridge that produces carbon monoxide. Restrictions vary for fumigants and they are most effective in the spring when soils are moist. There are many other details that are pertinent to the application of fumigants. For more information please refer to the CSU Extension Fact Sheet: Managing Prairie Dogs (http://bit.ly/CSU-Extension-Prairie-Dogs). Please be mindful that approaches and restrictions in the guide may not be specific to Wyoming. Contact your local Weed and Pest office or University of Wyoming Extension educator before start of work.

Balancing Livestock Production with Wildlife Habitat Conservation

It is imperative to first identify the economic, production, conservation and aesthetic goals for each individual landowner to balance livestock production with wildlife concerns, including prairie dogs. These goals will vary from one property to the next and rightly so - no two pastures or businesses are the same. Striking a balance between livestock production and wildlife such as prairie dogs has been a persistent rangeland management challenge. Despite much research on competition between prairie dogs and livestock, or prairie dogs and native ungulates like bison, few studies have focused on the effects of all three herbivores (prairie dogs, livestock and native ungulates) at the same place at the same time. Furthermore, none of these studies have been conducted in the Thunder Basin Ecoregion in Wyoming with native ungulates like pronghorn (*Antilocapra americana*) and elk (*Cervus canadensis*). Many additional questions arise related to the topic of

Table 2. Common approaches (alphabetically listed) and considerations to managing prairie dog populations with varying effectiveness.

Type of Treatment	
Alteration of habitat	spraying of herbicide, piling physical materials like rocks or trees, providing perches to encourage raptor predation
Contraception	to reduce reproductive rates; synthetic hormones can accumulate in predators and cause secondary effects
Fumigants	to kill prairie dogs
Gas exploding devices	to kill prairie dogs; may be illegal in some states
Limitation or postponement of livestock grazing	because prairie dogs prefer areas that are low in vegetation height (<12 in), areas intensively grazed by livestock may encourage colony expansion
Predator odors	olfactory deterrents
Translocation	limited by 'receiving' sites
Recreational shooting	to kill prairie dogs
Visual barriers	to discourage dispersal
Zinc phosphide poisoning	to kill prairie dogs; not harmful to scavenging species but lethal to non-target species

Table 3. Species that are dependent on, or associated with, black-tailed prairie dog colonies (Kotliar et al. 1999).

	Common Name	Scientific Name	Habitat Use
Mammalian			
	Black-footed ferret	*Mustela nigripes*	Den in prairie dog burrows
	Red fox*	*Vulpes vulpes*	Den in prairie dog burrows
	Swift fox*	*Vulpes velox*	Den in prairie dog burrows
	Gray fox	*Urocyon cinereoargenteus*	Den in prairie dog burrows
	American badger*	*Taxidea taxus*	Den in prairie dog burrows
	Black-tailed jackrabbit*	*Lepus californicus*	
	Deer mouse*	*Peromyscus*	
	Eastern cottontail*	*Sylvilagus floridanus*	
	Northern grasshopper mouse	*Onychomys leucogaster*	
	Pronghorn*	*Antilocapra americana*	
	Striped skunk*	*Mephitis mephitis*	
	Thirteen-lined ground squirrel*	*Ictidomys tridecemlineatus*	
	White-tailed deer*	*Odocoileus virginianus*	
Avian			
	Burrowing owl*	*Athene cunicularia*	Nest in prairie dog burrows
	Mountain plover*	*Charadrius montanus*	Nest in prairie dog colony-sites
	Western meadowlark*	*Sturnella neglecta*	
	American kestrel*	*Falco sparverius*	
	Chestnut-collared longspur	*Calcarius ornatus*	
	Eastern meadowlark	*Sturnella magna*	
	Horned lark*	*Eremophila alpestris*	
	Killdeer *	*Charadrius vociferus*	
Reptilian			
	Texas horned lizard	*Phrynosoma cornutum*	
	Ornate box turtle	*Terrapene ornata ornate*	
	Prairie rattlesnake*	*Crotalus viridis*	
	Western plains garter snake*	*Thamnophis radix*	
Amphibians			
	Great Plains toad	*Anaxyrus cognatus*	
	Plains spadefoot toad	*Spea bombifrons*	
	Tiger salamander*	*Ambystoma tigrinum*	Shelter in prairie dog burrows
	Woodhouse's toad	*Anaxyrus woodhousii*	

* Species present in the Thunder Basin Ecoregion of Wyoming.

Table 4. Common predators of black-tailed prairie dogs.

	Common Name	Scientific Name
Mammalian		
	Black-footed ferret	*Mustela nigripes*
	Coyote*	*Canis latrans*
	Red fox*	*Vulpes vulpes*
	Swift fox*	*Vulpes velox*
	Gray fox	*Urocyon cinereoargenteus*
	American badger*	*Taxidea taxus*
	Bobcat*	*Lynx rufus*
Avian		
	Bald eagle*	*Haliaeetus leucocephalus*
	Golden eagle*	*Aquila chrysaetos*
	Ferruginous hawks*	*Buteo regalis*
	Northern goshawk	*Accipiter gentilis*
	Northern harrier	*Circus cyaneus*
	Peregrine falcon	*Falco peregrinus*
	Cooper's hawk	*Accipiter cooperii*
	Red-tailed hawk*	*Buteo jamaicensis*
Reptilian		
	Bull snake*	*Pituophis catenifer sayi*
	Rattlesnake*	*Crotalus, Sistrurus*

* Species present in the Thunder Basin Ecoregion of Wyoming.

balance such as: 'Are there additional risks for invasive species associated with prairie dog disturbances?'; 'What are the long-term implications for livestock carrying capacity?'; and 'Is there an optimal level of prairie dogs that a livestock producer can live with?'. University of Wyoming scientists and graduate students are currently conducting research on these questions in the Thunder Basin Ecoregion, in collaboration with the USDA Agricultural Research Service, the Thunder Basin Grasslands Prairie Ecosystem Association, local grazing associations and the USDA-Forest Service.

CONCLUSION

While prairie dogs have shaped Great Plains ecosystems, they are also controversial in ranching communities. A better understanding of how prairie dogs influence rangeland health indicators, particularly bare ground and plant community composition relative to infiltration and runoff, is needed across the west (Pyke et al. 2002). Interactions among prairie dogs, livestock, humans and Great Plains ecosystems are complex (Figure 9) and rangeland owners and managers need to have a robust understanding of prairie dog issues in order to make management decisions that align with their goals and objectives. Where coexistence of livestock and prairie dogs is desired, management requires collaborative efforts that include diverse group of constituents working for creative solutions. Understanding the broad spectrum of concerns and benefits associated with prairie dogs is crucial if managers, ranchers and conservationists are to identify strategic management solutions for this native burrowing rodent.

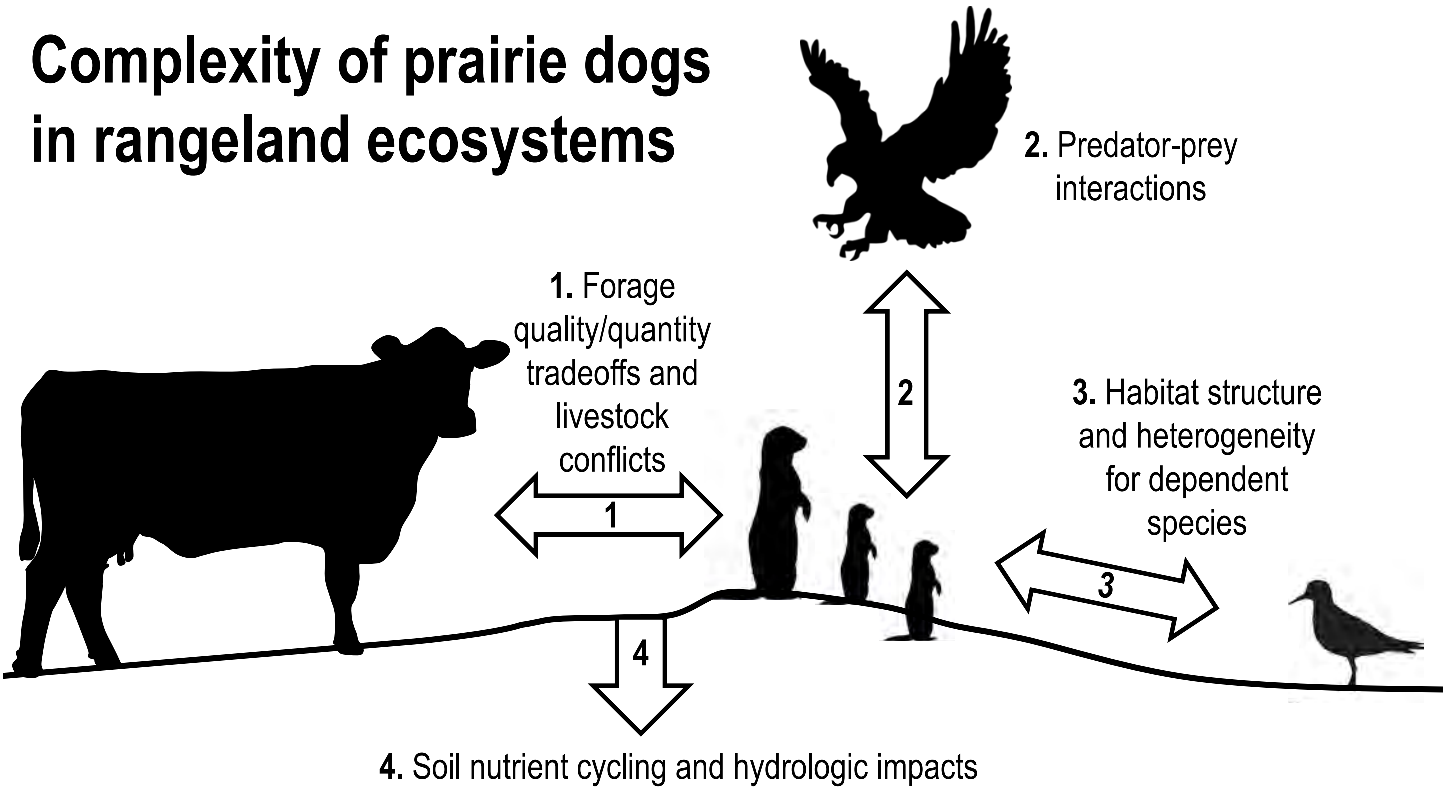

Figure 9. Prairie dogs in rangeland ecosystems represent a complex situation due to (1) forage quality and quantity tradeoffs and conflicts with livestock, (2) prairie dogs as a source of prey for predator species of concern, (3) prairie dogs creating habitat heterogeneity that is important for some species, and (4) their variable impacts on soil nutrient cycling and hydrology.

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