SPECIES ASSESSMENT FOR WHITE-TAILED PRAIRIE DOG (*CYNOMYS LEUCURUS*) IN WYOMING

prepared by

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Introduction

White tailed prairie dog range presently occurs 4 western states; Wyoming (71%), Colorado (16%), Utah (12%) and Montana (1%). This species is typically found in shrub-steppe and grassland environments in cool intermountain basins. White tails are one of five species of *Cynomys,* they have many characteristics that make them unique. Historically, white tails have been much maligned by white settlers in the west. Aggressive, government sponsored poisoning campaigns coupled with unregulated shooting and, most recently, the introduction of an exotic disesase (Plague, *Yersinia pestis*) have worked in unison to reduce population sizes from what they once presumably were. Currently, white-tailed prairie dogs still occur across most of their historic range, but in smaller, isolated patches and at much-reduced abundance. Combined with this restriction in distribution, they are experiencing numerous external threats to their persistence, disease, habitat alteration, and direct killing for sport and pest control being of most immediate importance.

Existing regulatory mechanisms at both the federal and state levels are inadequate to protect the white-tailed prairie dog. It is incumbent on the BLM to act on this animal's behalf using existing sensitive species policies within the Bureau. Minimally necessary conservation elements include: 1. reducing conversion of land to uses not compatible with local persistence of prairie dogs and minimizing impacts of semi-compatible uses (e.g., resource extraction and livestock grazing), 2. investigating the spread of disease among prairie dogs and minimizing its impacts on prairie dog complexes, 3. controlling recreational shooting and pest control efforts aimed at killing prairie dogs, and 4. monitoring populations using a thorough and consistent methodology across white-tailed range.

Natural History

Morphology

White- tailed prairie dogs (*Cynomys leucurus*) are robust, stockily built ground squirrels, and are the largest member of the white-tailed subgenus, *Leucocrossuromys* (Clark et al. 1971). Their coat is a yellowish buff brown, streaked with black. A large patch of dark brown-black occurs above the eye and on the cheek (Clark 1987). The last third of the tail is white tipped and with a total length of 4-6.5 cm long, shorter than their black- tailed relatives (Clark et al. 1971). Adult white-tailed prairie dogs usually weigh 0.8-1.5 kg and reach a length of 34-37cm (Clark 1987). Their body pelage molts seasonally and is different between age and sex groups. Juveniles undergo a "post-juvenile" molt starting at the rump and extending anteriorly (Smith 1967). Contrastingly, adults will molt from the head to the posterior every October. Males and females will also exhibit a differential molt, with the genetalia and secondary sexual characters (8 mammae) molting soon after the head (Smith 1967). The head of a prairie dog is broad and rounded with relatively large eyes and small ears. The legs are short and powerful, each foot having 5 digits with well-developed claws for digging.

Taxonomy and Distribution

Taxonomy

The complete taxonomic classification for the white-tailed prairie dog is as follows (Clark et al. 1971): Order: *Rodentia,* Suborder: *Sciurognathi,* Family: *Sciuridae,* Subfamily: *Sciurinae,* Tribe: *Cynomyini,* Subtribe: *Spermophilina,* Genus: *Cynomys,* Subgenus: *Leucocrossuromys,* Species: *leucurus.* There are 5 species of prairie dogs in the genus *Cynomys:* Black-tailed (*C. ludovicianus*), Gunnison (*C. gunnisoni*), Mexican (*C. mexicanus*), Utah (*C. parvidens*), and White-tailed. The genus has been split into two subgenera (Clark et al. 1971, Pizzimenti 1975), with Utah, Gunnison, and white-tailed prairie dogs comprising the subgenus *Leucocrossuromys* (Hollister 1916, Clark et al. 1971). It seems that white-tailed prairie dogs are most closely related to Utah prairie dogs, but were originally lumped with black-tailed prairie dogs because of their geographic association with that species (Clark et al. 1971).

<u>Range and Distribution</u>

The majority of the national range for white-tailed prairie dogs falls within Wyoming, with substantial occupation in northern Utah and Colorado, and a very small area in southern Montana (Figure 1) (Clark 1987, Seglund et al 2004). In Wyoming, the white-tailed prairie dog range extends east of Yellowstone National Park south to the Utah border, bounded on the east by the Bighorn and Laramie Mountains and on the west by the Bear River drainage (Clark et al. 1971). Within this broadly defined range, however, only a subset of land is deemed suitable and less than this is actually occupied, making their true distribution substantially smaller than is apparent by simple range maps (e.g., Table 1, Figure 1). Although current occupancy estimates may miss some area, because not all colonies have been mapped and private land is often inaccessible, there is also reason to believe they are overestimates, because they were generally based on historic data and pre-plague burrow distributions that are not necessarily indicative of current occupation (see Inventory and Monitoring) (e.g., Seglund et al 2004, Severson and Plumb 1998, Menkens (1987), Powell et al. 1994).

Habitat Requirements

<u>General</u>

In general, it seems white-tailed prairie dogs are found in mid elevation (roughly 1,150 m to 3,050 m) grasslands and shrublands with a moderate slope (< about 20%) (Seglund et al 2004). Typically, white-tails occupy cooler, higher elevation grasslands with more abundant shrub cover than black-tailed prairie dogs. Unlike black-tails, white-tails do not clip and maintain the vegetation in a short stature for predator detection (Tileston and Lechleitner 1966). Instead, white-tails prefer to occupy habitats with more vegetative cover in the form of shrub cover to avoid predation (Hoogland 1981) and due to the difference in overall environment (e.g., plant community composition, elevation, moisture regimes) and social structure (e.g., lower population densities) (Tileston and Lechleitner 1966). White-tails are more alert on an individual basis than black-tails, and may therefore select habitats with more existing cover (Hoogland 1981), because of a lessened importance of detecting signals from cohorts. Since individuals on the colony are not as dependant upon visual and auditory signals from other residents as black-tails are, shrubs and other tall vegetation are not removed in the same manner (Orabona-Cerovski 1991). The density of both burrows and individuals are lower in white- tailed colonies than on black- tailed colonies, due to the more relaxed social structure and the diminished importance of visual and auditory signals from nearby neighbors. Mean burrow density for white- tails is 59.1 per hectare, with prairie dog density being 3.2 per hectare (Clark 1973). These levels are considerably lower than those observed for black- tailed prairie dogs (Hoogland 1981). It should be noted that burrow density is a case specific phenomenon and should not be used for population estimation for any species of prairie dog (Orabona-Cerovski 1991).

Habitat of white-tails in Colorado is described in detail by Tileston and Lechleitner (1968) as consisting of predominantly of grasses and forbs followed by shrubs and sub-shrubs (dwarf shrubs, cactus, etc.). This study also demonstrates a wide variance in total canopy cover (10%-70%) on colonies in different areas (Tileston and Lechleitner 1966), which may be explained by the variance in time occupied between the areas. Further, burrows were closely associated with slopes greater than 15%, containing shrub cover and flanking meadow type vegetation. Common plant species on or around white-tailed prairie dog towns in Colorado include: greasewood

(*Sarcobatus vermiculatus*), rabbitbrush (*Chrysothamnus nauseosus*), sagebrush (*Atriplex* spp.), and wheatgrasses (*Agropyron* spp.) (Tileston and Lechleitner 1966).

Habitat use of white-tailed prairie dogs in Wyoming is similar to elsewhere in the species' range, consisting largely of grassland, desert grassland, and shrub-steppe of intermountain basins (Clark 1987). Vegetative cover on white-tailed colonies in Wyoming generally seems similar to that found in the other parts of the species range. However, one study conducted in Shirley Basin, Wyoming (the easternmost extension of the species range) found that bare ground ($\bar{x}$ = 62%) was the most common cover type with total plant cover constituting the remainder ($\bar{x}$ = 38%) (Orabona-Cerovski 1991). Of the plant cover, grasses and sedges were the most abundant, followed by sub-shrubs and cacti, forbs and shrubs were the least common. These results parallel what was found near Meeteetse, Wyoming in a study conducted by Menkens (1987) on white-tailed prairie dog habitat. This study also fount that the vegetation cover did not vary spatially or temporally, suggesting a uniform cover in each of the colonies (Menkens 1987). Dominant plant species on colonies in eastern Wyoming include western wheatgrass (*A. smithii*), blue grama (*Bouteloua gracilis*), junegrass (*Koeleria cristata*), Indian ricegrass (*Oryzopsis hymenoides*) needle-and-thread grass (*Stipa comata*), broom snakeweed (*Butierrizia sarothrae*), prickly pear (*Opuntia polycantha*), big sagebrush (*Artemisia tridentate*), greasewood (*S.vermiculatus*) and rabbitbrush (*C. nauseosus*) (Orabona-Cerovski 1991).

Area Requirements

The smallest area needed for a successful colony of white tails is difficult to determine. Individual home ranges may be larger than those of their more restricted, territorial black tailed relatives, due to the more relaxed social structure of white tailed prairie dog colonies (Hoogland 1981). Further, in large, well connected complexes of colonies (as is typical of black-tails), individuals may use a much larger home range than when colonies are more dispersed and isolated (as is typical of white-tails). Clark (1973) found that adult females had the largest home ranges (1.9 ha), followed by juvenile males (1.2 ha), juvenile females (1.1ha), and adult males (0.9 ha). Coterie, or family group, areas are analogous to home ranges. Given that the average area for a black-tailed coterie may be about 0.3 ha (Hoogland 1995), even the white-tailed demographic class using the least area (i.e., adult males) requires more space than a family group of black tails. This suggests that for a given population level, greater land area will be required to maintain a viable white-tailed prairie dog colony, so estimates of area required for black-tailed conservation are likely not sufficient for white-tails.

Landscape Pattern

In general, white tailed prairie dogs inhabit sagebrush steppe environments found in intermountain basins throughout their range, which are dryer and cooler than those used by black tailed prairie dogs. They also occur at lower densities and their colonies are more dispersed on the landscape, making them more difficult to define for research and management purposes. However, they are still affected by many of the same threats as black-tailed prairie dogs (see Extrinsic Threats and Intrinsic Vulnerability, below). Further, white-tailed prairie dog colonies can fluctuate greatly in occupancy on a fairly short time frame (e.g., years), due in part to external impacts and to the need for prairie dogs to shift occupancy within a colony (Clark 1973, Menkens 1987). The reason for these shifts is not clear, but is likely to allow burrows to recover from things like increased parasite loads and/or plague (Anderson and Williams 1997, Tileston and Lechlietner 1966). Therefore, a fairly large area is necessary to support a sustainable population of white-tailed prairie dogs. This area must include currently occupied towns surrounded by a contiguous mix of historic towns, previously unoccupied land suitable for future towns and corridors of suitable habitat connecting these areas to other colonies (e.g., Seglund et al. 2004).

Since prairie dogs may not disperse far (under 2 miles, even in good habitat; see Migration), colonies beyond this distance apart may not be expected to be "connected" unless enough suitable intervening habitat is available for town formation. For instance, a narrow, 6-mile long corridor of suitable habitat will not likely connect neighboring colonies, so those colonies may exhibit recolonization problems in the event of a plague outbreak. Of course, given the habitat requirements of white-tailed prairie dogs, all of this must occur within a natural habitat mosaic of grassland and shrub steppe (see General Habitat Requirements, above).

Movement and Activity Patterns

Migration

Although this species does not "migrate" in the sense that neotropical and other birds do, movement of animals from one colony to another is a common, yearly occurrence. Clark (1973) believed that immigration and emigration are very important phenomena to the dynamics of populations of white tailed prairie dogs. Anderson and Williams (1997) as well as Tileston and Lechlietner (1966) both believed that emigration immediately following a plague epizootic is important for colony recovery. In fact, Menkens (1987) found that emigration to his six study towns made up 24% of the prairie dogs he trapped each year. He also found that some of the study towns the sex ratio was biased toward females. Distance traveled by immigrants can vary widely and may be a short distance to the next colony in the complex, or travels of nearly 2 miles to a neighboring colony (Clark 1973). The time period in which movement takes place is limited to either the March-April movement (breeding season) or the July-August movement (Clark 1973).

Migration and acceptance of dispersing individuals into new colonies is probably more common in white tails versus black tails because of their more relaxed social structure (Tileston and Lechleitner 1966; Clark 1973a; Hoogland 1979a). Immigration appears to be an important part of white-tailed prairie dog population stability, and may be especially useful for repopulation of colonies after sharp declines (CNE et al, 2002).

When comparing the juvenile biased dispersal system of black tails to the adult biased systems of white tails, Grant (1995) speculated that juvenile dispersal may be less important because of the high levels of adult mortality during winter. Therefore, juveniles don't need to disperse to avoid inbreeding on their natal colony.

Phenology

A diurnal pattern best describes white- tailed prairie dog activity. Sunrise to 0900 and 1500 to sunset are the peaks of activity on a colony during mid summer (Clark et al. 1971). This pattern is largely driven by the temperature at ground level during these months (June- August), which can be too hot for extended activity above ground (Grant 1995). However, in early season (February-April) and late season (September – November) the peak of activity is unimodal and occurs around 1300 (Clark et al. 1971). Activity is most common between the temperatures of 15º to 70º F (Grant 1995), although short bouts of activity can occur between the temperatures of 75º to 80º F (Clark et al. 1971). Activity bouts can be affected by high wind speeds (exceeding 11 m/s) (Grant 1995).

Daily behaviors observed by Orabona-Cerovski (1991) indicate that white- tails spend about one third of their time above ground feeding ($\bar{x}$ = 36%) and one third sitting erect ($\bar{x}$ = 33%) possibly scanning for predators. Sitting horizontally accounts for 16% of the daily activity. The remainder of the behaviors (running, vocalizing, fighting, playing, kissing, digging, grooming) made up the remaining 15% of time spent above ground (Orabona-Cerovski 1991).

White- tailed prairie dogs are obligate hibernators, contrasting their close counterparts, the black- tailed prairie dog (Hosch 1999). Hibernation usually follows a pattern of 20 days of torpor interspersed with 1 day of arousal for white- tailed prairie dogs (Hosch 1999). Induction of the hibernation torpor is a coordination of nervous and endocrine cues to multiple organs, but the mechanism in the environment that signals a prairie dog to hibernate is still not understood (Hosch 1999). Experiments testing hormonal manipulation and food intake have not clearly illustrated what drives white- tailed prairie dogs to hibernate (Hosch 1999).

Seasonal behavior of this species is described in detail by Clark (1973) and Grant (1995). Emergence of the first individuals will occur sometime in February, consisting of two year old males or older (Clark 1973), and appears to be independent of surface conditions (Clark et al. 1971). These animals may dig through snow to reach the surface and sit for short periods of time (Clark 1973). Thereafter, other adults of mixed sex and age will emerge gradually until about mid March (Clark et al. 1971). Juveniles will emerge in late May (Clark 1973). Colony activity is at its highest at this point and will not begin to decline until late July, when adult males begin to disappear below ground (Clark 1973). Adult females will then begin to descend into burrows two to three weeks later (Clark 1973). Most juvenile males and females will begin to hibernate in late October or early November, allowing juveniles to be active above ground a full 1 to 2 months longer than their adult counterparts (Clark et al. 1971).

Reproduction and Survivorship

Breeding

The breeding biology of the white-tailed prairie dog is similar to that of the black-tailed prairie dog. Both species are harem polygynous, meaning that one or few males control a coterie of females and their offspring that often comprise a system of several burrows. However, their different habitats and social structure likely cause subtle differences in breeding system. For example, females on the colonies studied by Bakko and Brown (1967) displayed some breeding synchrony, which has not been found in black-tails.

Males are the first to emerge from hibernation in early March, usually between 2 and 3 weeks before females appear (Bakko and Brown 1967). These males usually have a thick layer of subcutaneous fat, presumably for the increased energetic demands of breeding in the month to come. Research states that at least three of the prairie dog species (black-tailed, Gunnison, and Utah) are sexually receptive for a period of only several hours during one day each year (Hoogland 2001), which may also be true for white tailed prairie dogs. Copulation occurs sometime during late March and early April (Erpino 1968). White- tailed prairie dogs usually breed at 1 year of age, produce 1 litter per year and have a gestation period of 30 days (Clark et al. 1971). Females will nurse the young until sometime in the middle of June; this indicates that the juveniles are about 5-7 weeks old when they first appear above ground (Tileston and Lechleitner 1966). The juveniles will begin to forage above ground at this time, gaining weight rapidly until they reach adult size in October (Clark 1973).

Fecundity and Survivorship

The average litter size for white-tailed prairie dogs is between 5 and 6 pups (Bakko and Brown 1967). Approximately 60% of white-tailed prairie dog pups emerge from their natal burrow (Tileston and Lechleitner 1966). Menkens and Anderson (1989) found no differential survival rates between sexes or between juveniles and adults as long as the colonies were not exposed to shooting or poisoning. Annual survival for colonies near Laramie, Wyoming was highly variable, ranging from 9% to 70% over 3 years on colonies that were probably not affected by plague

(Menkens 1987). On colonies with plague, it is not uncommon for all pups to die before their first winter.

Clark *et al*. (1985) created white-tailed prairie dog survivorship curves by aging cranial remains found in colonies from two colonies in Wyoming and one colony in Utah. All three colonies offered similar results wherein approximately 90% of white-tailed prairie dogs that emerge survive one year, 65% of those animals survive to age two, 20% of those animals survive to age three, and survival past age three is minimal.

Population Demographics

Metapopulations and Genetic Concerns

Metapopulation dynamics for all 5 species of prairie dogs are poorly understood. More research is needed in this area to address how large and small colonies interrelate over short and long distances. Research conducted on emigration and immigration of individuals is presented in the "movement and activity patterns" section. Understanding this movement is critical to understanding the genetic differentiation of prairie dogs and how it might be impacted by fragmentation and isolation of population segments. To date, there have been no studies investigating genetic structure (bottlenecking, stabilized, etc) of white tail populations on a complex or range-wide level (see Information Needs, below).

Food Habits

Prairie dogs consume a wide variety of foods. Herbivory in the forms of grasses, forbs, shrubs, cacti, seeds and roots are very common, but animal matter, usually insects and sometimes carrion, is eaten as well (Crocker-Bedford and Spillett 1981, Uresk 1984, others summarized in Seglund et al. 2004). Food habits of white-tailed prairie dogs loosely follows that of black-tailed prairie dogs in form of vegetation consumed (Clark et al. 1971), however, white-tails will preferentially consume sedges rather than forbs (Tileston and Lechleitner 1966).

The amount and timing of food resources, particularly succulent green vegetation, is critical for prairie dog survival, as noted by Seglund et al. (2004):

> White-tailed prairie-dogs inhabit unpredictable, heterogeneous environments with short growing seasons and thus do not remain active throughout the year. During active periods, they must mate, give birth, and build fat stores within a limited time frame, thus the quality and quantity of vegetation available to individuals is an important mechanism in survival and/or reproductive ability (Beck 1994). High quality forage is considered necessary for reproductive females that double their daily energy requirements to support reproductive needs and for accelerated ontogeny in juveniles (Crocker-Bedford and Spillett 1981). The amount of available cool season forage was correlated with Utah prairie-dogs density estimates (Crocker-Bedford 1976). Rayor (1985) found that Gunnison's prairie-dogs colonies located in habitats with higher quality vegetation resulted in Gunnison's prairie-dogs having a greater mass, accelerated sexual maturity, and earlier dispersal than colonies located in lower quality vegetation sites…. Prairie dogs lack an effective system for conserving water (Vorhies 1945, Schmidt-Nielsen and Schmidt-Nielsen 1952) and obtain most of their needed liquid from the plants they eat. White-tailed prairie-dogs can become water stressed during their active season if sufficient succulent vegetation is not available.

Kelso (1939) found that grasses, especially western wheatgrass (*Agropyron smithii*) and six-weeks fescue (*Festuca octoflora*) were most important followed by forbs such as Russian thistle (*Salsola australus*). Prickly pear cactus (*Opuntia* spp.) and shrubs such as saltbush (*Atriplex* spp.) were less important food items for black-tailed prairie dogs. White-tails will consume shrubs such as saltbush (*Atriplex* spp.) and sagebrush (*Artemisia* spp.) upon first emergence in early spring (Tileston and Lechleitner 1966). They will then switch to greening grasses and sedges such as western wheatgrass (*Agropyron smithii*) and foxtail barley (*Hordeum jubatum*). Contrasting to black- tails, white- tails do not dig up or consume root material (Tileston and Lechleitner 1966). Prairie dogs, and ground squirrels in general, will also consume animal protein, usually in the form of carrion, when such becomes readily available, as evidenced by consumption of prairie dog carcasses and meat-bait placed at live trapping stations in central Wyoming (Keinath, unpublished data).

Seasonal change in diet is very common, probably reflecting a shift to the most protein rich forage available for that season (Koford 1958). Feeding activities of black- tailed prairie dogs has been described as “aimless wandering”, whereas white-tails have more focused feeding areas and patterns (Tileston and Lechleitner 1966). The grazing of black-tails is thought to be more intense, however, because of the concentrated nature of the colonies (Detling and Whicker 1987). Therefore, species composition shifts may occur on black- tailed colonies, but not on white- tailed colonies (Tileston and Lechleitner 1966).

Much controversy has arisen on the food habits of prairie dogs due to the potential for competition with domestic cattle. However, dietary overlap has been shown to be minimal (Uresk 1984) and prairie dogs utilize several species that are not especially palatable to livestock. Stocking levels in areas cohabitated by cattle and prairie dogs is crucial to maintain a healthy range condition, and minimize competition between prairie dogs and cattle. In fact, it has been shown that prairie dogs enhance forage for a variety of grazers such as pronghorn, bison (Krueger 1986) and cattle (Knowles 1986).

Conservation

Conservation Status

Federal Endangered Species Act

A formal petition was filed on July 11, 2002 by a collaborative group[1] to list the white-tailed prairie dog under the Federal Endangered Species Act (ESA) (CNE et al. 2002). On November 9, 2004 the United States Fish and Wildlife Service released a "90-day" finding indicating they deemed current information did not warrant listing of this species at this time (USFWS 2004). There rational were summarized as follows:

> We have reviewed the petition, the Conservation Assessment [Seglund et al. 2004], and other information available in our files. Based on our review of this information, we find there is not substantial scientific or commercial information to indicate that listing the white-tailed prairie dog may be warranted at this time. Both the petition and the Conservation Assessment note that plague is the most important factor effecting white-tailed prairie dog population dynamics and the long-term viability of the species. However, the lack of long-term data or a detailed understanding of plague and white-tailed prairie dog dynamics indicate that substantial information is not available to determine that plague is a threat which may warrant the listing of this species. Plague (which occurs across the entire range of the species) and the conditions under which white-tailed prairie dogs are affected, both epizootically and enzootically, population responses to plague, and ensuing long-term population viability, require further evaluation. Likewise, the impacts of present and threatened destruction, modification, or curtailment of habitat are inadequately known to constitute substantial information that listing may be warranted.

[1] Center for Native Ecosystems, Biodiversity Conservation Alliance, Southern Utah Wilderness Alliance, America Lands Alliance, Forest Guardians, Terry Tempest Williams, Ecology Center, and Sinapu

It seems that the essential reason for denial was lack of credible information on trends and impacts. As typical of this type of judgment, the USFWS acknowledges the need to track further information, but the outcome cannot be predicted.

Bureau of Land Management

Of the four concerned states, the Wyoming and Montana State Offices of the Bureau of Land Management (BLM) list the white-tailed prairie dog on their sensitive species lists (USDOI BLM Wyoming 2001). As stated in the BLM Manual 6840, this designation is meant to provide protection for species with respect to BLM land management actions that is at least equivalent to the federal policy for candidate species under the Federal Endangered Species Act. This generally means that the BLM must review programs and activities to determine their potential effect on these species.

Forest Service

The range of the white-tailed prairie dog encompasses portions of 3 forest service regions; the Northern Region (R1), the Rocky Mountain Region (R2), and the Intermountain Region (R4). According to the last master list of regionally designated sensitive species (USFS unpublished data from 2000), only the Northern Region formally designated it as a sensitive species. However, following reevaluation as part of its Species Conservation Project, Region 2 now lists the white-tailed prairie dog on its sensitive species list (http://www.fs.fed.us/r2/projects/scp/). These designations evolve from Title 2600 of the Forest Service Manual, as supplemented and amended (e.g., http://www.fs.fed.us/im/directives/).

State Wildlife Agencies

The white-tailed prairie dog is afforded very little formal protection in any of the states within its range. Moreover, it is generally viewed as a game or pest species, so the direct killing of prairie dogs is actually encouraged in many circumstances. This establishes a non-productive management environment in which some agencies are striving to conserve the same animals that others are trying to destroy.

Prairie dogs are classified as small game species in Colorado (CWC Regulations, Chapter 3, Article 1), which requires people to purchase a small game license in order to kill them. However, the "hunting" season is open year-round with no bag limits or possession limits, and "toxicants" are an acceptable method of take, making poisoning campaigns legal.

Montana Fish Wildlife and Parks lists the white-tailed prairie dog as a critically imperiled Species of Concern, and also as "nongame wildlife in need of management" through the Nongame and Endangered Species Conservation Act of Montana (87-5-101, MCA et seq.). Shooting prairie dogs has thus been banned on public lands, but poisoning is still permitted and the Montana Department of Agriculture provides assistance to private landowners in this regard.

In 2003, the Utah Division of Wildlife Resources added the white-tailed prairie dog to its Sensitive Species List, but has not taken steps to develop a commensurate management plan. Therefore, it is still treated as a nongame species (Rule 657-19), which restricts live capture operations but still allows year-round direct killing (shooting and poisoning) with no license and no bag or possession limits. However, killing on public lands is now prohibited from April 1 - June 15 and no-take is allowed in the designated black-footed ferret Primary Management Zone in eastern Uintah County.

Wyoming Game and Fish Department lists the white-tailed prairie dog as a non-game species with a status rank of NSS4 (NSS1 is imperiled and NSS7 is abundant) (Oakleaf et al. 2002). However, they have no management plan in place and killing prairie dogs in unrestricted. Further, the Wyoming Department of Agriculture lists prairie dogs as pests (Weed and Pest Act of 1973, WS 11-5-101 to 11-5-119) and thus support population control efforts including poisoning.

Heritage Ranks

The Natural Heritage Network assigns range-wide and state-level ranks to species based on established evaluation criteria (e.g., Keinath and Beauvais 2003, Keinath et al. 2003, Master et al. 2000). White-tailed prairie dog merits a global rank of G4, which means that when the rangewide population is considered, it is deemed by Heritage scientists to be Apparently Secure. This is based on a synthesis of state ranks and biological evidence from state Natural Heritage Programs (NatureServe Explorer 2004).

Each state containing white-tailed prairie dogs also assigns a state-level rank to that portion of the range within its borders (Figure 2). Only four states contain white-tailed prairie dogs and their assigned ranks run the gamut of values: Colorado (S4), Montana (S1), Utah (S2?), Wyoming (S3) (NatureServe Explorer 2004). In general, state ranks are assigned based on the assessed risk of extinction within a state, where S1 species are deemed critically imperiled and S5 species are deemed demonstrably secure. Question marks (?) indicate that the rank is uncertain, generally due to lack of information on population status. These assessments are based on biological information on population status, natural history, and threats at the state level. Wyoming's rank of S3 is based on evidence suggesting that the range within Wyoming is large, but that range occupation is low relative to pre-plague levels, prairie dogs exhibit high biological vulnerability, and there are substantial external threats (Keinath et al. 2003, WYNDD unpublished data). This and other Heritage ranks are reevaluated semi-annually to incorporate new information.

Biological Conservation Issues

Abundance and Abundance Trends

Quantitative information is limited to state by state accounts of how many acres of active white tailed prairie dogs occur; no range-wide estimate is currently available. Those white-tailed prairie dog surveys that do exist have used varying methodologies, have not always clearly specified occupied or unoccupied habitats, and have been conducted in areas of varying size (USFWS 2004, Seglund et al.2004). Moreover, data were generally collected to determine habitat suitability for black-footed ferret reintroduction, so there is no population or trend information for smaller colonies and complexes and concerns have been raised as to the accuracy of black-footed ferret survey data as a tool to evaluate the status of white-tailed prairie dog populations, largely due to the questionable correlation between counts of active burrows and densities of actual animals (e.g., Menkens 1987, Severson and Plumb 1998, Powell et al. 1994).

However, despite such caveats, some information can be gleaned from existing survey information. By adding together all mapped colonies in the last 10 years, NWF and ED (2002) estimated 563,670 active acres, but stress that the estimate is not inclusive of many towns that have not been mapped. Also, the current status of many previously mapped towns is unknown. Recent acreages by state have been estimated and are represented in Table 1. The most acres of active white tailed prairie dog colonies currently exist in Wyoming which is home to between 65% and 71% of the range of the species (NWF and ED 2002, Seglund et al. 2004). Large complexes in Shirley Basin, Wyoming and northwest Colorado account for between 50% and 75% of all white-tailed prairie dogs (Table 2). Estimates of occupied acreage show around 186,000 hectares of active white tailed prairie dog colonies in Wyoming (Table 1), the major concentration being in the Shirley Basin. Based on interviews with local field personnel, Colorado may currently have about 77,600 hectares of active colonies and an additional 19,000 hectares where colony status is unknown (CDDOW 2003), although the actual status of even the occupied acreage is questionable given infrequent and inconsistent monitoring efforts.

Rangewide, the abundance of white-tailed prairie dogs has greatly decreased since such information has been recorded (Seglund et al. 2004), but more local estimates are less clear due to small scale shifts in abundance. The take home message regarding abundance is that white-tailed prairie dog populations are highly dynamic, fluctuating rapidly in both actual abundance and occupied acres (Menkens and Anderson 1989, Wolf Creek Work Group 2001). These small-scale fluctuations are generally caused by concurrent changes in the quantity and quality of forage due to grazing, resource extraction and fire suppression, as well as the influences of disease and predation (Menkens and Anderson 1989, Seglund et al 2004, Orabona-Cerovski 1991, Anderson and Williams 1997, Seglund et al 2004). Data on specific complexes is presented below.

Data on Wyoming populations is sparse and inconsistent, so trend estimates are based on relatively small portions of two complexes (Meeteetse and Shirley Basin) that received increased attention due to black-footed ferret research and ad hoc information from a few other sites. Considering available information provided by Wyoming Game and Fish Biologists (Grenier and Luce in Seglund et al. 2004), it seems the abundance of white-tailed prairie dogs in large Wyoming complexes:

1. Declined substantially during the first half of the 20th century, perhaps showing a reduction in occupied area as great as 99%. This was likely due to a combination of pest control efforts, habitat conversion by humans, and plague.
2. Was largely undocumented in the latter half of the 20th century until wild black-footed ferrets were re-discovered.
3. Crashed drastically during the 1990s, probably resulting from plague impacting complexes already reduced by the below-noted extrinsic threats.
4. On the whole increased during the last few years to levels nearly matching the late 1980s, but continue to fluctuate dramatically at the local scale.

Regarding the Meeteetse complex in particular, the Department of Agriculture Animal Damage Control estimated nearly 200,000 acres of active white tailed prairie dog colonies existed in 1915. Only 12,172 acres existed when the last black footed ferrets were discovered on the site in 1981. This declined to less than 1,000 acres by the end of the 1990s, demonstrating a 99% decline in acreage (NWF and ED, 2002). It has been suggested that after a precipitous decline in the early 1990s, due in large part to plague, these numbers have begun to increase (Grenier and Luce in Seglund et al. 2004), although the most recent estimate of 7,095 prairie dogs along transects is still far below it's level of 25,494 prairie dogs only 9 years before. Trends in the Shirley Basin, the second and larger of the two surveyed complexes, are less clear. Huge fluctuations in recorded abundances along transects precluded a trend analyses, so a qualitative assessment that abundance is currently increasing following large declines in the mid 1990s was made by state game and fish biologists (Grenier and Luce in Seglund et al. 2004).

Repeatedly surveyed areas in Colorado generally experienced large-scale declines in abundance during the early-mid 1980s, with a partial rebound late in the decade, although several populations never recovered (surveys summarized by Seglund et al 2004). Trends of individual colonies within complexes were often unrelated. Many colonies further showed drastic decreases in occupied area concurrent and following those of the 1980s; up to a 92% decline in occupied area from 1990 to 1999 (Squires et al. 1999).

Based on four black-footed ferret management areas, the overall pattern in Utah populations seems to show declines during the late 1990s, followed by a sharp increase in 2002, and decreases in subsequent years (Seglund et al. 2004). Regardless of overall trend, individual colonies seem to fluctuate in abundance from year-to-year, often dramatically, and may have not recovered to former levels following declines. For instance, abundance at Shiner Basin declined from 47,551 in 1998 to 5,383 in 1999 and remains extremely low today.

Distribution and Connectivity Trends

It appears that the extent of the range of white tailed prairie dogs has not changed much from presettlement times, but there is evidence that occupied habitat within that range has decreased (Knowles 2002, Seglund et al 2004) and it is likely that colony connectivity has decreased as well, due to the varied extrinsic threats to their persistence (see Extrinsic Threats). However, despite recent attempts to estimate white-tailed prairie dog distribution by several states and agencies, inconsistencies in methodology and lack of historic data have precluded reliable trend estimates except at very local scales or roughly at the range-wide level (Seglund et al 2004).

Habitat loss to agricultural conversion or urbanization do not seem to be an important factor in the decline of the species over much of the range. Only in the small portions of Montana and in the Bighorn Basin, Wyoming does agricultural conversion to irrigated crops seem to pose a serious threat to populations there (NWF and ED, 2002).

Although anecdotal and often conflicting guesses abound, due to inconsistent survey effort, methods, and documentation, there is no valid estimate for trends of the distribution of white-tailed prairie dogs in Wyoming. Even the two most heavily surveyed areas seem to provide conflicting reports. Wyoming biologists reported substantial declines in occupied area for the Meeteetse complex followed by some local increases after remapping efforts (Biggins 2003, Luce 2000). Although no information on historic occupancy was provided, studies suggest recent increases in occupied area within the Shirley Basin complex (Seglund et al. 2004, Grenier et al. 2002), which coincide with abundance increases following the precipitous declines of the early 1990s (see above), however it is unclear if this increase in area approaches historic occupancy levels. Other ad hoc surveys and anecdotal reports have suggested both large declines and large increases in occupied area, with no statewide trend discernable (Seglund et al. 2004). The picture is further clouded because recent methods used to delineate colony boundaries may artificially inflate acreage estimates compared to previous methods (Albee 1993, Seglund et al. 2004). A consistent, long-term effort to regularly sample a subset of colonies across the state is needed to reduce the current "guesswork" associated with distribution trends in Wyoming (see Information Needs).

Trends in occupied area in Colorado and Utah are similarly confusing. Data from Colorado show fluctuating proportions of area occupied and within-colony shifts in active burrows between survey efforts. The total change in occupation since ferret habitat surveys have been conducted (roughly 1986 to 2002) seems to follow abundance patterns, which are negative over this time frame (Seglund et al. 2004). In those Utah colonies for which area occupied estimates are available for multiple years, several experienced large declines, several others experienced increases, and a handful remained relatively the same (Seglund et al. 2004).

Extrinsic Threats

Anthropogenic Impacts

Anthropogenic impacts to prairie dogs generally fall into two main categories: direct killing and habitat alteration, which are discussed below.

Direct Killing

Prairie dogs are directly killed by humans through rodent control efforts (e.g., poisoning and systematic shooting) and sport shooting. Intentional poisoning and eradication programs have been prominent in the past, and still occur in many areas due to long-standing views of prairie dogs as pests (Reading and Kellert 1993). Most federal and state land and wildlife management agencies were directly responsible for the large-scale extirpation of prairie dogs from millions of hectares (Anderson et al. 1986, Mulhern and Knowles 1995, Miller et al. 1996). Despite clear evidence contradicting many of the detrimental aspects of prairie-dogs, government-endorsed poisoning continued into the 1990's (Mulhern and Knowles 1995) and private efforts continue to this day (e.g., Smith et al 2005, WYNDD unpublished data). Such efforts are specifically aimed at exterminating prairie-dogs and therefore have substantial and undeniable negative impacts on populations.

Recreational shooting of all species of prairie dogs still occurs throughout their ranges (Mulhern and Knowles 1995, Seglund et al 2004), with peak shooting pressure occurring in May - June, when weather is cool, juveniles are emerging, lactating females are vulnerable. Shooting pressure causes serious demographic and population declines (Pauli 2003, Gordon et al. 2003, Knowles 1988, Stockrahm and Seabloom 1988, Voshburgh 1999, Vosburgh and Irby 1998). Not only are substantial numbers of animals killed by shooters, but surviving animals often abandon the town (Gordon et al. 2003, Keffer *et al*. 2000) or have reduced fitness (Buskirk and Pauli 2003, Stockram and Seabloom 1988). For instance, Keffer et al (2000) showed that when 23% of the prairie dogs on one town were shot, 69% of the remaining prairie dogs emigrated from the town. When only 8.8% of the prairie dogs were being shot, emigration was not detected.

Habitat Alteration

Habitat alteration can be local and drastic (e.g., a prairie dog colony becomes a suburban parking lot) or more subtle and widespread (e.g., forage quantity deceases from over-grazing or formerly contiguous colonies become fragmented by an oil field). Generally, prairie dog populations are negatively impacted when human activity causes one or more of the following to occur:

1. forage quality or quantity is reduced, often in specific seasons

2. soil is compacted and cryptogamic crusts are destroyed, thus hindering germination and altering soil hydrology
3. soil becomes unable to hold a burrow
4. colony connectivity is reduced
5. predation (and shooting pressure) is artificially increased, usually due to roads and power lines
6. stress from increased human presence decreases prairie dog fitness

A wide range of activities have been shown to result in one or more of these habitat alterations and thereby reduce prairie dog populations: crop production (Dinsmore 1983, Knowles 2002), livestock grazing (among others: Abdel-Bagind et al. 1987, Beck 1994, Cottam 1961, Collier and Spillett 1975, Fleishner 1984), resource extraction (especially petroleum extraction when well density is high; Clark 1986, USFWS 1990), fire suppression (Crawford et al. in press), recreation, road development (Gordon et al. 2003), and urban development. The take-home message is that any activity altering the natural state of the landscape has the potential to impact prairie dogs through a variety of mechanisms and that such activity is common on the western landscape. We expound on a few such issues below.

Petroleum development and agriculture are the most frequently cited as being of immediate conservation concern, and there is ample evidence to support this assertion (Seglund et al. 2004). Oil and gas development is currently occurring at unprecedented levels, with substantial expansion expected in the future, making it an ever increasing threat. In Wyoming, 77% of the white-tailed prairie-dog predicted range is being developed at some level for oil and gas, Colorado has 4,953 wells and Utah has 8,835 wells in the predicted distribution of white-tailed prairie dogs (Seglund et al. 2004). Even when petroleum activity does not directly eliminate active burrows, it has been shown to be detrimental to prairie dog populations and much occupied habitat has been classified as valuable for oil and gas extraction activity, particularly in Colorado and Wyoming (Seglund et al 2004, USFWS et al 2001). In contrast, land conversion to cultivated crops has likely plateaued or declined (e.g., http://www.ag.state.co.us/, http://www.wy.nrcs.usda.gov) and is therefore has less potential for future harm than petroleum development. Further, if farmers allow prairie dogs to occupy areas adjacent to crops and forage on those crops, there may actually be benefits to prairie dogs (Crocker-Bedford 1976).

The high elevation intermountain basins where white-tails occur are used mostly for livestock grazing, which, when practiced appropriately and without extermination efforts, is more compatible with prairie dog persistence than cultivation.

Invasive Species

Like most native species, white-tailed prairie dogs are increasingly impacted by invasion by exotic flora and fauna. The most noxious example in this case is cheatgrass (*Bromus tectorum*), which is spreading throughout the range of white tails (e.g., Boshcen 1986). Cheatgrass out-competes native species for moisture and does not provide late-season nutrition for herbivores (Whitson et al. 2000, Stubbendieck et al. 1997), potentially decreasing the ability of prairie dogs to add sufficient fat reserves for winter survival.

Other Factors

Natural preditors of white-tailed prairie dogs include black-footed ferrets, various hawks, golden eagles, badgers, and coyotes. Survivorship of adult white tails seems to be quite low (see survivorship section), so natural predation could an important part of the survivorship of adults and therefore the population dynamics of the colony. In healthy populations, however, natural predation does not seem to pose a threat long term survival (King 1955, Clark 1977), since these predators have evolved in the prairie ecosystem using prairie dogs as a prey source for millennia without causing extinction or radical declines in the overall populations. In populations impacted by other extrinsic factors, predation could have a greater influence.

In healthy populations, stochastic factors such as weather events should not play a large role in the long-term status of a species. However, in combination with other stresses, such as those discussed above, extreme weather events become much more detrimental to persistence. It has been suggested that the recent drought conditions in many western states has negatively impacted white-tailed prairie dog populations, as evidenced by decreases in diet quality, mid-winter emergence from hibernation, and associated (although untested) reductions in survival and reproduction (Seglund et al. 2004).

Very little information is available on the genetic health of white-tailed prairie dogs, and more research is certainly warranted. Pizzementi (197?) completed some research suggesting the age of the species and subgenus *Leucocrossuromys*, but did not elaborate on the long-term genetic profile of the white tailed prairie dogs.

Intrinsic Vulnerability

Disease

Plague (*Yersinia pestis*), is considered to be the primary factor limiting white-tailed prairie dogs today (Cully and Williams 2002, Heller 1991, Seglund et al. 2004). *Y. pestis* is an exotic bacterial disease that first invaded the United States just before the turn of the century. It was first discovered in black-tailed prairie dogs in the 1940’s in Texas (Culley 1989) and in white-tailed prairie dogs at about the same time in Wyoming (Eskey and Haas 1940). The disease may be cyclic in nature, with epizootics arising every 5-7 years (Culley, pers. comm.), removing as much as 86% of a colony's population each time (Anderson and Williams 1997). This disease has a profound impact on populations of prairie dogs, which have no immunity. Black-tailed prairie dog towns have shown 100% mortality within one season and epizootics can spread across whole complexes in a few years (e.g., Anderson and Williams 1997, Cully and Williams 2001, Rayor 1985). Although transmission rates in white-tailed prairie dogs may be slower and less dramatic, declines are still very high (85% - 90% mortality) (Anderson and Williams 1997, Clark 1977). Moreover, since white tails occur at lower densities and have a smaller geographic range, plague may be a greater conservation concern than for black-tailed prairie dogs (NWF and ED 2002). In Colorado, fluctuations in monitored white-tailed prairie dog populations likely all due to disease, primarily plague and some populations have not recovered following the last major outbreak more than nine years ago (Seglund et al 2004). Nearly all Wyoming populations of prairie dogs have witnessed declines due to plague outbreaks.

Tularemia and West Nile virus have also been shown to cause mortality in prairie dogs, but their population-level effects are currently uncertain and overshadowed by the imminent threat from *Y. pestis* (Barnes 1982, Seglund et al. 2004). Once plague impact has been mitigated, further research should be conducted on these diseases.

Habitat and Area Restrictions

The potential for epizootics, mass die-offs, and the need for refugia from which land can be recolonized suggests that very large and relatively contiguous complexes may be necessary for the long term persistence of the species (see Habitat and Landscape Context). The area required for colony establishment is flexible, but generally greater than for that of black tailed prairie dogs. Average home range sizes for adults range from 1 to 2 ha. (Clark 1973), suggesting that these sizes may be the minimum area needed to meet energetic demands.

White tailed prairie dogs utilize sage steppe environments in intermountain basins. This habitat selection is very consistent, with no observed use of other habitat types such as forest, desert, etc.

Due to the colonial nature of these animals, there is a high fidelity for their habitat , once selected. Emigration from selected colonies has been observed under pressure from shooting (for black tails), but it is reasonable to assume that most adults will experience little in the way of large movements to different habitat types during their lifetime.

When compared to the highly aggressive and territorial nature of black tailed prairie dogs, white tails have a much more relaxed social structure (Hoogland 1981). Clans of white tails tend to occupy familiar burrow systems, however, members of different clans will feed together and not will not show aggression to non-clan members when they approach burrows other than their own. Both Tileston and Lechleitner (1966) and Clark (1973) were unable to clearly delineate territory boundaries, but could recognize family groups.

Dispersal Capability

As discussed above in the "movements and activity" section, emigration is possible for white tailed prairie dogs, and may be an important part of their ecology. However, due to the species dependence upon burrows for protection from many predators, prairie dogs may be more vulnerable to predation while moving in the open from one colony to the next. In general, prairie dogs will not be able to readily avoid the extrinsic threats presented to them by dispersing from areas affected by forces such as habitat loss, shooting, poisoning, and disease.

Reproductive Capacity

Although they do not have a naturally low reproductive rate, fertility rates may be depressed by external stresses, for instance plague (Clark 1973). The mechanism by which these effects are enacted is unclear (death before or after birth, etc.), but effects are clearly evident. Sexual maturity is delayed in white tails just as it is in other species of prairie dogs, further reducing the reproductive capacity of the population as a whole. White-tailed prairie dog reproduction has not evolved toward rapid population replacement, which magnifies the effects of plague, poisoning, recreational shooting, and habitat loss (CNE et al. 2002).

Conservation Action

Existing Conservation Plans

There are no legally binding conservation or management plans in place for the white-tailed prairie dog in any portion of its range. The White-tailed Prairie Dog Conservation Assessment (Seglund et al. 2004) drew together a body of experts from each state to evaluate status and make conservation recommendations, but this is purely a guidance document and will only be effective if state and federal agencies and the public use it to influence policies, for example by restricting shooting and poisoning or mitigating indirect take. The Montana Prairie Dog Working Group produced a similar guidance document (Knowles 2002) which provides numerous recommendations but similarly lacks a mechanism for implementation. Until documents such as these formally influence extrinsic threats to prairie dogs through concrete and enforceable actions of state wildlife departments and federal land management agencies, existing mechanisms are inadequate to conserve the white-tailed prairie dog.

Wyoming in Context

When reviewing necessary conservation measures, the reader must be aware that Wyoming BLM carries the most responsibility for the range-wide persistence of white-tailed prairie dogs. The vast majority of white-tailed prairie dog habitat (75%) occurs in Wyoming, followed by 13% for Utah, 11% for Colorado, and <1% for Montana (Seglund et al. 2004). Over half (54%) of the Wyoming range falls on lands administered by the BLM, with most of the rest falling on private land. Thus, if white-tailed prairie dogs attain critical status (e.g., listing under the US Endangered Species Act), the Wyoming BLM will bear the brunt of recovery expense. It is therefore critical that BLM land managers be proactive in their conservation of white-tailed prairie dogs and act upon the conservation elements noted below.

Conservation Elements

Existing regulatory mechanisms at both the federal and state levels are inadequate to protect the white-tailed prairie dog (Seglund et al. 2004). Until these mechanisms become more effective, it will be incumbent on the BLM to act on this animal's behalf using existing sensitive species policies within the bureau. The following are minimally necessary conservation elements that the Wyoming Bureau of Land Management should consider to insure persistence of white-tailed prairie dogs in Wyoming and throughout their range. Each is expounded upon in subsequent sections.

1. Habitat Conservation: Reduce conversion of land to uses not compatible with local persistence of prairie dogs and minimize impacts of semi-compatible uses including livestock grazing and resource extraction.
2. Disease Control: The spread of disease among prairie dogs should be investigated and management should seek to minimize its impacts on prairie dog complexes.
3. Shooting and Extermination Control: Unless strictly controlled, recreational shooting and pest control efforts aimed at killing prairie dogs are not compatible with healthy populations.
4. Monitor Populations: Current monitoring efforts are insufficient to generate reliable and comparable trend information and are therefore inadequate to track the future of white-tailed prairie dog populations. A thorough and consistent methodology must be applied in Wyoming and across white-tailed range, as discussed in the Inventory and Monitoring section below.

Element 1: Habitat Conservation

In order to insure the long-term viability of white-tailed prairie dogs, Wyoming land and wildlife managers need to reduce conversion of land to uses not compatible with local persistence of prairie dogs (e.g., crops, human settlement; see above section on Extrinsic Threats). This should occur on both occupied and unoccupied white-tailed prairie dog habitat including corridors for inter-population dispersal and colony expansion (Seglund et al 2004).

Where land conversion does not wholly eliminate white-tailed prairie dogs, steps should be taken to minimize or eliminate impacts. For instance, when considering oil and gas development:

1. Suitable habitat and current colonies should be mapped on all proposed exploration and development sites PRIOR to those activities.
2. Mapped information should be analyzed by unbiased prairie dog biologists to determine local population densities, quality of habitat, spatial distribution of colonies and habitats, potential inter-patch dispersal needs, and how drilling activity might impact these metrics. If drilling must occur, this information can then be used as a baseline to quantify impacts.
3. When analyses noted above suggest drilling may have a negative impact on local prairie dogs, drilling should either be relocated elsewhere or impacts should be mitigated to acceptable levels, for example as follows:
   a. As much as possible, wells and roads should be located outside areas of current and recent prairie dog occupation and outside suitable habitat adjacent to occupied areas. This may entail directional well drilling or secession of certain areas.
   b. Timing restriction can be placed such that vehicle traffic occurs predominantly when prairie dogs are least active.

c. Drilling activities can be seasonally restricted to times when prairie dogs are least active (e.g., winter) and less environmentally stressed.

4. In those areas where drilling occurs on or near prairie dog towns, monitoring of key population metrics (e.g., active burrow density, prairie dog abundance, reproductive output, mortality, town boundaries, etc.) and development statistics (e.g., well density, road density, traffic levels, well proximity to burrows, etc.) should occur at least semi-annually for the duration of drilling activity. This information can be used to determine if and how drilling activities are impacting prairie dogs at that sight.

When considering livestock management; in currently occupied white-tailed prairie dog complexes, maintain stocking rates and grazing practices that do not deplete the availability of cool-season grasses and do not facilitate the encroachment of shrub cover (Seglund et al 2004). A brief set of specific practices promoting the ecological health of systems containing white-tailed prairie dogs was presented by Seglund et al. (2004) as follows:

1. Reduce grazing pressure by allowing periodic rest from grazing, deferring grazing during periods of critical growth, seed dispersal and establishment, and/or fencing high priority areas for prairie dogs.
2. Develop grazing practices that alter the season, duration, distribution, frequency and intensity of grazing with the objective of:
    a. maintaining sufficient upland vegetation year-round to support prairie dogs
    b. maintaining sufficient upland and riparian vegetation to protect against erosion and maintain soil filtration
    c. maintaining a diverse mix of native plant species
    d. reducing the spread of exotics such as cheatgrass
3. Re-vegetate disturbed sites (e.g., overgrazed areas, burns, well and mine sites) to insure proper native diversity of locally adapted plant species. Where appropriate, incorporation of mechanical, chemical, and/or biological methods to control noxious, invasive weeds may be necessary.
4. Manage livestock grazing and prescribed treatments in concert with natural disturbances such as fire, draught and flooding to maintain a mosaic of natural vegetation.

Element 2: Disease Control

Although plague may originally have been brought to this continent by human transport of rat vectors, it is currently beyond our ability to eliminate. There are, however, steps that can be taken to mitigate plague impacts until it can be more fully understood (see Seglund et al. 2004 for a summary of studies). For instance:

1. Immigration of healthy animals out of plague-ridden towns and into towns recovering from plague may be an essential mechanism preventing local extinction (Seglund et al. 2004). Therefore, maintaining a landscape in which fragmentation of complexes in minimized, and dispersal corridors are therefore maximized, may allow the prairie dogs to cope with plague epizootics.
2. Other stresses to prairie dog populations (e.g., shooting, surface disturbance from drilling and grazing) can be eliminated, or greatly reduced, during plague epizootics, thus affording colonies a reprieve to cope with the disease.
3. Using uniform plague survey methods and GIS technology to characterize disease spread at large scales (hundreds of square kilometers) and extended time periods (multiple years and decades) rather than the currently ad hoc, localized evaluation of infestation will enable better understanding of plague cycles and may eventually allow prediction, and therefore aversion, of epizootics.
4. There has been some research in the use of plague vaccination that shows promise for reducing plague susceptibility of populations over the long term (Rocke et al. 2001). Similarly, because fleas are the vector that transmits plague between prairie dogs, methods to reduce flea loads of prairie dogs have been investigated (Seglund et al. 2004). When used in combination with methods to predict plague occurrence, these techniques might be applied to those colonies most likely to experience epizootics and could thus avert the major mortality rates previously experienced.

Element 3: Shooting and Extermination Control

Unless strictly controlled, recreational shooting is not compatible with healthy populations of prairie dogs (see Extrinsic Threats). Further, unlike some other threats (e.g., disease, urban encroachment) it is well under the control of land managers. Optimally, shooting should be eliminated, particularly on otherwise impacted towns. If shooting is not eliminated, it should be restricted as follows:

1. Seasonal closures to all shooting when females and pups are most vulnerable (e.g., April 1 - July 15; Seglund et al. 2004).
2. Shooters must obtain prairie dog shooting permits specific to designated areas. Optionally, this could be instituted as an additional stamp on an existing small game permit.
3. As a requirement of obtaining a shooting permit, shooters must report the numbers, age, and sex of animals harvested and the location of those harvests. This will allow State Wildlife Agencies to accurately quantify annual harvest.
4. Take should be limited. Studies have shown individual take of prairie dogs during a single day and on a single town of over 60 animals (Knowles and Vosburgh 2001), which is not sustainable on a medium-sized town. Ideally take would be based on the size, health, and abundance of a town, but given the monitoring effort this would entail, fixed limits would be suitable. The authors of this assessment suggest on the order of 10 prairie dogs per person, per county.

Efforts to exterminate and contain prairie dogs within currently defined colonies are antithetical to the species conservation. Such activities are explicitly meant to kill large numbers of prairie dogs and will thus reduce population numbers and decrease the ability of colonies to persist. Further, if poisoning restricts prairie dog distribution to currently occupied territory, it is likely to severely hinder their ability to cope with plague outbreaks, since animals cannot emigrate to uninfected habitat and the repopulation of previously infected colonies is far less likely. If white-tailed prairie dog conservation is to succeed, the Bureau of Land Management should ban the use of rodenticides on public land, as most areas have done (Seglund et al. 2004) and rigorously enforce this ban. Further, poisoning on private lands might directly impact colonies on BLM lands. For example, prairie dogs from public land colonies may emigrate to those vacated on private land due to poisoning efforts, thus creating a sink dynamic that negatively impacts the health of the public land colony. In such cases, agreements might be made between BLM and adjacent land owners to manage such activities to mitigate impacts to public land colonies. In cases of extreme damage to existing property (e.g., undermining of facility foundations by prairie dog burrows), highly localized control efforts may be warranted.

<u>Element 4: Inventory and Monitoring</u>

Currently, there has been little monitoring of populations outside of designated black footed ferret reintroduction areas on a rangewide scale (Knowles 2002), and even these efforts have not been methodologically consistent across jurisdictional boundaries (Seglund et al 2004). However, if any conservation efforts hope to be shown successful, it is essential to accurately and consistently inventory and monitor white-tailed prairie dogs throughout their range. Effects of management actions and continuing threats (e.g., control efforts, shooting and plague) will go un-noticed unless annual monitoring efforts are used. Without careful observation of population trends, this species may decline severely and make conservation efforts increasingly difficult and expensive.

In order for abundance estimates and population trends to be meaningful, it is of utmost importance for all organizations involved in prairie dog conservation to meticulously follow uniform guidelines. A monitoring protocol has been developed by Colorado State University, Colorado Division of Wildlife, and Utah Division of Wildlife Resources (Andelt et al. 2003) and is currently being tested. We suggest that land managers needing to monitor white-tailed prairie dogs use the most current version of this protocol that has been approved by the interstate team that drafted the white-tailed prairie dog conservation assessment (Seglund et al 2004).

Although we therefore will not outline a monitoring plan in this document, following are some critical issues that those responsible for prairie dog surveys should be aware of:

1. The density of active burrows is a frequently used surrogate for prairie dog abundance, but it may not accurately represent abundance (e.g., Seglund et al. 2004), because there is not a uniform correlation between prairie dog numbers and burrow use (e.g., a large family of prairie dogs may use a single burrow while a single animal may have multiple burrows).
2. Since populations can fluctuate rapidly (from year to year, or even month to month) and inactive burrows can remain recognizable on the landscape for years following abandonment (Biggins 2003, Squires et al 1999), total burrow density is even less reliable than active burrow density and should never be used as a monitoring tool.
3. There are a variety of ways to classify a burrow as active. A uniform method must be agreed upon and implemented throughout the BLM. Further, personnel conducting surveys should be trained by experts on how to make these judgments, so methods are reliably applied.
4. Habitat and colony delineation via aerial survey, aerial photography and satellite imagery has proven much more difficult for white-tailed prairie dogs than black-tailed prairie dogs due in large part to their more dispersed colony structure and more extensive use of shrublands. Population evaluations based on these metrics should be viewed with caution and validated by field reconnaissance.

Information Needs

The following list briefly notes some of the key information needed to develop sound white-tailed prairie dog conservation strategies.

1. Inventory: Current information on the distribution, abundance, and trends of white-tailed prairie dogs is largely supposition based on scattered, ad hoc efforts that cannot be combined or reliably interpreted. At the outset of prairie dog conservation activities, it is crucial that valid, replicable estimates of population distribution and abundance be obtained, or else managers will not have a baseline upon which to evaluate future events. Moreover, the longer that lack of information persists, them more likely are future listing actions that could result in large economic impacts.

2. Monitoring: A consistent, long-term effort to regularly sample a subset of colonies across the state is needed to reduce the current "guesswork" associated with distribution trends in Wyoming. This needs to be implemented as soon as possible and consider areas of high current and future impact (such as active oil and gas leases) in order to determine trends relating to these activities. Changing survey technology must be considered so if recommended survey methods change over time, effort can be made to make the output of future versions comparable with previously collected data.
3. Disease: Although some research has investigated the dynamics of plague in prairie dog colonies, there are still huge questions regarding its prevalence, cycle of occurrence and distribution in the natural environment and very little work has been done resulting in practical guidelines for managers. Strategies allowing managers to predict and mitigate epizootics is very important given the catastrophic impact this disease has had on prairie dogs (see Disease, above); for instance, field trials of vaccinations or parasite management strategies and/or real-time, large-scale, high-resolution mapping of epidemics.
4. Shooting and Poisoning: Shooting and poisoning of prairie dogs has been repeatedly demonstrated to harm colonies (see Extrinsic Threats, above) and some programs have been instituted to reduce these things. However, estimates of current shooting losses and private poisoning programs, and how those losses impact population goals, is largely unknown. These must be understood and regulated if management strategies are to be effective.
5. Population Goals: Although we know there have been large population declines in the past, we do not know the population size and habitat requirements to maintain healthy and stable populations into the future. Moreover, we may never know this until it is too late and drastic, expensive measures are necessary to stop total population crashes. Right now, goals for healthy populations should be set using existing knowledge and management should actively try to reach these goals. Concurrently, research should be conducted to evaluate the appropriateness of those goals, potentially leading to refinements in the future.
6. Fragmentation and Connectivity: As noted in previous sections, very little is known about the metapopulation dynamics and intraspecific genetics of white-tailed prairie dogs. To be design optimally effective conservation strategies, we need understand how local populations interact with each other and how extensive this interaction must be for persistence of a genetically diverse species. This has major ramifications for how we maintain towns, colonies, and complexes in multiple-use landscapes.

Tables and Figures

Table 1: State estimates of acreage of white-tailed prairie dog colonies based on figures reported by Seglund et al. (2004). Please see Figure 1 for a visual representation of this data.

State	Percent of range within state	Percent of predicted distribution within state	Predicted area of possible habitat within state (ha) [a]	Area of known colonies within state.	Percentage of distribution occupied
Colorado	21	11	1,470,390	124,649 [b]	8.48%
Montana	0.9	0.9	111,694	48 [c]	0.04%
Utah	16	13	1,693,108	57,463 [d]	3.39%
Wyoming	62	75	9,791,694	185,988 [e]	1.90%

a. Deductive habitat model based on four-state GIS information of habitat type, elevation, slope, and major disturbances (Seglund et al. 2004).
b. Colorado Division of Wildlife 2002 statewide mapping effort (CDOW 2003). Preliminary data; includes both active and inactive towns.
c. Montana active colonies as of 2003. Inactive colonies may total about 232 additional hectares (Seglund et al. 2004).
d. Minimum estimate of active colonies on public lands in Utah as of 2003 (as reported in Seglund et al. 2004).
e. Incomplete studies from 1987 and 1995; includes active and inactive towns (reported by Greneir and Luce in Seglund et al. 2004).

Table 2: Population estimates for selected white-tailed prairie dog complexes. These complexes were monitored as possible black-footed ferret reintroduction sites. Data was taken from Seglund et al. (2004) as reported by USFWS (2004). Blank cells represent years when data was either not collected or were not comparable in collection method to other dates.

Colony	1988	1989	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Wyoming:															
Shirley Basin			30,389	29,828	14,551	5,916	7,564	19,876	10,343	6,547	7,161	6,669	34,698		
Meeteetse	25,494	17,692			1,299				7,095			1,066			
Colorado:															
Coyote Basin									3,132		5,509	6,666	3,545	3,677	1,055
Wolf Creek—West												19,719		7,266	9,214
Wolf Creek—East													10,331	8,212	10,754
Utah:															
Coyote Basin									43,205	39,565	38,180	33,438	37,424	54,444	14,031
Kennedy Wash										10,697	6,411	5,725	3,670	10,282	3,313
Shiner Basin									15,065	47,551	5,383	13,707			
Snake John													49,346	50,437	31,118

Figure 1: North American range and potential distribution of white-tailed prairie dogs reproduced from Seglund et al (2004). Solid black lines delineate the probable extent of prairie dog range. Gray areas represent the subset of this range that is deemed possible of containing prairie dogs based on a simple overlay of habitat type, elevation, slope, and major disturbances. Black areas represent rough outer limits of historic and current prairie dog colonies identified by state wildlife agencies.

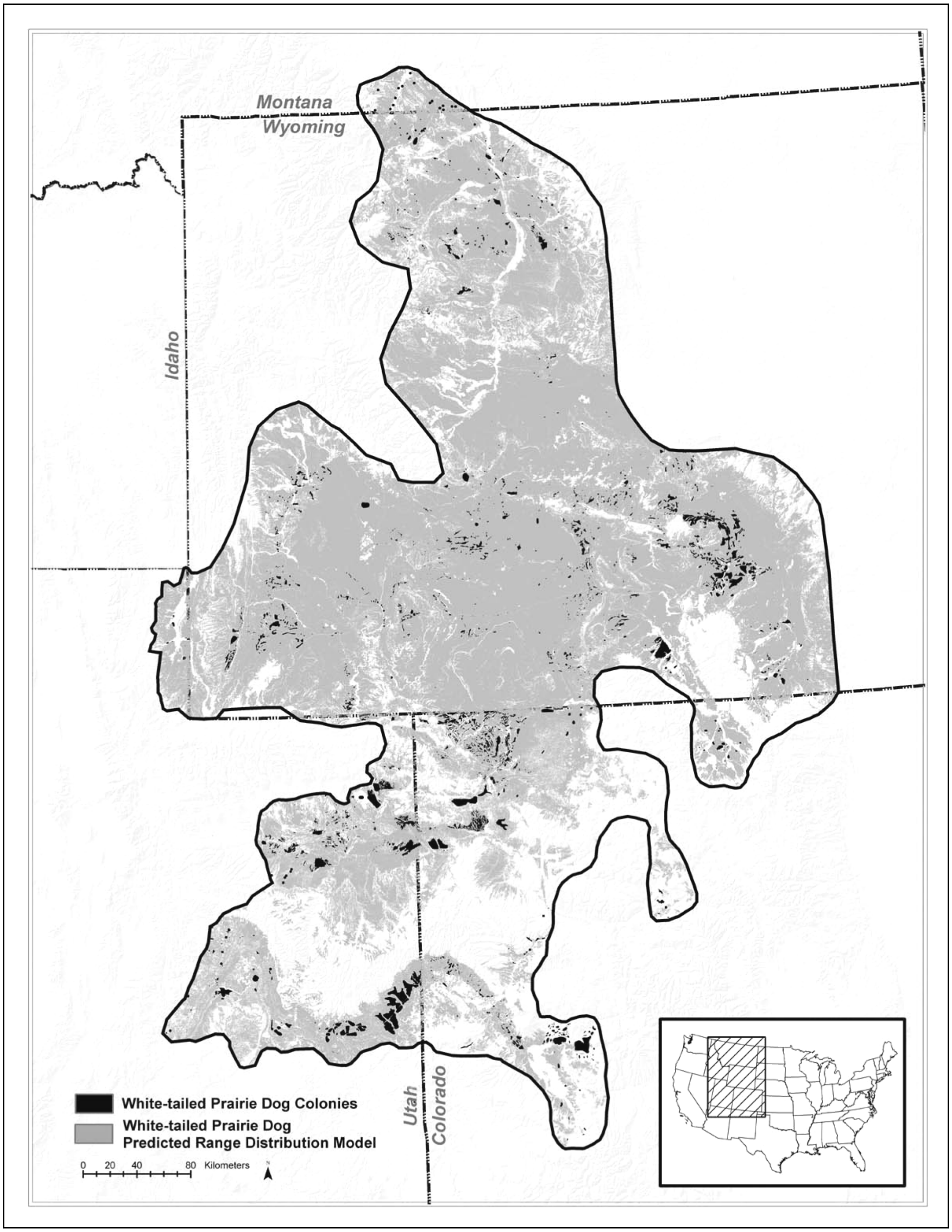
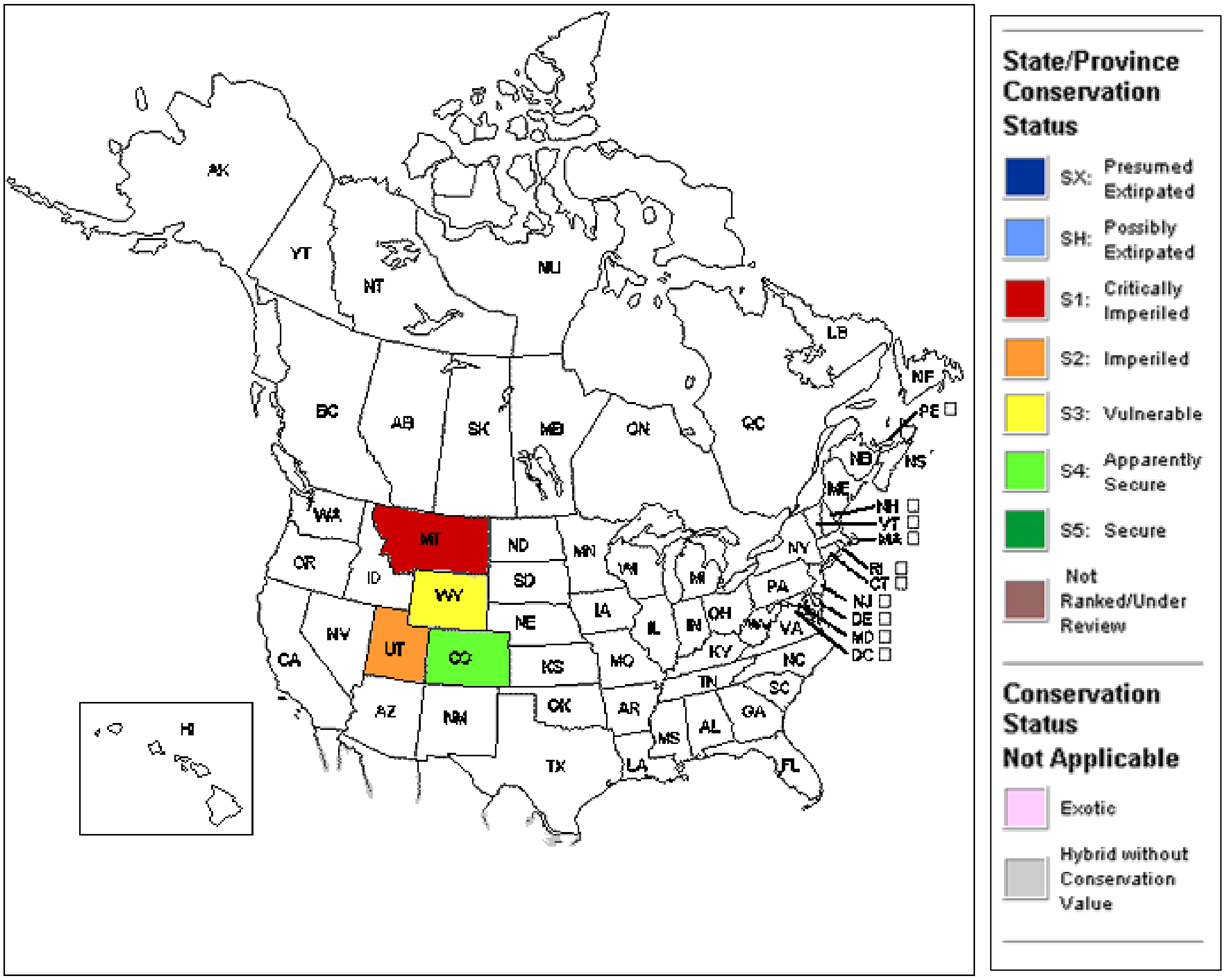


Figure 2: Map of Natural Heritage ranks for white-tailed prairie dog (NatureServe Explorer 2004).



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