WHITE-TAILED PRAIRIE DOG CONSERVATION ASSESSMENT

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White-tailed Prairie Dog photo by Ron Stewart

Western Association of Fish and Wildlife Agencies
January 2006

Recommended Citation

Seglund, A.E., A.E. Ernst, M. Grenier, B. Luce, A. Puchniak, and P. Schnurr. 2006. White-tailed prairie dog conservation assessment. Western Association of Fish and Wildlife Agencies. Laramie, Wyoming. Unpublished Report. 137 pp.

Acknowledgments

We received significant input from a number of sources or their publications. We especially wish to acknowledge the following people and organizations: Dean Biggins, U.S. Geological Survey; Brent Bibles, Utah State University Extension in Vernal, Utah; Bart Zwetzig, Ed Hollowed, Steve Madsen, Robin Sell, Dave Roberts, Mike Albee, and Jay Parks, U.S. Bureau of Land Management; Erin Robertson, Center for Native Ecosystems; Lonnie Renner, contractor for the Colorado Division of Wildlife; Larry Nelson, Colorado Division of Wildlife; Heidi Youmans, Montana Department of Fish, Wildlife, and Parks; Brian Maxfield and Craig McLaughlin, Utah Division of Wildlife Resources; Bob Oakleaf, Wyoming Game and Fish Department; Craig Knowles, Fauna West Consulting; Bob Leachman, Laura Romin, and Renee Chi, U.S. Fish and Wildlife Service; and Sterling Miller, National Wildlife Federation.

Deb O'Neill, Shortgrass Prairie Interstate Coordinator, and Terry B. Johnson, Chair of WAFWA's Nongame and Endangered Species Committee, helped edit the final drafts of this report.

EXECUTIVE SUMMARY

On 11 July 2002, the U.S. Fish and Wildlife Service was petitioned by the Center for Native Ecosystems, Biodiversity Conservation Alliance, Southern Utah Wilderness Alliance, America Lands Alliance, Forest Guardians, Terry Tempest Williams, Ecology Center and Sinapu to list the white-tailed prairie dog under the federal Endangered Species Act. After the petition was received, the White-tailed Prairie Dog Working Group of the 12-state Prairie Dog Conservation Team began development of a Conservation Assessment for the white-tailed prairie dog to assess the current status of the species rangewide and address possible threats limiting conservation. Data integrated into the Conservation Assessment came from an assemblage of sources including published literature, Environmental Impact Statement reports for energy clearances on potential black-footed ferret habitat, and state and federal grey literature. These sources provided information used to index temporal population changes, evaluate gross changes in occupied habitat, and examine current management of white-tailed prairie dogs within each state. A risk assessment for the species based upon the five listing criteria used by the U.S. Fish and Wildlife Service when evaluating a species' potential for listing under the Endangered Species Act was also completed.

To provide the most scientifically accurate assessment regarding the current status of the white-tailed prairie dog, two types of data were analyzed. The first data set indexed population changes at Black-footed Ferret Management Areas. The second data set evaluated gross changes in occupied habitat at mapped locations in individual states. Both data sets had weaknesses and limitations as described in the text, but were the best and only data available for this assessment. The incorporation of both data sources provided a more complete assessment of the rangewide status of the white-tailed prairie dog by describing changes not only with regard to numbers of animals, but also examining the distribution of occupied habitat across the range. In addition to the population and occupied habitat data analysis, a Geographic Information Systems spatially detailed, Predicted Range Model for the white-tailed prairie dog was produced. This model provided information on the number of hectares in the gross and predicted ranges of the species and the amount of its range being impacted by anthropogenic disturbances.

In 1981, with the discovery of black-footed ferrets at Meeteetse, Wyoming, states within the historic range of this species initiated programs to identify complexes of white-tailed prairie dogs as potential reintroduction sites for black-footed ferrets. Because white-tailed prairie dogs and black-footed ferrets occur sympatrically, evaluation of suitable black-footed ferret habitat was dependent upon mapping prairie dog colonies and determining densities of animals within these colonies. To determine densities, a technique was developed that involved counting active burrows within 1 km x 3 m transects distributed over colonies. The active burrow data were converted to prairie dog counts and finally to an estimate of density. Although burrow counts are inaccurate at producing precise population estimates of white-tailed prairie dogs, they are useful for indexing abundance over large scales of time and space. Since no long-term monitoring data were available from sites where black-footed ferret reintroduction was not a consideration, the evaluation of temporal population changes of white-tailed prairie dog populations was based solely on surveys at black-footed ferrets reintroduction sites.

To quantify gross spatial changes that have occurred in occupied habitat within white-tailed prairie dog range, colonies and complexes that were mapped in response to specific energy project clearances as well as those mapped in the identification of potential black-footed ferret reintroduction sites were compared to recent mapping efforts. Direct comparison in the estimation of occupied hectares of prairie dog colonies was problematic and needed to be evaluated with caution. White-tailed prairie dog colony boundaries are difficult to discern and their distribution and activity levels within these boundaries are extremely variable. This results in the investigator relying on their best estimate by using topographic features or breaks in habitats to delineate boundaries. Until variation between mapping efforts can be described and compensated for, mapping can only provide a gross approximation of white-tailed prairie dog occupied hectares. These gross approximations are meaningful in areas that have experienced significant declines or increases. In areas where changes have been less extreme, mapping cannot produce comparable results.

Population information analyzed in this Conservation Assessment showed that white-tailed prairie dog populations can fluctuate year-to-year with calculated coefficients of variation ranging from 14% to 91% in areas surveyed in Utah and Colorado. Large annual fluctuations of white-tailed prairie dog estimates within colonies also were reported in Shirley Basin, Wyoming. Continued population monitoring is needed to assess the level of observed fluctuations and resultant long-term projections of population viability. The data available are not sufficient to evaluate whether white-tailed prairie dogs currently exist at lower densities and experience more extreme fluctuations in numbers than they did historically.

Changes in occupied habitat showed that white-tailed prairie dog distribution is dynamic, with occupation shifting on a landscape scale. No clear pattern emerged to account for increases or decreases in occupied habitat; information such as plague monitoring and periodic habitat evaluations were not available for most sites. Significant declines and increases in occupied habitat that could not be attributed to mapping error were apparent in the Little Snake Black-footed Ferret Management Area, Colorado (92% decline from 1994-1999); Cisco complex, Utah (84% decline from 1985-2002); all colonies in Montana (83% decline from 1975-2003); and portions of Shirley Basin, Wyoming (50% increase from 1990-2004). This evaluation of occupied habitat underscores the importance of evaluating white-tailed prairie dog populations on a landscape scale in order to provide an accurate rangewide assessment of the status and distribution of this species. Colonies and complexes must remain arrayed across the range as both viable and isolated to allow repopulation of depleted colonies and complexes, yet not to encourage the spread of plague between complexes.

Concern over the long-term viability of white-tailed prairie dog populations is warranted. It appears that some individual colonies and complexes are prone to significant declines without recovery to previous occupied habitat or population levels (e.g. Little Snake, Colorado). Other areas however, appear able to recover rapidly after significant population declines (e.g. Kennedy Wash, Utah). Why there is a difference between recoveries at sites is unknown. It may be due to the continued infection of areas by plague and lack of immigration into areas after infection. Plague may be the reason that colonies and complexes show such dramatic oscillations in densities and shifts in occupied habitat. Prior to the introduction of the disease, populations likely were more stable, providing a reliable prey source for such species as ferruginous hawks and development of a specialized predator like the black-footed ferret. The role that plague has and will play in the overall decline and biogeographic dynamics of white-tailed prairie dogs is a critical question for future management and research. Plague remains the unknown factor in the equation for conserving the white-tailed prairie dog. Though work is being conducted on the ecology of the disease and oral vaccine development is proceeding, managing for the effects of plague epizootics will be an immense challenge for resource managers and scientists.

Historically, white-tailed prairie dogs have been displaced from areas by grassland conversion to agriculture, urbanization, and oil/gas exploration and extraction, and have been negatively impacted by habitat alterations due to livestock grazing and fire suppression. Conversion of habitat to cultivated agriculture is not occurring at a significant rate today, and currently only 3.6% of the gross range is impacted by this activity. Urbanization affects 0.2% of the gross range making it a concern in local areas but not on a rangewide scale. Loss of habitat due to oil/gas development under current Bureau of Land Management policies may be a significant threat. Within the predicted range of the WTPD in Wyoming, oil and gas is affecting 2,903,338 ha (7,174,051 ac) in low potential, 6,468,508 ha (15,983,466 ac) in medium potential, and 415,649 ha (1,027,057 ac) in high potential development areas, or 77% of the gross range in the state.

Livestock grazing practices may have impacted the white-tailed prairie dog range by altering landscapes through introduction of non-native annuals, increased shrub cover, loss of cool season grasses and lowered water tables. The Bureau of Land Management, which manages 56% of the white-tailed prairie dog gross range, has reduced stocking rates and improved range conditions in some areas, but upland habitats are difficult to restore and options for their restoration are lacking. Thus, continued research into the impacts of habitat alterations on white-tailed prairie dogs and techniques to restore upland habitats needs to be undertaken.

Shooting has the potential to contribute to the decline and fragmentation of populations, lower colony productivity, and slow or preclude recovery rates of colonies reduced by plague or other disturbances. However, without knowing the survival and fecundity rate of populations, it is impossible to evaluate the long-term affects of shooting on white-tailed prairie dog populations. Shooting, unlike plague, is a manageable threat to white-tailed prairie dogs. State wildlife agencies need to develop programs to evaluate their current regulatory authorities and measures to ensure that they have mechanisms to regulate take of white-tailed prairie dogs.

As settlement of the West occurred, the prairie dog became the focus of widespread eradication efforts. Poisoning became less common after the 1970s because the government began to regulate poisons. Limited poisoning continues today, mostly on private lands, and is used for local containment rather than large-scale eradication. Only toxicants registered by the Environmental Protection Agency may be legally used to control prairie dogs. Because the majority of the white-tailed prairie dog range is located on public land, poisoning can be managed by agencies.

White-tailed prairie dogs have become a focal species for many state and federal management agencies over the past few years. Utah and Montana have implemented statewide seasonal shooting closures on public lands to help conserve this species. The United States Geological Survey and United States Department of Agriculture are working on programs to monitor plague, develop methods to help prevent epizootics from impacting colonies, and predict areas susceptible to infection. State agencies have started to monitor known colonies and complexes, map additional areas, and work cooperatively with other agencies to develop intensive monitoring programs using statistically valid estimation techniques. By implementing management actions at local, state, and federal levels, including regulation of shooting, elimination of mandatory control and pest status, incorporating better grazing and fire management practices, adopting incentive programs for private land owners, instituting research to provide a scientific basis for decisions, development of long-term monitoring of populations, and development of public outreach and education, conservation of this species can be achieved.

At this time the White-tailed Prairie Dog Working Group does not believe listing the white-tailed prairie dog as threatened under the Endangered Species Act is justified. The information analyzed across the range of the white-tailed prairie dog showed that some individual colonies and complexes are prone to significant declines with little post recovery to pre-decline levels, while other colonies and complexes exhibit rapid recovery to pre-decline levels. With current available data, it is impossible to determine whether populations across the range occur at lower densities and occupy less area than they did historically. It is also impossible to predict a long-term trend due to the short-duration in past monitoring (3-7 years) and the lack of definitive patterns emerging among the populations monitored. The biggest concern is that the ecosystem as a whole is not as productive or stable as it was historically. Colonies and complexes show dramatic oscillations in densities and shifts in occupied habitat. With the possibility that current populations are more dynamic, there is concern over the viability of associated wildlife species that are dependent on white-tailed prairie dog populations.

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INTRODUCTION

Five species of prairie dog inhabit western North America and they differ with regard to current conservation status. The Mexican prairie dog (*Cynomys mexicanus*) is federally listed as endangered in Mexico (50 C.F.R), the Utah prairie dog (UPD; *C. parvidens*) is listed as threatened (17.11 C.F.R.), and the black-tailed prairie dog (BTPD; *C. ludovicianus*), formerly a candidate species for listing (65 Federal Register 5476-5488), is still of conservation concern. The Gunnison's prairie dog (GPD; *C. gunnisoni*) was petitioned to be listed on 23 February 2004 (Forest Guardians 2004). The white-tailed prairie dog (WTPD; *C. leucurus*) was petitioned to be listed as threatened under the Endangered Species Act (ESA) on 11 July 2002 by the Center for Native Ecosystems, Biodiversity Conservation Alliance, Southern Utah Wilderness Alliance, America Lands Alliance, Forest Guardians, Terry Tempest Williams, Ecology Center and Sinapu. Both the GPD and WTPD petitions cited habitat loss, shooting, disease, a history of eradication efforts, and inadequate federal and state regulatory mechanisms as threats to the long-term viability of these prairie dog species. After the petition to list the WTPD was filed, the National Wildlife Federation and Environmental Defense contracted with Dr. Craig Knowles to prepare a status review summarizing current knowledge of GPDs and WTPDs. This contract resulted in the publication, *Status of White-tailed and Gunnison's Prairie Dogs* (Knowles 2002). In this document, Dr. Knowles stated, "It is clear that state and federal conservation agencies need to make a range-wide effort to develop credible status reports on these two species".

The 11 states included in the range of the BTPD began a multi-state conservation effort in 1998 with the formation of the Black-tailed Prairie Dog Conservation Team (BTPDCT). This team was responsible for development of a rangewide conservation assessment and strategy for the BTPD (Van Pelt 1999). In addition, the team published an addendum to the Conservation Assessment and Strategy entitled, *A Multi-State Conservation Plan for the Black-tailed Prairie Dog in the United States* (Luce 2003). In March 2002, the BTPDCT was expanded to include both GPDs and WTPDs. Expansion of the team was warranted because many of the management issues such as survey protocols, identification and ranking of threats, regulation changes, recreational shooting, management plan frameworks, relocation techniques, and long-term monitoring are similar for all prairie dog species. State wildlife agency biologists from the GPD and WTPD states, all of whom except Utah were already members of the BTPDCT, formed a White-tailed/Gunnison's Prairie Dog Working Group. This group agreed to emulate, where possible, methodologies and expertise developed during the BTPD multi-state conservation effort. The BTPDCT was subsequently renamed the Prairie Dog Conservation Team (PDCT) in September 2002 and the Western Association of Fish and Wildlife Agencies' (WAFWA) Interstate Coordinator's duties were expanded to include coordination of conservation for all three prairie dog species. The PDCT continues to meet annually to evaluate and discuss rangewide management goals for all three species.

Following the process used to address rangewide conservation of the BTPD, WAFWA agreed at its July 2002 meeting to develop a rangewide Memorandum of Understanding (MOU) that would implement a similar collaborative effort and result in Conservation Agreements and Strategies for GPDs and WTPDs. Specific conservation objectives in the draft MOU were:

1. Quantify current population status and trends of both white-tailed and Gunnison's prairie dogs by collecting and analyzing population estimates and distribution data throughout their ranges and from this information develop multi-state management planning efforts.
2. Develop partnerships with communities, industries, interested entities, private landowners and government agencies to design and implement conservation strategies to preserve and/or restore suitable habitat as well as maintain and enhance present distribution and abundance of white-tailed and Gunnison's prairie dogs.
3. Conduct monitoring of temporal and spatial population trends on a landscape scale to evaluate conservation strategies to stabilize and increase white-tailed and Gunnison's prairie dog occupancy and abundance.
4. Conduct rigorous and repeatable scientific experiments to determine detrimental effects of human induced disturbances and disease on white-tailed and Gunnison's prairie dog populations and from this research develop responsible management objectives.

On March 4, 2003, Jeff Koenings, WAFWA President, sent letters to U.S. Fish and Wildlife Service (USFWS) Regional Directors, Dale Hall and Ralph Morgenweck, detailing the intent of the states to prepare Conservation Assessments and Strategies for both the GPD and WTPD. WAFWA proposed to the USFWS that the states take the lead role in writing the Conservation Assessments and Strategies, and that the USFWS use the documents produced as the basis for the 90-day finding for both the GPD and WTPD petitions.

In December 2002, the White-tailed/Gunnison's Prairie Dog Working Group began development of a WTPD Conservation Assessment (CA). The objectives put forth by White-tailed/Gunnison's Prairie Dog Working Group to be incorporated in the WTPD CA were: 1) summarize and evaluate the current distribution and population status of the WTPD across its historic gross range; 2) develop a Predicted Range Model; 3) identify specific threats impacting the viability of the species, and 4) identify management and research options for consideration in the future development of a conservation strategy for the WTPD. Data used to meet the objectives of the WTPD CA included published literature, Environmental Impact Statements for energy clearances on black-footed ferret (*Mustela nigripes*) habitat, and state and federal grey literature. From the information collected, temporal population changes and gross spatial changes in occupied habitat across the range were examined, current and historic management of WTPDs within each state was evaluated, and a risk assessment for the species based upon the five listing criteria used by the USFWS when evaluating a species' potential for listing under the ESA was completed.

TAXONOMY

The family Sciuridae is found worldwide except in Australia, Madagascar and the polar regions, comprising 51 genera and approximately 250 species (Lawlor 1979). Included in this family are tree and ground squirrels, flying squirrels, chipmunks, marmots, and prairie dogs. Prairie dogs, not unlike ground squirrels, have characteristic flattened heads, straight claws, short tails and unspecialized ankles (Lawlor 1979). As a group, prairie dogs diverged from ground squirrels about 1.8 million years ago during the late Pliocene or early Pleistocene (Clark et al. 1971).

Today there are 5 species of prairie dogs inhabiting North America, all of which belong to the genus *Cynomys*. The genus has been divided into two subgenera based on pelage color and tail length (Clark et al. 1971; Pizzimenti 1975). The UPD, GPD, and WTPD comprise the subgenus *Leucocrossuromys*. This group is distinguished by short, white-tipped tails, a weaker social structure, and less specialized dentition and morphology than the black-tailed subgenera (Pizzimenti 1975). The black-tailed subgenera, *Cynomys*, which includes the BTPD and Mexican prairie dog, have long, black-tipped tails and are more specialized morphologically and behaviorally (Pizzimenti 1975). The BTPD occupies short or mixed-grass prairies across a majority of the Great Plains and the Mexican prairie dog is restricted to an area of grasslands in northeastern Mexico (Goodwin 1995). The *Cynomys* subgenera shows the greatest divergence from ancestral ground squirrel stock (Pizzimenti 1975).

Within the subgenus *Leucocrossuromys*, the GPD has been found to be genetically, morphologically, and behaviorally distinct from the other 2 white-tailed species (Pizzimenti 1975). The GPD retains a chromosomal makeup more closely resembling that of other ground squirrels, suggesting a more recent divergence (Pizzimenti 1975; Goodwin 1995). Genetic analysis conducted on populations of GPDs and WTPDs in Ouray, Delta, and Montrose counties in Colorado, confirmed the genetic makeup of these 2 species was unique (Pizzimenti 1975).

In general, both UPDs and WTPDs inhabit more xeric habitats at relatively lower elevations than the GPD which is commonly found at mesic, high elevation sites (Pizzimenti and Nadler 1972). UPDs and WTPDs are antigenically similar and may have once belonged to a single interbreeding species (Pizzimenti 1975; McCullough et al. 1987). Pizzimenti (1975) described the UPD and WTPD as allospecies due to the geographic isolation of their populations by the Fish Lake and Wasatch Plateaus of central Utah. The WTPD is considered a monotypic species with no suggestion of the existence of a subspecies (Fitzgerald et al. 1994).

DESCRIPTION

The WTPD can be distinguished by the presence of a short, white-tipped tail and distinct facial markings of dark black or brown cheek patches that extend above the eye (Fitzgerald et al. 1994). The WTPD differs from the GPD by lacking a black-band on the tail and retaining white for the entire terminal half (Clark et al. 1971). The GPD is also smaller, has a darker coloration and the facial marking are less striking than those of the WTPD (Fitzgerald et al. 1994). The WTPD differs from the UPD by having a coat that is more grayish in color than the reddish coloration commonly found in UPDs (Hollister 1916).

The WTPD weighs between 650-1700 g (1.4-3.8 lb; Fitzgerald et al. 1994). The total body length of the WTPD is 315-400 mm (12.4-15.8 in) with a tail length of 40-65 mm (1.6-2.6 in; Fitzgerald et al. 1994). Male WTPDs are typically larger than females (Fitzgerald et al. 1994).

DISTRIBUTION

The WTPD occupies the third largest geographic range within the genus *Cynomys* (Knowles 2002). WTPDs inhabit intermountain basins, open shrublands, semi-arid to arid shortgrass steppes, and agricultural lands in Utah, Montana, Wyoming, and Colorado (Figure 1; Pizzimenti 1976a; Hall 1981; Clark and Stromberg 1987; Fitzgerald et al. 1994). Their gross range occurs from extreme south-central Montana (0.9% of range), south through Wyoming (62% of range), extending into western Colorado (21% of range) and eastern Utah (16% of range; Table 1; Figure 1). The gross range of the WTPD encompasses 20,224,807 ha (49,974,813 ac; Table 1; Figure 1).

The gross range of this species is thought to have changed little since historic times, but occupied habitat and population densities probably declined within the last century (Knowles 2002). Attempting to quantify a decline is difficult due to the lack of accurate historical data prior to the introduction of plague, habitat alteration and loss, and onset of historic eradication campaigns (Anderson et al. 1986; Knowles 2002). Even today, estimates of distribution, occupied habitat, and densities across the range and at known complexes are inadequate for management purposes.

NATURAL HISTORY

Habitat requirements

WTPDs occur at elevations ranging from 1150 m (3772 ft) in Montana (Flath 1979) to 3200 m (10,498 ft) in Colorado (Tileston and Lechleitner 1966; Fitzgerald et al. 1994). In Utah, WTPDs have been found at elevations from 1280-2438 m (4199-7999 ft; Boschen 1986; Cranney and Day 1994; Intermountain Ecosystems 1994). Luce (PDCT Interstate Coordinator, personal communication) recorded elevations at 11 WTPD complexes in Wyoming that ranged from 1300 m (4265 ft) near Manderson in the Bighorn Basin to 2300 m (7546 ft) along the Wyoming-Colorado border south of Rawlins. Other researchers documented WTPD occupied habitat in Wyoming within the same elevational range (Menkens 1987; Orabona-Cerovski 1991; Grant 1995).

WTPDs require deep, well-drained soils for development of burrows. UPDs require burrows to be located on soils at least 1 m (3.3 ft) deep over the caliche layer for successful hibernacula establishment (Coffeen and Pederson 1993 in Wagner and Drickamer 2003). Soils commonly found on WTPD colonies are derived from sandstone or shale parent rocks and are described as clay-loam, silty clay, or sandy loam (Forrest et al. 1985; Clark et al. 1986; Boschen 1986; Patton 1989; Wolf Creek Work Group 2001). Topography of inhabited areas is flat to gently rolling with slopes of less than 30% (Forrest et al. 1985; Collins and Lichvar 1986).

A majority of WTPD habitat occurs in semi-arid to arid areas that have high evaporation rates and low precipitation rates (Wolf Creek Work Group 2001; Knowles 2002). Documented annual precipitation ranges from 18-30 cm (7-12 in; Flath 1979; Collins and Lichvar 1986; Patton 1989) and diurnal temperature can range from >30°C (86°F) in summer to <-15°C (-59°F) in winter (McDonal et al. 1981; Forrest et al. 1985; Patton 1989). The majority of native plant communities within WTPD habitats have their main growing season from mid-April to the end of June (Wolf Creek Work Group 2001). These cool season plants are able to use stored winter moisture for growth and dominate WTPD habitats that are generally dry from mid-June to mid-August. In August and September, late summer rains are common, making early fall another period when nutritious and abundant food sources become available (Wolf Creek Work Group 2001).

Common vegetation associations on WTPD habitats are saltbush (*Atriplex* spp.) and sagebrush (*Artemisia* spp.) shrub communities that contain an understory of grasses and forbs (Kelso 1939; Gilbert 1977; Flath 1979; Forrest et al. 1985; Boschen 1986; Beck 1994; Cranny and Day 1994; Wolf Creek Work Group 2001; Knowles 2002). Saltbush associations commonly are found in areas with fine-textured soils and are characterized by low growing, widely spaced plants (Wolf Creek Work Group 2001). WTPD habitats in northwestern Colorado and Utah are dominated by shadscale (*Atriplex confertifolia*), mat (*A. corrugata*), and Gardner's saltbush (*A. gardneri*); and to a lesser extent, Wyoming big sagebrush (*Artemisia tridentata*), black greasewood (*Sarcobatus vermiculatus*), and rabbitbrush (*Chrysothamnus* spp.; Gilbert 1977; Boschen 1986; Cranney and Day 1994; E. Hollowed, BLM, personnel communication). Annual grasses (e.g. cheatgrass [*Bromus tectorum*]) and forbs dominate the herbaceous communities comprising much of the WTPD habitat in both Colorado and Utah (Boschen 1986; Wolf Creek Work Group 2001). In Montana, some colonies are dominated by saltbush mixed with a variety of perennial forbs and limited sagebrush cover (*Artemisia tridentata*; Flath 1979). Others sites are dominated by winterfat (*Eurotia lanata*) and poverty sump weed (*Iva axillaris*; Flath 1979). In Wyoming, species composition has been found to consist of western wheatgrass (*Agropyron smithii*), blue grama (*Bouteloua gracilis*), junegrass (*Koeleria cristata*), Indian ricegrass (*Oryzopsis hymenoides*), needle-and-thread (*Stipa comata*), broom snakeweed (*Gutierrizia sarothrae*), plains prickly pear (*Opuntia polycantha*), big sagebrush, greasewood (*Sarcobatus* spp.), and rabbitbrush (Menkens 1987; Orabona-Cerovski 1991; Grant 1995).

WTPDs, like other prairie dog species, are found in relatively open plant communities with short-stature vegetation (Tileston and Lechleitner 1966; Clark 1977; Collins and Lichvar 1986; Menkens 1987; Orabona-Cerovski 1991). Preference for open areas is probably due to their use of visual surveillance for predators and for social interactions (Fitzgerald and Lechleitner 1974). Menkens (1987) found near Laramie and Meeteetse, Wyoming, that median shrub densities varied from slightly greater than 0-0.3 shrubs/m^2 (0-3.2 shrubs/ft^2) and only rarely did he find shrubs to cover more than 5% of a sample grid. Median shrub heights measured on grids ranged from 24-35 cm (9.4-13.8 in). Similarly, Collins and Lichvar (1986) found shrub densities to range from 0.1-2.5 stems/m^2 (1.1-27 stems/ft^2) and shrub heights to be generally less than 66 cm (26 in) at occupied habitats in Meeteetse, Wyoming. From their analysis, Collins and Lichvar (1986) stated that plant height, rather than vegetation type, determined WTPD distribution. This also has been demonstrated for the UPD where percent plant cover and height were considered more important than plant species composition in determining occupancy (Collier 1975; Crocker-Bedford 1976; Player and Urness 1982).

Total vegetative cover on WTPD colonies is highly variable with an average of 38% reported in Shirley Basin, Wyoming (Orabona-Cerovski 1991); a range of 45-83% at Meeteetse and Laramie, Wyoming (Collins and Lichvar 1986; Menkens 1987); and from 10-70% reported in Colorado (Tileston and Lechleitner 1966). Grasses generally comprise the highest percent of plant cover (Tileston and Lechleitner 1966; Collins and Lichvar 1986; Menkens 1987; Orabona-Cerovski 1991). WTPDs do not alter above ground vegetation structure as do BTPDs (Coppock et al. 1983; Collins and Lichvar 1986). Menkens et al. (1987) found no visual difference in the vegetation between colonized and uncolonized WTPD sites.

Dietary requirements

WTPDs are primarily herbivorous with grasses making up the majority of their diet. Hasenyager (1984) found that the diet of the UPD was similar to the WTPD with cool season grasses dominating the diet in spring and early summer, and additional plants used during other seasons. Sagebrush and saltbush are used by WTPDs during late winter, forbs are used in early spring before other green food is available, and as grasses and sedges flower, seed heads become dominant in their diet (Tileston and Lechleitner 1966). Rabbitbrush flowers are consumed in fall prior to hibernation (Tileston and Lechleitner 1966). Kelso (1939) found by examining the contents of 169 stomachs collected from WTPDs in Montana, that plants of the Chenopodiaceae family (saltbush, Russian thistle [*Salsola pestifer*], winterfat, and goosefoot [*Chenopodium* spp.]) were found most often in the diet except during the months of April, July, August, and October when grasses appeared to dominate. In the Chenopodiaceae diet, Nuttall saltbush (*Atriplex nuttallii*) had the highest consumption rate whereas in the grass diet, wheat grass (*Agropyron* spp.) had the highest rate. Also found in stomach contents were sagebrush, wild onion bulbs (*Allium* spp.), prickly pear (*Opuntia* spp.), false mallow (*Malrastrum coccineum*), and a small amount of animal matter. Stockard (1930) examined 92 stomachs collected during the spring near Laramie, Wyoming and found them to contain weed and grass seeds, cactus roots and stems, sagebrush leaves, grasses, and insects. Renner (Colorado Division of Wildlife (CDOW), personal communication) observed WTPDs capturing and consuming Mormon crickets (*Anabrus simplex*) as well as foraging on the seed heads of wheat grass at Wolf Creek, Colorado. Crocker-Bedford and Spillett (1981) found that UPDs selected foods in the following order: *Cicadidae* insects, alfalfa, grasses, forbs, shrubs, and dead vegetation. The most to the least preferred plant parts consumed were flowers and seeds, young leaves, old leaves, and stems.

WTPDs inhabit unpredictable environments with short growing seasons and because of this, do not remain active year round. During their limited active period they must mate, give birth, and build fat stores. This requires that the quality and quantity of vegetation to be adequate for their survival and reproductive output (Beck 1994). High quality forage is necessary for reproductive females which double their daily energy requirements to support reproductive needs and for accelerated growth in juveniles (Crocker-Bedford and Spillett 1981). The amount of available cool season forage has been correlated with UPD density estimates (Crocker-Bedford 1976). In addition, Rayor (1985) found that GPD colonies located in habitats with higher quality vegetation resulted in individuals having a greater mass, accelerated ontogeny, and earlier dispersal than colonies located in lower quality vegetation sites.

Juvenile WTPDs mature more quickly both physically and behaviorally than BTPDs (Tileston and Lechleitner 1966; Clark 1977). After emergence, WTPD juveniles reach 88-100% of adult size within 120 days, approximately 2.5 months before BTPD juveniles (Tileston and Lechleitner 1966; Clark 1977). Juvenile UPDs have been found to consume up to 157 kcal/day (36 dry-grams of forage; Crocker-Bedford and Spillett 1981), whereas juvenile BTPDs, who remain active throughout the year and live in a more stable environment, consume on average, 110 kcal/day (25 dry-grams of forage; Hansen and Cavender 1973 in Crocker-Bedford and Spillett 1981). Grant (1995) found the most significant growth and increase in body mass of juvenile WTPDs occurred between emergence in early June and mid-July, which coincided with abundant above-ground biomass of succulent, highly nutritious grasses and forbs. After mid-July, juvenile body mass plateaus at approximately 120 days of age (Cooke 1993). During hibernation, body mass for juveniles was found to decrease by 26-30% (Cooke 1993).

WTPDs 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. WTPDs can become water stressed during their active season if sufficient succulent vegetation is not available. Collier (1975) found that higher moisture content in plants was correlated with higher population densities of UPDs, and higher moisture content was crucial to maintaining populations during times of drought. UPDs have been found to travel 300-400 m (984-1312 ft) during the summer to access vegetation in moist areas (Crocker-Bedford 1976; Crocker-Bedford and Spillett 1981). Similarly, Koford (1958) found that BTPDs congregate near moist vegetation, and new colonies and colony expansion more likely will occur in these areas. GPDs also use areas near the edges of wet meadows (Longhurst 1944). The presence of moist vegetation may be crucial to maintaining WTPD populations because without it, they can not remain active long enough to gain sufficient weight to guarantee winter survival (Beck 1994).

Population dynamics

WTPD populations have been reported to fluctuate by more than 50% between consecutive years (Menkens 1987; Menkens and Anderson 1989). In most cases, adult variation in density (27-167%) was less than that reported for juveniles (124-348%; Menkens 1987). Variation in densities between years and among habitats likely is due to disease cycles and vegetation quantity and quality. Hyper-productive environments have been found to correlate with higher densities of prairie dogs. For example, a comparison study examining the life history traits of the UPD at 3 different locations found densities ranging from 2.3 prairie dogs/ha (0.9/ac) at a high elevation site, 16/ha (6.5/ac) at a low elevation site, and 36/ha (14.6/ac) at a low elevation site associated with an alfalfa field (Crocker-Bedford 1976). The difference in densities was attributed to the quantity and quality of available vegetation. Turner (2001) found that after a plague epizootic severely reduced a population of UPDs in Bryce Canyon, survival of juveniles, juvenile mass, and the number of females successfully weaning young increased. These factors were thought to contribute to the rapid recovery of the population. The mechanism driving the increase in these three factors was unclear, but was thought to be due to the increase in resource availability after a population decline. Cooke (1993) found both yearling and adult females were more successful at weaning litters on sites with high quality food resources than those on poorer sites. In addition, female juveniles remained resident on their natal home ranges on higher quality sites.

Disease, especially the introduced pathogen *Yersinia pestis* responsible for sylvatic plague, may play a role in amplifying population fluctuations. Historically, WTPD populations probably were not static, but with the evolution of an obligate predator such as the black-footed ferret that relies on prairie dogs as their main food source, it is unlikely that populations fluctuated as dramatically as they do today. A plague-free BTPD colony in Wind Cave National Park, South Dakota provides an example (Hoogland 1995). Plague has never been detected within this colony and yearly population levels are relatively stable. This differs from a population at the Rocky Mountain Arsenal National Wildlife Refuge near Denver, Colorado where epizootics of plague are frequent and extreme population fluctuations are common (Biggins and Kosoy 2001b).

Reports of burrow densities vary greatly from location-to-location, ranging from 0.8-291/ha, (0.3-118/ac) with a mean of 2.1-41.7/ha (0.8-16.8/ac; Tileston and Lechleitner 1966; Clark et al. 1986; Menkens 1987; Orabona-Cerovski 1991). Collins and Lichvar (1986) found that burrows were widely distributed and equidistant from one another in WTPD colonies located in contiguous, homogeneous suitable habitat. However, if colonies occurred within a mosaic of habitat types with not all areas suitable for prairie dogs, burrows were arranged in a clumped pattern.

Ecology and behavior

WTPDs cease above ground activity during periods when they are unable to meet metabolic needs (Michener 1977; Bakko and Nahorniak 1986; Harlow and Menkens 1986; Rayor et al. 1987). Lack of precipitation, extreme daily temperatures and/or lack of forage and water appear to be the ultimate factors in induced dormancy (Hudson and Bartholomew 1946 in Collier and Spillett 1975). WTPDs generally hibernate for 4 to 5 months during the winter and may aestivate during mid- to late summer, however timing of these patterns varies with latitude and elevation (Hollister 1916; Tileston and Lechleitner 1966; Bakko and Brown 1967; Pizzimenti 1976b; Harlow and Menkens 1986; L. Renner, CDOW, personal communication). In Colorado and Wyoming, WTPD colonies have been reported to be active above ground from 7 to 9 months of the year with sexes and age groups maintaining different activity periods (Tileston and Lechleitner 1966; Clark 1977; B. Luce, PDCT Interstate Coordinator, personal communication). Staggered activity periods among sexes and ages have been postulated as an evolutionary adaptive strategy for reducing competition for limited resources (Clark 1977).

Adult males are the first to emerge in mid-February to early March, about 2 to 3 weeks before adult females (Tileston and Lechleitner 1966; Clark 1977; Cooke 1993). After emergence of females, the breeding season begins and lasts for about 2 to 3 weeks (Bakko and Brown 1967). Pups emerge in mid- May to June at about 5 to 7 weeks of age, at which time the colony experiences a dramatic increase in above ground densities of 150-400% (Tileston and Lechleitner 1966; Clark 1977). The first week after emergence pups remain very close to their natal burrows, but by week 3 they become entirely independent of both their mothers and natal burrows (Clark 1977). Surface activity begins to cease for adult males in late July to mid-August and for adult females about 2 to 4 weeks later (Bakko and Nahorniak 1986). Juveniles remain active above ground until late fall.

Both male and female WTPDs are reproductively mature at 1 year of age (Cooke 1993). Females are monestrous and, based on uterine swellings, show an average of 5.64 ± 0.74 embryos per litter (Bakko and Brown 1967), but mean litter size at juvenile emergence is lower. Tileston and Lechleitner (1966) found 40% of the embryos were lost in the interval from implantation to emergence. Flath (1979) found an average of 4.58 pups per litter at 7 weeks based on a sample size of 7 litters. Hoogland (2001) found fewer than 4 juveniles emerging from nursery burrows in GPDs and UPDs and indicated that BTPDs, GPDs, and UPDs reproduce slowly for 5 reasons: 1) survivorship is less than 60% for all 3 species and remains low in subsequent years; 2) females produce a single litter per year regardless of available resources; 3) the percentage of males that copulate as yearlings is less than 50% for all 3 species; 4) the average probability of weaning a litter varies from 43-82% among the 3 species; and 5) the mean litter size at juvenile emergence varies from 3.08 to 3.77 for all 3 species.

Cynomys species are known to be colonial and gregarious, however variations in the degree of colonialism and social patterns exist among the 5 different species. WTPDs are one of the least colonial within the genus and often colonize in an irregular pattern over the landscape. Unlike BTPD colonies where boundaries are normally easy to define, WTPD colonies are extremely difficult to characterize (Tileston and Lechleitner 1966; Forrest et. al. 1985; Mariah Associates, Inc. 1986, 1987, 1988; Bio/West Inc. 1988; Patton 1989). In addition, densities of adults and yearlings within a colony are usually significantly lower than those found in other prairie dog species (Lechleitner 1969; Clark 1977; Hoogland 1979, 1981).

Sociality is less pronounced in the WTPD than in the BTPD and this may be due to their staggered activity periods and unpredictable environments. The social system of the WTPD has been classified as a single-family female kin cluster (Tileston and Lechleitner 1966; Michener 1983) comprised of several reproductive females, occasionally 1 or 2 males of reproductive age, and dependent young (Cooke 1993). Females within a cluster are generally members of the same matriline (Cooke 1993). Within the cluster, WTPDs spend little time in social maintenance and most of their active time feeding (approximately 60%; Tileston and Lechleitner 1966; Clark 1977; Orabona-Cerovski 1991; Grant 1995). Conversely, BTPDs form polygenous harems and spend much of their time socially active (Michener 1983). Juvenile WTPDs are more gregarious than adults for the first few weeks after emergence, but by late summer their behavior resembles adults (Clark 1977). Overt defense of individual WTPD cluster territories does not occur except during the breeding season when individual males defend plots around burrows allowing only receptive females to enter for copulation (Clark 1977; Cooke 1993). Clark (1977) also found that females showed a weak defense around nest burrows just prior to the emergence of young (Tileston and Lechleitner 1966; Clark 1977).

Little work has been done examining home range sizes in different habitats and for different sex and age classes with regard to WTPDs. In southeastern Wyoming, WTPD home ranges have been found to range from 0.5-1.9 ha (1.2-4.7 ac; Clark 1977) and in north-central Colorado, home range sizes range from 0.15-0.2 ha (0.37-0.49 ac; Cooke 1993). Home range sizes calculated for UPDs were 0.5-1.8 ha (1.2-4.4 ac) with the home range size inversely related to density (Wright-Smith 1978 in McDonald 1992).

Emigration and immigration occur in early spring during the reproductive period, and again in late summer and early fall as young disperse (Clark 1977). At study sites near Laramie and Meeteetse, Wyoming, the percentage of immigrants into populations ranged from 0-50% of the total animals captured with an average of 24% for all 6 colonies examined (Menkens 1987). Anderson and Williams (1997) examined WTPD colonies near Meeteetse during a plague epizootic. After plague was no longer present in the area, colonies showed rapid increases and had high proportions of juvenile males. This led the investigators to postulate that immigration led to the rapid increase in animal numbers. Additional researchers have suggested that immigration and emigration can contribute greatly in some years to WTPD population dynamics (Tileston and Lechleitner 1966; Clark 1977; Menkens 1987).

Clark (1977) found that young of the year began to disperse when the population densities within colonies was greatest (late June to early July). Competition and changes in social climate probably initiated dispersal. Five of the 6 dispersing young on his study grid were males and the greatest distance moved was 300 m (984 ft). The other animals moved less than 60 m (197 ft). Dispersing young usually occupied old, uninhabited burrow systems but also dug new burrows. At Shirley Basin, Wyoming dispersal from natal dens did not always occur (Orabona-Cerovski 1991; Grant 1995). Orabona-Cerovski (1991) found only 1% of all males dispersed more than 200 m (656 ft), with the majority moving less than 50 m (164 ft). The majority of juvenile females also moved less than 50 m (164 ft) from their natal burrows with most individuals not moving at all. Only 3% of females moved greater than 200 m (656 ft). Grant (1995) found that none of his radio-collared juveniles dispersed from their natal areas. Two translocated animals traveled 767 m (2516 ft) and 823 m (2700 ft) back to their original trap location. In Montana, Flath (1979) documented a dispersal distance of 2.4 km (1.5 mi) of a single WTPD during the fall. In north-central Colorado, Cooke (1993) found dispersal to occur by both male and female juvenile WTPDs in July and August. Dispersal distances ranged from 0.4-2.4 km (0.1-1.4 mi) with one female dispersing 8.0 km (4.8 mi). Dispersal in UPDs mainly occurs among juveniles with dispersal distances of up to 1.2 km (0.8 mi; Wright-Smith 1978 in McDonald 1992).

WTPD activity is greatest between ambient temperature of 18-28ºC (64-82ºF; Grant 1995). Individual animals within colonies can be seen throughout the day however, there are peak activity periods in the morning and late afternoon in the summer, and in the afternoon during spring and fall (Tileston and Lechleitner 1966). WTPDs are not active in heavy rain, high wind, snow, or hail storms.

WTPDs may spend up to two-thirds of their life underground in burrows (Clark et al. 1971). Burrows provide shelter from inclement weather, protection from predators, a refuge for bearing and rearing young, and as hibernacula (Burns et al. 1989). A single WTPD may use several burrows, and within active colonies there may be unused burrows. Mounds at maternity burrows are significantly larger than at other types of burrows (Flath 1979). Burrow maintenance is generally confined to the spring when debris collected in burrow entrances during the winter is removed (Clark 1977).

EVALUATION OF WHITE-TAILED PRAIRIE-DOG POPULATION STATUS BY STATE

Accurate evaluation of the rangewide population status of the WTPD was difficult due to the absence of historical information prior to the mid-1980s. This significantly limited our ability to document changes or project long-term trends. In addition, because agencies lack valid estimation techniques to monitor WTPD populations, inconsistencies in survey methods and variable time periods between surveys made analysis of rangewide trends impossible. In order to provide the most accurate assessment regarding the current status of this species, 2 types of data were analyzed. The first data set examined were those collected at black-footed ferret reintroduction sites. This survey information was used to index population changes at localized scales. The second data set used evaluated gross changes in occupied habitat within each state at selected sites. Both data sets have weaknesses and limitations as described below, but were the best and only available data for this assessment. The incorporation of both data sources provided a more complete assessment of the rangewide status of the WTPD by describing changes not only with regard to numbers of animals but also the distribution of occupied habitat across the range.

The Colorado, Montana, and Utah sections were evaluated with the methods described below and were authored by Amy Seglund. The Wyoming section was written by Martin Grenier and Bob Luce.

METHODS

Population analysis

In 1981, with the discovery of black-footed ferrets at Meeteetse, Wyoming, states within the historic range of this species initiated programs to identify complexes (Appendix A) of WTPDs as potential reintroduction sites for black-footed ferrets (Figure 2). Because WTPDs and black-footed ferrets occur sympatrically, evaluation of suitable black-footed ferret habitat has been dependent on mapping WTPD colonies and determining densities within these colonies (Forrest et al. 1985; Biggins et al. 1989, 1993). To aid in the evaluation of prairie dog habitat, Biggins et al. (1989, 1993) developed a technique that involved counting active burrows within 1 km x 3 m (0.6 mi x 9.8 ft) transects distributed over colonies. Transects were designed to sample the mean burrow density for an entire complex within 10% at the 95% confidence level. The number of active burrows was then converted from burrows to prairie dog counts, and finally to an estimate of density. This method (Biggins et al. 1989, 1993) also attempted to define and standardize mapping of colonies and complexes. Because this method has been consistently used at black-footed ferret reintroduction sites and no other long-term monitoring data are available, the evaluation of temporal population changes of WTPD populations is based on surveys conducted at black-footed ferret reintroduction sites.

Concerns were raised among the WTPD Working Group members regarding the use of the black-footed ferret survey data to evaluate the status of WTPD populations due to the questionable correlation between counts of active burrows and densities of animals. A review of the literature found that Severson and Plumb (1998), Menkens (1987), and Powell et al. (1994) did not find a relationship between burrow density and above ground counts of either WTPDs or BTPDs. Similarly, Van Horne et al. (1997) did not detect a consistent relationship between burrow entrance counts and Townsend's ground squirrel (*Spermophilus townsendii*) population estimates. These authors recommended that burrow counts not be used to index population density unless first thoroughly verified. However, other studies involving ground squirrels correlated counts of burrows with densities (Owings and Borchert 1975; Nydegger and Smith 1986; Weddell 1989 in Van Horne et al. 1997).

The reason for discrepancies among studies may be the result of a number of factors. One may be an observer's ability to reliably differentiate between active and inactive burrows. Biggins et al. (1989, 1993) defines active prairie dog burrows as those that have fresh fecal material detected within 0.5 m (1.6 ft) of a burrow entrance. Thus active burrow designation is not left up to the subjective judgment of an observer. The second problem that may occur when correlating burrow density with above ground counts is the timing of surveys. Both ground squirrels and WTPDs limit above ground activity in winter, and conducting surveys too early in the year may provide an inaccurate measurement of activity. Surveys at black-footed ferret reintroduction sites using Biggins et al. (1989, 1993) are conducted at the same time each year to provide a better estimate of activity. Finally, the scale at which the surveys are conducted may affect correlation between active burrow density and population estimates. Burrow indices appear to be better suited for indexing trend over larger geographic scales and over longer time periods (Biggins 2004).

Consensus among the WTPD Working Group was that the Biggins et al. (1989, 1993) method provided the best available technique to index WTPD populations and that, although burrow counts may be inaccurate at producing precise population estimates of WTPDs, they are useful for indexing abundance of the species at the landscape scale. In addition, because the methodology uses strip transects to sample burrows, it may provide a more accurate method for sampling an unevenly distributed species such as the WTPD (Biggins 2003b).

When developing the Conservation Assessment, the WTPD Working Group recognized the value of standardizing reporting methods for WTPD survey data collected at black-footed ferret management areas in order to establish a rangewide trend for the WTPD. The Working Group reviewed the survey techniques based on the Biggins et al. (1989, 1993) methodology used over the past 15 years by Brent Bibles, Utah State University, in Colorado and Utah; Bob Luce, former Nongame Mammal Biologist for the Wyoming Game and Fish Department (WGFD) in Shirley in Wyoming; and Dean Biggins, U.S. Geological Survey (USGS) in Meeteetse, Wyoming. Though the Biggins et al. (1989, 1993) methodology was the foundation for black-footed ferret habitat sampling completed in all 3 states, there were departures in both sampling methodology and analysis from the original Biggins et al. (1989, 1993) protocol (Appendix B). These departures made standardizing the data between states impossible. For this reason, the Conservation Assessment does not compare population changes on a rangewide basis, but rather presents data state-by-state.

WTPDs reproduce once per year and because populations have been found to fluctuate widely from year-to-year, a population estimate at a single point in time may represent a low, high, or mid point in the population cycle. Thus, only black-footed ferret reintroduction sites surveyed for ≥3 years were evaluated. In addition, because burrow indices appear to be better suited for indexing trend over large geographic scales, only surveys conducted on areas greater than 1500 ha (3706 ac) were used in the population analysis. To evaluate the variability in population estimates calculated over time at survey sites, coefficients of variation and standard deviations were calculated. Sites used for temporal population analysis in the Conservation Assessment were: Coyote Basin, Utah and Colorado; Wolf Creek, Colorado; Kennedy Wash, Shiner Basin, and Snake John, Utah; Meeteetse and Shirley Basin, Wyoming (Figure 2). Additional large complexes were mapped and surveyed but did not provide sufficient data to document trends. These areas included Cisco, Utah and Little Snake, Colorado. No complexes suitable for black-footed ferret reintroduction have been identified in Montana and thus no surveys were available to develop a population trend for this state.

Changes in occupied habitat

The geographical range of the WTPD has changed little since historic times, however it is thought that occupied habitat has declined (Knowles 2002). Quantifying the magnitude of this decline is difficult due to the lack of accurate estimates of occupied habitat prior to the introduction of plague, alteration of landscapes, and implementation of poisoning campaigns (Anderson et al. 1986; Knowles 2002). Even today, estimates of occupied WTPD habitat are not accurately quantified.

Techniques used to map WTPD habitat have relied on delineating colony boundaries based on burrow distribution. However, WTPD colony boundaries are difficult to discern and their distribution and activity levels within these boundaries are extremely variable. This results in an investigator relying on their best estimate by using topographic features or breaks in habitats to delineate boundaries. In addition, individual burrow activity is not always assessed, which results in both active and inactive areas included in estimates of occupied habitat. Little information is available on the length of time a burrow persists on the landscape and it is likely that the rate of deterioration varies with activity of other burrowing mammals (e.g. badgers, ground squirrels), and weather conditions (e.g. precipitation, wind). Biggins (2003b) examined a subset of 7 colonies at Meeteetse, Wyoming that underwent sudden, steep declines and found that burrows began to deteriorate at a rather steady rate. On 5 of the 7 colonies, no burrows were found on sample transects by year 6; no burrows were detected by year 4 on 1 of the colonies; and none were detected by year 5 on 2 others. Anecdotal evidence from locations in Colorado found burrows collapsing 6 years after a known die-off (Squires et al. 1999), and in Montana, there is evidence that siltation of vacant burrows occurs within 1 to 3 years (Montana Prairie Dog Working Group 2002). The consequence of mapping both active and inactive areas is an overestimation of occupied habitat, with declines not accurately documented.

Because of the problems stated above, direct comparisons in the estimation of occupied habitat of WTPD colonies is not accurate enough to determine trends except at a gross level. Until a systematic measure of variation between mapping efforts can be developed, mapping can only provide a gross approximation of occupied WTPD habitat. Gross approximations are meaningful in areas that have experienced significant declines or increases, but in areas where changes have been less extreme, mapping cannot produce comparative results. Most data collection over the last 20 years have reported only "occupied area", without a density or population estimate, therefore the WTPD Working Group had no other large-scale data set to use to compare past versus current WTPD status. It is beyond the scope of this document to include specific actions to address this situation. However, the Conservation Assessment recognizes that consistency in occupied area and density estimates must be addressed in WTPD mapping efforts in the future.

To assess the changes in occupied habitat as accurately as possible, only areas that were mapped with similar effort and methodology were compared to evaluate statewide trends. The bulk of historic information came from colonies and complexes that were mapped in response to specific energy project clearances as well as those mapped in the identification of potential black-footed ferret reintroduction sites. Energy clearances were conducted in response to the USFWS recommendation that inventories be completed on all projects or actions that involved WTPD colonies of greater than 101 ha (250 ac) or at aggregations of colonies that combined, could support a black-footed ferret population (USFWS 1986). Recent mapping used for comparisons include statewide efforts to locate and map occupied WTPD habitat as well as re-mapping of colonies at black-footed ferret reintroduction sites. The goal of the current statewide mapping in Colorado, Montana, and Utah is to develop baseline knowledge of WTPD occurrence for conservation planning and eventual long-term monitoring of occupied habitat. Wyoming is using historic map data (mapping efforts prior to 1995) for WTPD conservation planning.

Predicted range model

Typically lacking for most species is a spatially detailed, regional representation of the species' range map. With the advancement of computer-aided mapping and the accessibility of digital Graphical Information Systems (GIS) datasets, a spatially detailed, Predicted Range Model for the WTPD was produced.

The first step in the development of the Predicted Range Model was to acquire pre-existing digital GIS data layers from the following sources:

> Bureau of Land Management (BLM) Ownership: Bureau of Land Management. 2001. Representation of statewide and regional land ownership of 11 western states. 1:100,000. Landholders in the dataset are Federal, State, local governments, universities, tribal, and private lands.
>
> State Boundaries: Environmental Systems Research Institute, Inc. (ESRI) Data Team. 2001a. A generalized representation of the fifty U.S. States and the District of Columbia. 1:3,000,000. ESRI, Redlands, CA. 92373.
>
> County Boundaries: Environmental Systems Research Institute, Inc. Data Team. 2001b. A generalized representation of the counties of the fifty U.S. States and the District of Columbia. 1:3,000,000. ESRI, Redlands, CA. 92373.

Gross Range Map: Modified from Hall (1981). CDOW and WGFD provided a more detailed and accurate description of the current WTPD range. The modified CDOW map included areas in Colorado, such as the Bookcliffs and Roan Plateau, which are known not to contain WTPDs. The range map outer boundary identifies the extent of the distribution and does not infer that all areas contained are suitable for WTPDs. The Utah portion of the range map was modified from the Utah Gap Analysis program.

Colony Data: Both current and historical colony localities were provided by the individual state agencies.

National Elevation Dataset: U.S. Geological Survey. 2000. Designed to provide national elevation data in a seamless form with a consistent datum, elevation unit (30-meter), and projection. http://gisdata.usgs.net/ned/default.asp

National Land Cover Dataset: U.S. Geological Survey. 2001. Derived from the early to mid-1990s Landsat Thematic Mapper satellite data, at a 30-meter spatial resolution, the National Land Cover Data (NLCD) is a 21-class land cover classification scheme applied consistently over the United States. http://landcover.usgs.gov/natllandcover.asp

Colorado Oil and Gas Conservation Commission (COGCC) Oil and Gas Well Spatial Data Set: 2004. A representation of more than 57,000 oil and gas well locations in Colorado.

Utah Division of Oil, Gas, and Mining: State of Utah, Department of Natural Resources. 2004. Individual records of basic information for each well in the Utah Division of Oil, Gas, and Mining database.

Potential Exploitable Minerals for the State of Wyoming: U.S. Bureau of Mines. 1990. Availability of Federally Owned Minerals for Exploration and Development in the Western United States. 1:500,000. A general, small-scale view of where potential exploitable minerals areas are located in the State of Wyoming. http://www.wygisc.uwyo.edu/clearinghouse/metadata/mineral.html

2000 Urbanized Areas Cartographic Boundary: 2000. U.S. Census Bureau. Consists of a densely settled territory that contains 50,000 or more people.

The second step in creating the Predicted Range Model was to process the unrelated input data layers. The individual data layers were imported into Erdas Imagine 8.6 and then projected to a common coordinate system called Albers Equal-Area map projection. This projection system is used in the United States and other countries that have a larger east-west than north-south extent, thus portraying areas over the entire map with the same proportional relationship as the actual geographic areas that they represent on Earth. The National Elevation Dataset (NED), downloaded in individual 1:250 quadrangles, was then map-joined to create one complete layer for each individual state. The NLCD was downloaded in complete state sections including a 300-meter (10 pixel) buffer added to the outer boundary. For these reasons, the NED and NLCD datasets were clipped to each corresponding state jurisdictional boundary. The final pre-processing step was to derive percent slope from the NED dataset using the algorithm incorporated into Erdas Imagine 8.6.

The third step in producing the Predicted Range Model was to separate specific habitat associations from those considered as non-appropriate habitat. These associations were based on the scientific literature and known species occurrences. We selected 3 input data layers as indicators of potentially appropriate WTPD habitat. These data layers included an elevation range between 1150-3050 m (3773-10,006 ft), 0-20% slope, and 2 generalized land cover classes, specifically called Grasslands and Shrublands (Table 2). Land cover characteristics that were removed from the Predicted Range Model were classes in the NLCD dataset called Water, Developed, Barren, Forest, Non-Natural Woody, Agriculture, and Wetlands (Table 2).

The fourth step was to calculate the actual Predicted Range Model. This was accomplished by using the additive overlay technique in which each data layer is added together as an equally weighted component in the model. Although the process is referred to as an additive approach, the calculations produce only a combination of the important variables, removing any areas not fitting the appropriate criteria. A model was calculated for each individual state and then assembled together to form one complete, seamless dataset. An additional filter, which eliminates isolated patches of pixels smaller than 202 ha (500 ac), was performed. This function was used based on the assumption that small, isolated pixels may not provide appropriate habitat for the WTPD. Finally, the large mosaic was clipped to the gross range boundary, creating the outer extent of the Predicted Range Model. The gross range map was produced by acquiring state specific range information from the state wildlife agencies and then editing and edge matching the specific range maps at state boundaries to portray a smooth, continuous range boundary. The gross range boundary identifies the outer extent of the WTPD range. Within the boundary, areas exist that do not provide, nor have ever provided suitable WTPD habitat. The hectares within the Predicted Range Model were then calculated in Erdas 8.6. The gross range boundary, along with the additional data layers, such as landownership, census data, and oil and gas well locations were used to facilitate analysis for the risk assessment. It is important to note these calculations were accomplished using a combination of Erdas 8.6 and ArcGIS 8.3 software. The use of other software or different map projections may result in slightly different hectare estimates.

The Predicted Range Model was produced as a more accurate, spatial depiction of the potential range of the WTPD. The main constraint of the model was the availability of pre-existing GIS data layers at the regional scale. Although the NLCD dataset provided a consistent, region wide land cover data layer, it depicted only general land cover associations. The NLCD does not contain information associated with shrub density, shrub height, or shrub species; and current, detailed land cover information, along with a data layer depicting detailed soil characteristics, are not available in a digital, GIS format. Thus the Predicted Range Model overestimates suitable habitat for the WTPD due to critical indicators of WTPD occupation that the model cannot address. Additionally, the data layer was created from 30-meter Landsat Thematic Mapper (TM) data captured between 1991 and 1993, which limits our ability to evaluate current landscape characteristics. Given these constraints, this model was developed as a first-cut guide to help locate appropriate areas for more intensive on the ground field surveys or to be used to identify habitat connections and corridors. This model is not meant to imply the entire area could be or is appropriate for WTPD occupation.

Colorado
Historic information. The U.S. Department of Agriculture (USDA; 1911) provided the following description of WTPD occupied range and economic concerns of this species in Colorado:

> "The white-tailed prairie dog replaces the Gunnison's and black-tailed prairie dog on the sage plains of northwestern Colorado, where it occupies much of the open country west of the Park and Gore Range and north of the Lower Gunnison Valley. It occurs also in North Park, but was not found in the Laramie Valley, east of the Medicine Bow Range, nor does it range across the Rabbit Ear Mountains into Middle Park and Blue River Valley. In the Snake River Valley it is found east to Honnold, and in White River Valley it is common as far up as the mouth of the South Fork. Prairie dogs occur throughout the Bear River Region, and follow this stream to its headwaters in Egeria Park, thence, sparingly, south across the divide to McCoy and Grand River, and again across Piney Divide to Wolcott, on Eagle River, and West in the Grand Valley to Gypsum. They do not extend through the Grand Canyon above Glenwood, nor do they pass around it, and they are absent from the Grand valley between Glenwood and Grand Junction. On the desert areas between Grand Junction and the Utah boundary, prairie dogs are common, doubtless coming in from the west, where the range is probably continuous around the western end of the Bookcliffs in Utah. They range from Axial Basin south across the lowest passes of the Danforth Hills to the White River Valley at Meeker, but apparently do not cross the White River Plateau or its western extension, the Book Plateau, at any point in the state.
>
> Instead of extending northeast from Grand Junction in the narrow Grand Valley, *C. leucurus* ranges to the southeast in the broad Gunnison and Uncompahgre Valleys, and occurs over a wide area between the Grand Mesa and Uncompahgre Plateau. In the Uncompahgre Valley it was noted south to a point on Dallas Creek, a few miles west of Ridgeway. East of Montrose it was abundant along the railroad at Cedar Creek, and a few were seen almost to the summit of Cerro Ridge, between Cedar Creek and Cimarron. None were observed at Cimarron, and the divide between the Cimarron and Uncompahgre Rivers appears to mark the eastern limit of the range in this region. The species extends east along the North Fork of the Gunnison to Hotchkiss and Paonia, and was abundant at the west base of the West Elk Mountains, between Hotchkiss and Crawford. The majority observed in this section were on dry adobe flats, where the only vegetation worthy of mention was the prostrate, scrubby, desert-growing *Atriplex nuttallii* and a sparse *Dondia* in damp alkaline spots.

> Wherever white-tailed prairie dogs live in the neighborhood of cultivated ground they are very injurious to green crops. In the vicinity of Grand Junction the burrows are usually in the dry banks of irrigating ditches, and the prairie dogs inflict considerable damage on the adjacent truck farms by eating cabbages, cantaloupes, and other crops. They destroy considerable areas of range grasses and feed extensively in alfalfa fields and hay meadows in the river valleys throughout their range."

The approximate range of the WTPD in the northwestern portion of the state was also documented in 1910 by a scientific trip conducted by the University of Colorado (Ramaley 1910). This scientific expedition documented numerous WTPD colonies between Rifle and Meeker, noted them to be common locally from Meeker to Axial and along Little Beaver Creek, and found a few scattered colonies remaining from Meeker up to White River to a point just below Buford where the last WTPDs were seen.

Monitoring efforts. The majority of surveys and mapping of WTPD colonies has occurred within the boundary of the BLM's White River Resource Area. This area comprises much of Rio Blanco County, the southern portion of Moffat County below the Little Snake Resource Area, and the northern section of Garfield County. It extends west to the Utah border and east to the White River National Forest. Approximately 24,282 ha (60,000 ac) of WTPD occupied habitat was thought to be distributed more or less continuously north of the White River from Pinyon Ridge west along the U.S. State Highway 40 corridor to Utah, and south through Coal Oil Basin and Coyote Basin. Since the earliest surveys, WTPD populations in the White River Resource Area have seen dramatic fluctuations in both abundance and distribution. Biologists believe that these fluctuations have been driven primarily by disease and to a lesser extent changes in the composition and structure of plant communities due to grazing, resource extraction, and fire suppression (Wolf Creek Work Group 2001).

Gilbert (1977) surveyed for active WTPD colonies on approximately 97,000 ha (239,683 ac) in the west-central part of the White River Resource Area. Colonies were mapped on USGS topographic maps (1:24,000) and occupied habitat was calculated by hand. Eighty-two colonies encompassing 10,843 ha (26,792 ac) were mapped. Colony size averaged 132 ha (326 ac) with the largest being 3350 ha (8277 ac). Sixty-eight percent of the colonies were located on BLM lands, 28% on private lands, and 4% on state lands. Twenty-one belt transects (500 m x 5 m [1640 ft x 16 ft]) were completed in 14 colonies to sample burrow density as an index to activity. The mean density of active burrows in colonies sampled was 68/ha (27/ac) with the number of active burrows exceeding inactive burrows in all but 1 of the colonies transected. Transecting was prematurely halted when Gilbert noted evidence of a possible plague epizootic within the study area.

A number of surveys were conducted in the White River Resource Area in the 1980s. Almost all of the surveys found that WTPDs began to decline around 1985 with subsequent increases in WTPD numbers by 1988. Summaries of these surveys are described below.

A decrease in WTPD numbers was documented around Blue Mountain and Massadona during a long-term prey availability study conducted as part of a ferruginous hawk (*Buteo regalis*) nesting mitigation study in Moffat and Rio Blanco counties (Stalmaster 1985, 1988). WTPD densities were estimated annually by walking or driving established transects in April and June from 1982 to 1988 and counting the number of WTPDs seen along transects. The WTPD numbers observed along transects declined significantly from a high of 119 prairie dogs/km^2 (309/mi^2) in 1983 to extreme lows of 8 and 9 prairie dogs/km^2 (20.8 and 23.4/mi^2) in 1986 and 1987, respectively. By 1988, WTPD densities appeared to be improving with 52 prairie dogs/km^2 (135/mi^2).

A decline in occupied habitat of WTPDs in the mid-1980s was also demonstrated during a pre-construction ecological study completed along a proposed route for the Craig-Bonanza transmission line in Utah and Colorado in 1988 (Bio/West Inc. 1988). The survey was conducted to determine the amount of occupied habitat and activity status of WTPD colonies in an area extending from Bonanza, Utah north towards Dinosaur, Colorado and then east along U.S. State Highway 40 to Maybell, Colorado. A preliminary helicopter survey conducted in 1987 identified 30 colonies encompassing 6102 ha (15,080 ac) of which 6 were active on 2072 ha (5120 ac) (Department of Energy 1987). In the 1988 ground surveys, 28 of the previous 30 colonies were verified and an additional 7 colonies were mapped. All 35 colonies located were active and total occupied habitat mapped in 1988 was 4540 ha (11,218 ac). These surveys again indicated that WTPD populations in the White River Resource Area declined in the mid-1980s, but by 1988 were beginning to rebound.

Chevron Oil Company conducted mapping surveys of WTPD colonies within Coal Oil Basin from 1985 to 1988 (Mariah Associates, Inc. 1986, 1987, 1988). Coal Oil Basin is comprised of Colorado’s largest oil field, the Rangely oil field (12,141 ha [30,000 ac]). The Rangely oil field was first explored in 1933, and was fully developed with 478 wells at 16 ha (40 ac) spacing by 1949. Beginning in 1963, Chevron began infill drilling, and by 1984 the majority of the field had been drilled at 8 ha (20 ac) spacing. Since 1991 no new wells have been drilled, but considerable maintenance activity remains and in 2001, a limited-scale 3-D seismic effort was undertaken. Surveys within this area from 1985 to 1988 mapped 2446 ha (6044 ac) of occupied habitat with little apparent difference in occupancy between years. However, burrow densities were not estimated. In 1988, the survey team found 3 WTPD carcasses in a curled-up position near burrow entrances with no apparent external injuries, possibly implying the presence of plague. WTPD populations appeared to maintain themselves throughout Coal Oil Basin from the mid- to late 1980s, whereas other areas within the White River Resource Area declined. Relative to other occupied WTPD habitats in the White River Resource Area, Coal Oil Basin supports the most consistently abundant WTPD population (E. Hollowed, BLM, personal communication).

In 1985, lands exhibiting past and present occupation of WTPDs were mapped by the White River Field Office in Meeker (E. Hollowed, BLM, personal communication). These surveys indicated that about 16,000 ha (39,536 ac) of occupied habitat occurred in an area roughly described as west of Pinyon Ridge, south of U.S. State Highway 40, and north and east of U.S. State Highway 64 in Moffat and Rio Blanco counties. In 1985, a presumed plague epizootic severely reduced prairie dog abundance in Divide Creek, Wolf Creek, and Coal Creek Drainages by >75% (CDOW 1986).

One additional area was surveyed in the 1980s, but it was surveyed one time and no data on trends were reported. The surveys occurred at 2 Known Recoverable Coal Resource Areas near Rangely, Colorado. The areas were surveyed for WTPDs in 1981 in response to prospective coal leasing activity by the BLM (McDonal et al. 1981). During the surveys, 14 WTPD colonies covering 3621 ha (8947 ac) were mapped, with private and state land holdings comprising <28% of the prairie dog occupied area.

Population analysis. Within the State of Colorado, 3 areas were evaluated for their potential as black-footed ferret reintroduction sites. These areas included Coyote Basin, Little Snake, and Wolf Creek (Figure 2). All 3 sites are located in northwestern Colorado in Rio Blanco and Moffat counties. The Little Snake Black-footed Ferret Management Area is located within the BLM's Little Snake Resource Area, and both Wolf Creek and Coyote Basin are located within the BLM's White River Resource Area. Wolf Creek and the Colorado portion of Coyote Basin were selected to serve as black-footed ferret reintroduction sites and reintroduction was approved in the Record of Decision for the White River Resource Area Management Plan, July 1997 (Wolf Creek Work Group 2001). Selection of these 2 areas was due to favorable land use practices, landownership pattern, and suitability of WTPD resources. Population data were examined for Wolf Creek and Coyote Basin. The Little Snake Black-footed Ferret Management Area could not be evaluated due to lack of survey data but it is included in the change in occupied habitat analysis.

Wolf Creek – The Wolf Creek Management Area predominantly lies in southwestern Moffat County, about 29 km (18 mi) northeast of Rangely, with about 10% of the Management Area in Rio Blanco County; U.S. State Highway 40 crosses the northern portion of the Management Area between Massadona and Elk Springs (Figure 2). Primarily comprised of federal land, this 33 km^2 (81 mi^2) Management Area encompasses nearly one-half of the WTPD habitat found on BLM lands within the White River Resource Area (Wolf Creek Work Group 2001). The first WTPD mapping of the Wolf Creek Management Area was completed in 1989. Both active and inactive colonies were delineated on topographic maps by an observer scanning colonies from an elevated vantage point. Remapping of the area in 1993 excluded areas of inactivity thus a decline in mapped occupied habitat resulted (Table 3). Surveys within the Wolf Creek Management Area have been inconsistent. In 1993/94, surveys were conducted in an area from Pinyon Ridge on the east to Deserado Mine road on the west; in 2000, only the west side of the mapped area between Pinyon Ridge on the east and Coal Ridge road on the west was transected (colonies 1-13); and in 2001, the east side of this area was transected (colonies 14-26; L. Renner, CDOW, personal communication; B. Bibles, Utah State University, personal communication). The 2002 and 2003 surveys were the first time that the entire mapped area was transected with CDOW transecting the east end, and Utah State University and the BLM transecting the west. Because of the discrepancies in data collection and protocol within the Management Area, data collected on the west and east sides are presented separately to describe population changes. In Wolf Creek, like other areas within the White River Resource Area, plague appeared to negatively impact WTPD populations in the Management Area beginning on the east side in 1985 and progressing west to eventually affect the entire area (L. Renner, CDOW, personal communication). WTPD populations began to increase in the early 1990s, and by 1993/94 they were thought to be near pre-plague levels (L. Renner, CDOW, personal communication). Survey data from the east side of Wolf Creek showed a relatively stable population from 2001 to 2003 with a coefficient of variation of 14% (Tables 3 and 4; Figure 3). The WTPD population on the west side of Wolf Creek however, declined significantly after the 2000 surveys and has not recovered to pre-decline levels (Table 3; Figure 3). This population showed a high measure of variability with a coefficient of variation of 55% (Table 4).

Coyote Basin – The Coyote Basin Management Area encompasses about 4 km^2 (10 mi^2) in extreme western Rio Blanco County and is located about 18 km (11 mi) west-northwest of Rangely (Figure 2). This site is contiguous with the Coyote Basin Black-footed Ferret Management Area in Utah and was selected as a logical expansion site for the Utah-Colorado Basin reintroduced black-footed ferret population. Colorado and Utah share the same black-footed ferret experimental population area, but unique management plans were developed for each state. Coyote Basin, Utah was chosen to receive the first black-footed ferrets under this program. The Coyote Basin Management Area in Colorado was intensively surveyed in 1997 and from 1999 to 2003. Despite the short-term of monitoring (6 years) in Coyote Basin, WTPD populations showed a relatively high level of dispersion in population estimates with a coefficient of variation of 49.7% (Tables 4 and 5; Figure 3). The Coyote Basin Management Area saw a doubling in prairie dog abundance between 1997, when the population estimate for the Management Area was 3132, and 2000 when the prairie dog population estimate was 6666. Beginning in 2001, prairie dog populations began to decline in Coyote Basin, and by 2003 WTPD numbers were reduced to 1055.

Changes in occupied habitat. The Little Snake Management Area is located in Moffat County and is bounded on the north by the Colorado-Wyoming state line and on the south by Colorado U.S. State Highway 318 (Figure 2). This Management Area encompasses approximately 251,885 ha (548,270 ac) and is located within the BLM's Little Snake Resource Area. Federal land represents 88% of the Management Area, 8% is state land, and 4% is private land.

Standardized prairie dog sampling (Biggins et al. 1989, 1993) was used to delineate 31,506 ha (77,851 ac) of occupied WTPD habitat within the Management Area in 1989 (Patton 1989). The Little Snake Management Area straddles the Colorado-Wyoming Border and the Wyoming portion of the complex supported an additional 7215 ha (17,828 ac) of occupied WTPD habitat. However in both 1989 and 1990, greater than 50% of the Wyoming portion was either inactive or contained very low densities of WTPDs (B. Luce, PDCT Interstate Coordinator, personal communication). In 1989, occupied habitat for both the Wyoming and Colorado portion of the Little Snake Management Area consisted of 38,721 ha (95,678 ac).

Mapping of the Colorado section of the Little Snake Management Area in 1989 identified 2 complexes: 1) the Hiawatha-Powder Wash complex (complex A) comprising 98% of the mapped hectares lying largely between the Little Snake River on the east and the Cold Spring Mountain-Middle Mountain highlands to the west, and 2) a much smaller complex located just south of Irish Canyon near Dinosaur National Monument (complex B; Patton 1989). Complex A contained 276 colonies on 31,000 ha (76,601 ac) and complex B consisted of 14 colonies on 506 ha (1250 ac). Approximately 7% of the area mapped in 1989 was inactive due to some colonies recovering from a possible disease outbreak first suspected in 1983, when dramatic population declines were recognized by BLM biologists.

In 1990, black-footed ferret habitat surveys were conducted on 24,220 ha (59,847 ac) of complex A (Hyde 1990). For ease of mapping, complex A was divided into four sub-complexes: A1 (Little Snake) = 46 colonies on 5262 ha (13,002 ac); A2 (Vermillion) = 91 colonies on 7843 ha (19,380 ac); A3 (Powder Wash) = 18 colonies on 4010 ha (9909 ac); and A4 (Hiawatha) = 71 colonies on 8942 ha (22,095 ac). Hectares sampled within each sub-complex varied: A1 = 34 colonies totaling 4642 ha (11,470 ac); A2 = 66 colonies totaling 7395 ha (18,272 ac); A3 = 14 colonies totaling 3787 ha (9357 ac); and A4 = 44 colonies totaling 8397 ha (20,748 ac). Complex B was not surveyed. Thirteen of the 158 colonies sampled met the minimum criteria for good black-footed ferret habitat having at least 25 active burrows/ha (10/ac). The WTPD population estimate for the four sub-complexes combined was 14,381.

In 1993 and 1994, black-footed ferret habitat surveys were conducted within the 4 sub-complexes of complex A to further examine population trends and distribution of WTPDs (Albee 1993; Albee and Savage 1994). In 1993, a total of 360 transects were completed on 115 WTPD colonies covering 14,824 ha (36,629 ac; 47% of the complex). Thirty-eight of the 115 colonies, or 9129 ha (22,557 ac), met the minimum criteria of good black-footed ferret habitat (29% of the complex). The 1993 surveys showed shifts in WTPD activity from the 1990 surveys. For example, sub-complexes that had the highest numbers of WTPDs in 1990 had reduced activity in 1993, and other sub-complexes that had low numbers of animals in 1990 had increased levels in 1993.

In 1994, only colonies that had densities of equal to or greater than 763 WTPDs recorded in 1993 were sampled (Albee and Savage 1994). A total of 218 transects were completed on 32 colonies covering 7088 ha (17,514 ac; 22% of the complex). Thirteen of the 32 colonies comprising 3403 ha (8408 ac; 11% of the complex) met the minimum requirement for good black-footed ferret habitat. Again, significant changes in activity were noticed with the most active colonies in 1993 almost completely devoid of activity in 1994, and colonies having little activity in 1993 appearing active.

The Center for Disease Control (CDC) in Fort Collins, Colorado confirmed plague in the Little Snake Management Area from flea samples collected in 1994, and from coyote blood samples in 1995 (Albee and Savage 1994; USFWS et al. 1995). WTPD populations throughout the Little Snake Management Area were severely impacted by plague and virtually disappeared after the 1994 surveys. Because of this, the area was dropped from consideration as a reintroduction site, and surveys were discontinued until populations could recover to pre-plague levels.

In 1999, occupied habitat in sub-complexes A1 and A3 was remapped and transected to evaluate recovery rates and black-footed ferret habitat potential (Squires 1999). This remapping resulted in identification of 41 colonies covering 735 ha (1816 ac); a decline of 92% in occupied habitat from 1990 when sub-complexes A1 and A3 contained 64 colonies on 9272 ha (20,827 ac; Figure 4). The area of good black-footed ferret habitat in 1999 was 465 ha (1148 ac) with an estimated WTPD population of 5064 (10.3-11.6/ha [4.2-4.69/ac]). Most of the burrows outside of the areas mapped as active revealed signs of collapse indicating that they had not been occupied since the 1994 population decline.

In 2002, the active colonies in sub-complexes A1 and A3 were remapped and WTPD activity in other sub-complexes was informally assessed. From this effort there appeared to be little change from the 1999 survey, and what changes did occur were largely negative (Renner 2002). In 2003, WTPD colonies in sub-complexes A2 and A4 were remapped and other areas were informally assessed (Renner 2003). The 2003 survey showed modest improvement over the 2002 surveys, however there was concern that this observed recovery may not continue due to the continued drought conditions causing significant amounts of sagebrush and saltbush to become dormant or die over large portions of the area (Renner 2003). The areas surveyed had virtually no forb or grass cover forcing prairie dogs to subsist on underground roots. This lack of plant growth may ultimately decrease winter survival and subsequent reproductive rates.

Current occupancy. In 2002, the CDOW embarked on a statewide effort to document occupied WTPD habitat by interviewing field personnel from CDOW, the USFWS, and the BLM (CDOW 2003). WTPD colonies were mapped on 1:50,000 USGS county sheets and were designated as active (known to have WTPDs inhabiting the colony within the last 3 years) or as unknown (WTPDs were known to occur historically, but current status was unknown). From this mapping, a total of 77,648 ha (191,866 ac) of active and 19,021 ha (47,001 ac) of unknown WTPD colonies were documented. These data are preliminary and represent only those colonies and areas identified by agency personnel. Field verification of identified colonies is planned and budgeted for spring 2005.

Predicted range model. Twenty-one percent of the WTPD gross range and 11% of the WTPD predicted range occurs in Colorado (Table 1, Figure 5). The gross range boundary overestimates percent of habitat in Colorado as it includes large areas within it that are not, nor have ever been suitable habitat for WTPDs. Six percent of the WTPD gross range in Colorado is located on agricultural lands and 0.2% is located in urban areas (Tables 6 and 7). Forty-two percent of the gross range and 37% of the predicted range is located on private land within the state (Table 8). Colorado currently maintains 9952 oil wells within the WTPD gross range and 4953 in the predicted range.

Limiting factors.
Disease – The significant fluctuations in WTPD numbers recorded for Wolf Creek and Coyote Basin Management Areas may be due to plague or other diseases such as tularemia. Since evaluation of the areas began, populations in Coyote Basin and Wolf Creek west have shown fluctuations in WTPDs numbers (Table 4). These fluctuations may stem from plague infiltrating these areas and infecting populations as soon as densities of WTPDs become sufficient to increase transmission rates and spread the disease. Disease monitoring has not taken place at either location and thus it is unknown if plague is the culprit for the dynamic nature of these WTPD populations.

The Little Snake Management Area was the first area to be selected as a black-footed ferret reintroduction site in Colorado. However, a dramatic die-off of WTPDs in 1994 precluded the area from further consideration. Nine years after a plague epizootic was first documented, WTPD numbers and occupied habitat within the Little Snake Management Area remain severely depressed. Why this area has been unable to recover is unknown.

Human disturbance – Historic rodent control was significant in the White River Resource Area, but in the last 25 years little if any poisoning of either WTPDs or ground squirrels has taken place (USFWS et al. 2001). Rodent control on BLM lands in Moffat County has not been authorized since 1975, and large scale eradication of WTPDs through poisoning no longer occurs (USFWS et al. 1995).

A majority of lands in the White River Resource Area have been classified as valuable for oil and gas, though most of the development within the last 20 years has been outside of the Wolf Creek and Coyote Basin Management Areas (USFWS et al. 2001). Oil and gas developments occur in the northern portion of the Little Snake Resource Area with the 2 primary fields located in the Hiawatha and Powder Wash sub-complexes. Both of these sub-complexes have high densities of oil wells (USFWS et al. 1995).

Winter and spring sheep and cattle grazing occur in all 3 Black-footed Ferret Management Areas. Stocking rates and timing of grazing historically were sufficient to deplete availability of cool season grasses and increase encroachment of shrub cover. However, today the BLM attempts to manage grazing with the objective of providing sufficient rest during the critical growing season to allow for reproduction and replenishment of plant reserves (E. Hollowed, BLM, personal communication).

Shooting remains popular in the White River Resource Area, though the number of shooters and WTPDs harvested each year is not adequately monitored to evaluate the effects on population viability. Shooting of WTPDs has been documented in the Little Snake Resource Area, but is not considered to be widespread (USFWS et al. 1995).

Anthropogenic disturbances in northwestern Colorado do not appear to occur at high enough levels to cause significant declines in WTPD populations, but these disturbances may act in conjunction with disease epizootics resulting in amplification of population declines and delayed recovery of WTPD populations.

Montana

Historical information. Montana is the northern extent of the WTPD's gross range, where it historically inhabited shrub-grassland habitats in the intermountain valleys between the Beartooth and Pryor Mountain Ranges in the south central portion of the state (Hollister 1916, Flath 1979). No pre-settlement records concerning distribution and abundance exist for the state, but anecdotal information from the 20th century indicated WTPDs were restricted to a triangular area bounded by Bridger, Crooked Creek and Robertson Draw (Montana Prairie Dog Working Group 2002).

Changes in occupied habitat. During the past century, a decline in numbers of WTPDs and a contraction in occupied habitat have been observed (Flath 1979). Between 1975 and 1977, 15

WTPD colonies totaling 280 ha (692 ac) were mapped in southern Carbon County (Flath 1979; Table 9, Figure 6). After revisiting 14 of the 15 colonies in 1997, Flath found only 2 colonies comprising 39 ha (96 ac) remaining. Two additional small, previously unmapped colonies were located in 1999, increasing WTPD occupied habitat in the state to 41 ha (101 ac; Montana Prairie Dog Working Group 2002).

In 2003, 22 known WTPD colonies were revisited and 6 active colonies were mapped. Since 1999, little change in the total amount of WTPD occupied habitat was documented. The 2003 mapping identified approximately 48 ha (119 ac) of WTPD habitat in 6 colonies (C. Knowles, Fauna West Consulting, personal communication; Table 9). Thus, from 1975 to 2003, known occupied habitat in Montana has declined by 83%. Ongoing surveys are being conducted in Montana to locate additional WTPD occupied habitat where historic populations existed.

Currently the BLM, Montana Natural Heritage Program, and Fauna West Consulting are conducting aerial surveys throughout the WTPD range in Montana to identify additional colonies. Much of the WTPD occupied habitat in Montana is located on private lands. All colonies mapped in 2003 were located on public lands, adjacent to roadways, and may not accurately represent the total occupied habitat for the state. If new colonies can be located, each will be evaluated for its conservation potential based on land ownership, habitat, topography, estimated population, and proximity to other colonies.

The current observed decline of the WTPD in Montana during this century represents a range contraction for the species, and risk of extirpation in the short-term is high. In an attempt to maintain the viability of the WTPD in Montana, the BLM and Montana Fish Wildlife and Parks prepared a draft environmental assessment, as documented in the Conservation Plan for BTPDs and WTPDs in Montana, proposing reintroduction of WTPDs to formerly occupied sites (Montana Prairie Dog Working Group 2002). A successful reintroduction could ensure continued existence of the WTPD in the most northern portion of its natural range, and would help meet the mandate of Section 87-5-103(1), Montana Codes Annotated, which states in part, that nongame wildlife species should be "perpetuated as members of ecosystems".

The initial target for reintroduction efforts is to translocate approximately 60 to 350 WTPDs into 1 to 5 release sites. Adjustments to this target will be made depending on WTPD catch rates, success of translocations, and time required for monitoring. Records of number, sex, age, and location of all captures and releases will be maintained to facilitate monitoring. Active WTPD occupied habitat resulting from translocations will be mapped annually for at least 3 years with subsequent mapping completed at 2 to5 year intervals. Colonies on private lands will be augmented with landowner permission.

Two actions will precede the translocation of WTPDs in Montana. First, a public comment period needs to be completed on the proposed Translocation Protocol (Administrative Rules of Montana), as prepared by the Montana Prairie Dog Working Group. In July, these comments will be reviewed by the Montana Fish, Wildlife and Parks Commission and Montana Fish, Wildlife and Parks staff prior to final approval and adoption of the rule (2001). In addition, an exemption to the recently enacted Federal ban on the movement of prairie dogs (in response to the presence of Monkey Pox in prairie dogs associated with the pet trade) will need to be obtained. The second action is the reassessment of WTPD donor populations and colonies identified in 2002 as potential release sites. Source WTPD colonies were originally identified north of Greybull, Wyoming and near Chance Bridge, Montana. However, since the reintroduction effort was initially planned, many, if not all of the potential source populations in Wyoming and Montana may have suffered significant declines and may now be considered unsuitable as donor populations. In addition, recent changes in habitat at proposed release sites may require reconsideration and/or mitigation. Efforts are currently underway to identify new donor populations and additional reintroduction sites at some of the historically successful WTPD colonies in Montana.

Current occupancy. Today, WTPD colonies in Montana are small and isolated with few opportunities for widespread expansion and immigration between colonies. Because of this, the area has not been considered suitable habitat for black-footed ferret reintroduction. Information regarding population status of the WTPD in the state is based on a comparison of spatial mapping data from “historic” mapped colonies to mapping occupied habitat within the same areas in 2003.

Predicted range model. Montana represents 0.9% of both the gross and predicted range of the WTPD (Table 1). Agricultural lands impact 7% of the gross range within Montana while none of the gross range is impacted by urban development (Tables 6 and 7). Forty-seven percent of the gross range and 49% of the predicted range in Montana occurs on private lands (Table 10). With the possible exception of a single colony, urban and oil and gas development are not currently threatening habitats within the predicted range of the WTPD in Montana.

Limiting factors. Disease, historic eradication efforts, and conversion of shrub/grassland habitats to agriculture were most likely causes for the decline of WTPD populations in Montana. In one of the currently occupied colonies, highway traffic may pose some risk to the local population. On one colony where plague was suspected, sagebrush plants were found growing in silted-in mouths of old burrows during a 1997 survey (Montana Prairie Dog Working Group 2002). Of the 3 plants collected, one was 5 years old and 2 were 4 years old. This evidence implies that burrows were silted in, to the point of providing a suitable seed bed for sagebrush, as early as 1992. Considering soil type and precipitation in this area, it is logical to assume that siltation of vacant burrows would take place in 1 to 3 years. Therefore, WTPD colonies may have been impacted by plague as early as 1989 to 1991 (Montana Prairie Dog Working Group 2002).

Utah

Monitoring efforts. A statewide evaluation of the distribution and population status of WTPDs in Utah is confounded by a history of incomplete and inconsistent surveys, and variable time periods between estimates at specific sites. The only comprehensive effort to quantify prairie dog distribution was conducted by Utah Division of Wildlife Resources (UDWR) in 2002 to 2003. Previous efforts to account for the statewide distribution of WTPDs were incomplete. Therefore, trends in occupied habitat of WTPDs in Utah over time must be inferred from evaluation of quantitative data collected on a limited number of sites. In addition, WTPD colonies occur on private lands, and trespass restrictions prevent foot access for field surveys. Consequently, the data presented below represent minimum estimates of both WTPD distribution and abundance.

The first concerted effort to document prairie dog distribution and abundance throughout Utah occurred in 1968 when the Division of Wildlife, Bureau of Sport Fisheries and Wildlife (later renamed UDWR) compiled a map of UPD, GPD, and WTPD colonies using knowledge from professional biologists throughout the state (Bureau of Sport Fisheries and Wildlife 1968). The effort produced a rough map of species' distribution, but did not attempt to quantify occupied habitat by each species. This collaboration identified both the Uintah Basin in northeastern Utah and Castle Valley in eastern Utah (south of Price and west and east of U.S. State Highway 10) as areas supporting the greatest amount of WTPD occupied habitat. In far eastern Utah, the Cisco Desert along Interstate 70 and Rich County near Evanston, Wyoming were thought to contain the lowest concentrations of WTPDs.

The next major effort to document WTPD distribution and abundance in Utah occurred in 1985 (Boschen 1986, Cedar Creek Associates 1986). Since 1985, state and federal agencies, and occasionally private consultants, have sporadically surveyed portions of the species' range. In addition to surveys to document occupied habitat, a handful of WTPD sites have been intensively monitored to evaluate their suitability as black-footed ferret habitat.

Population analysis. Surveys of WTPD populations have been conducted at 4 Black-footed Ferret Management Areas in the Uintah Basin of northeastern Utah from 1997 to 2003 (B. Bibles, Utah State University, pers. comm.; Table 11; Figure 2). Although WTPD density in the Cisco Desert complex in southeastern Utah was also monitored, differences in survey protocols prevent meaningful assessment of population changes. The Cisco Desert complex is discussed in the change in occupied habitat analysis.

Coyote Basin, Kennedy Wash, and Snake John are all sub-complexes located within the larger Wolf Creek/Coyote Basin complex. Coyote Basin, a release site for black-footed ferrets, is located south of Snake John along the Utah-Colorado border; Kennedy Wash is located northwest of Coyote Basin; and Snake John is located along the Utah-Colorado border along U.S. State Highway 40, east of Jensen (Figure 2). Shiner Basin is located northeast of Vernal and south of Diamond Mountain (Figure 2). Within these 4 Black-footed Ferret Management Areas, WTPD colonies were mapped, evaluated as to their potential as black-footed ferret reintroduction sites, and monitored annually to track continued habitat suitability for black-footed ferrets (Biggins et al. 1989, 1993).

Coyote Basin – Little was known about the Coyote Basin sub-complex before initiation of black-footed ferret habitat surveys, but it was thought that a die-off had occurred here in 1990 (Boschen 1993). Windshield surveys from 1992 to 1993 showed an increase in WTPD numbers throughout the sub-complex (Boschen 1993). Intensive black-footed ferret habitat surveys (Biggins et al. 1989, 1993) were conducted in Coyote Basin from 1997 to 2003 (Table 11; Figure 7). Surveys from 1997 to 2000 showed the Coyote Basin population declining slightly. In 2001, the population began to increase and in 2002, the population of WTPDs was the highest recorded since transecting began in 1997. Subsequent surveys in 2003 showed a significant decline in the number of WTPDs. The coefficient of variation for Coyote Basin was 33% (Table 12).

Kennedy Wash – From 1982 to 1988 a ferruginous hawk mitigation study was conducted in the Kennedy Wash area of the Uintah Basin (Stalmaster 1985, 1988). During this research project, WTPD densities were determined by counting WTPDs seen along established transects in April and June. Numbers of WTPDs observed varied from a high of 242 WTPDs/km^2 (629/mi^2) in 1983 to a low in 1987 of 13 WTPDs/km^2 (33.8/mi^2). In 1988, the WTPD population increased and was estimated at 65 WTPDs/km^2 (169/mi^2). Black-footed ferret habitat surveys were conducted in the Kennedy Wash sub-complex from 1998 to 2003 (Table 11; Figure 7). The Kennedy Wash sub-complex showed a trend pattern similar to that documented in Coyote Basin; the population declined slightly from 1998 to 2001, increased sharply in 2002, and declined significantly in 2003. The coefficient of variation for Kennedy Wash was 48% (Table 12).

Snake John – Black-footed ferret habitat surveys were completed in the Snake John sub-complex from 2001 to 2003 (Table 11; Figure 7). WTPD population estimates were similar in 2001 and 2002, but like Kennedy Wash and Coyote Basin, populations declined significantly in 2003. The coefficient of variation for Snake John was 25% (Table 12).

Shiner Basin – Shiner Basin was surveyed from 1997 to 2000 (Table 11; Figure 7). WTPD populations declined from a high of 47,551 in 1998 to an estimated low of 5383 in 1999. Due to this significant decline, Shiner Basin was removed from consideration as a black-footed ferret release site even though transecting in 2000 documented an increase in the WTPD population estimate. For the 4 years of surveys, Shiner Basin had a coefficient of variation of 91% (Table 12). In 2002 and 2003, a low intensity survey effort (~60% of the area was sampled) was conducted within the Shiner Basin Management Area in order to evaluate WTPD population recovery (B. Zwetzig, BLM, personal communication). Survey results showed presence of WTPDs but at extremely low densities.

Averaging WTPD population estimates for all 4 Black-footed Ferret Management Areas surveyed in Utah from 1997-2003 showed a pattern of populations reaching high densities with subsequent declines in both 1999 and in 2003 (Figure 7). WTPD populations at all 4 Black-footed Ferret Management Areas within the Uintah Basin fluctuated despite the short term duration in monitoring (3-7 years/site) with coefficients of variation ranging from 25% to 91% (Table 12; Figure 7). Population estimates demonstrated dramatic increases and decreases in numbers of WTPDs within a one-year period (e.g. Kennedy Wash increased from an estimated 3670 prairie dogs [3/ha; 7.4/ac] in 2001 to 10,282 prairie dogs [8.6/ha; 21.2/ac] in 2002 and Shiner Basin saw a decline in WTPDs from 47,551 [11/ha; 27.2/ac] in 1998 to 5383 in 1999 [1.8/ha; 4.4/ac]) (Table 11). Because WTPDs reproduce only one time per year and juvenile emergence ranges from 2.94-3.83 per litter (Tileston and Lechleitner 1966; Bakko and Brown 1967), these oscillations in population estimates are biologically significant. Whether these fluctuations are normal is unknown and can not be determined with the short-term duration in sampling. Additional long-term data is needed to evaluate trends.

Changes in occupied habitat. Mapping of occupied habitat in Utah has been undertaken by a number of governmental agencies and consulting firms. Methods used and location of areas selected to compare changes in the amount of occupied habitat between surveys are described below.

> Cedar Creek Associates (1986) – Colonies were located with aerial surveys. Aerial surveys were flown along parallel transects spaced approximately 1 km (0.6 mi) apart. All colonies located during aerial surveys were visited on the ground to map colony boundaries based on distribution of both active and inactive burrows. Occupied habitat was calculated by placing a calibrated grid over each mapped colony and counting the number of grid and partial grid squares contained within the colony boundary. The total number of grid squares was then multiplied by the known hectare of one grid square.
>
> Boschen (1986) – Colony boundaries were determined by driving an ATV around the perimeter of burrows and hand drawing boundaries onto a topographic map. Colonies were defined as “areas with 10+ burrow openings per/ha”. Burrow activity was not assessed during surveys.
>
> Intermountain Ecosystems (1994) – WTPD colonies were first identified with helicopter surveys and then on-the-ground inventories were conducted to map extent of colonies, document other colonies not recorded during aerial surveys, and estimate WTPD densities using belt transects. Percent activity was estimated by recording active versus non-active burrows found along transects. Both active and inactive burrows were included in the estimate of occupied habitat.
>
> Seglund (2002) – WTPD colonies were located from existing roads. Once a colony was located, an observer drove the perimeter of the colony on an ATV delineating the boundary with an on-board Trimble GPS unit. To classify WTPD activity level, observers randomly walked throughout each colony counting the number of active and inactive burrows based on the presence of fresh WTPD fecal material. A colony was considered active if the number of active burrows was greater then 25% of the total counted. Both inactive and active areas were mapped and included in the estimate of occupied habitat.
>
> Maxfield (2002) – Colonies were located from existing roads. Colony boundaries were mapped by a stationary observer located at an elevated point within or near a colony, who then visually estimated colony boundaries. Boundaries were hand-marked on topographic maps and digitized into GIS. Colony activity was not evaluated during this process.

All other mapping completed for comparisons was done following Biggins et al. (1989, 1993).

The occupied habitat analysis measured changes over intervals from 8 to 17 years. Annual percent change in occupied habitat at all sites varied from -10.8% to 30.6% (Table 13; Figure 8).

For sites monitored for 17 years, the average annual percent change in occupied habitat was 1.74% (n = 6, range = -4.9% to 8.7%); for sites measured for 8 years, average annual percent change in occupied habitat was 19.8% (n = 2, range = -10.8% to 30.6%); and for the single site sampled at a 12 year interval, annual percent change was 17.8%. Site locations and changes in occupied habitat are described below.

> Huntington – In 1994 within a project area of 250 km^2 (97 mi^2), an Environmental Assessment was completed on a proposed coalbed methane project near Price (Intermountain Ecosystems 1994). The project area extended south of Helper to Huntington, west to Hiawatha, and east to Elmo and Wellington (Figure 9). In 1994, 2352 ha (5813 ac) were located and mapped. In 2002, the area was resurveyed resulting in 795 ha (1964 ac) of occupied habitat (Seglund 2002).
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> Buckhorn and Woodside – Mapped habitat within these 2 areas extended south of Huntington to Interstate 70 along U.S. State Highway 10, east to U.S. State Highway 6 (Figure 9). Cedar Creek Associates (1986) located and mapped 3555 ha (8784 ac) within these 2 areas. In 2002, the areas were resurveyed resulting in 3908 ha (9656 ac) of occupied habitat (Seglund 2002).
>
> Crescent Junction – Mapped habitat within this area extended along Interstate 70 just east of Thompson Springs and west of Green River in Emery and Grand counties (Figure 10). Cedar Creek Associates (1986) located and mapped 4089 ha (10,103 ac) within this area. In 2002, the area was resurveyed resulting in 3973 ha (9817 ac) of occupied habitat (Seglund 2002).
>
> Cisco Desert – Between July 1985 and February 1986, mapping and estimation of burrow densities for WTPDs was undertaken by UDWR (Boschen 1986) in an area encompassed by the Book Cliffs, Arches National Park, and the Colorado River (Figure 10). Surveys resulted in 16,729 ha (41,336 ac) being located and mapped. A majority of the colonies contained an average of 2 to 10 active burrows/ha (4.94-9.88/ac). Only 499 ha (1233 ac) had greater than 20 active burrows/ha (49.4/ac).
>
> In August of 1991 and 1992, the Cisco Desert complex was revisited to estimate WTPD density (Boschen 1991, 1992). This area was reevaluated because WTPDs appeared to have declined after the mapping in 1985/86. Random line transects were placed within portions of the 1985/86 mapped colonies and the number of WTPDs observed while driving transects was recorded. From 1991 to 1992 there was a marked increase (360%) in the number of WTPDs detected along transects. In the 1991 surveys, a mean of 67 WTPDs was recorded per colony (12 colonies transected) with densities along transects ranging from 0 to 278 WTPDs. In 1992, a mean of 452 WTPDs was counted per colony (8 colonies transected) with a range of 14 to 1297 animals recorded.

In 1997 and 2001, black-footed ferret habitat surveys (Biggins et al. 1989, 1993) were completed in the 1985/86 mapped areas of the Cisco Desert. In 1997, 11,182 ha (27,630 ac; 67% of the complex) were sampled with 55.7% or 6228 ha (15,389 ac) rated as good black-footed ferret habitat. A total of 2322 active and 2609 inactive burrows were counted along transects resulting in a WTPD population estimate for the entire complex of 50,089 (4.84 prairie dogs/ha [12/ac]). In 2001, a total of 5451 ha (13,469 ac; 33% of the complex) were evaluated. Only 17% of burrows were found to be active (208 active burrows/1186 of total burrows detected) with 83% inactive (978 inactive/1186 total burrows detected). Because of the low activity level recorded in 2001, remapping of the Cisco complex in 2002 was undertaken. This mapping effort resulted in 2682 ha (6627 ac) of occupied habitat (Seglund 2002).

Eightmile Flat, Twelvemile Flat, Sunshine Bench – A Resource Management Plan identified sites within the Diamond Mountain Resource Area as potential black-footed ferret reintroduction sites (U.S. Department of the Interior 1993). The area is located west and north of the Green River in northeastern Utah. Two sites, Eightmile Flat and Twelvemile Flat, were first mapped in 1985 by Cedar Creek Associates (1986; Figure 11). In 1985, Twelvemile Flat contained 363 ha (897 ac) and Eightmile Flat contained 2673 ha (6605 ac) of occupied habitat. In 1992 and 1993, Eightmile Flat and Twelvemile Flat were reevaluated as to their suitability as black-footed ferret reintroduction sites and a third site, Sunshine Bench, was also surveyed (Cranney and Day 1994; Figure 11). Mapping on Sunshine Bench yielded a total of 2085 ha (5151 ac) of occupied habitat. Twelvemile Flat showed an increase in size from 363 ha (897 ac) in 1985 to 771 ha (1905 ac) in 1993 (Cranney and Day 1994). Remapping of Eightmile Flat was not completed in the 1992/93 surveys. Within the 3 areas, a total of 548 burrow density transects were sampled covering 164 ha (405 ac; Biggins et al. 1989, 1993). Active burrow densities ranged from 0 to 10.37/ha (0 - 25.62/ac) and the WTPD densities ranged from 0 to 1.53/ha (0 -3.78/ac). None of the transects sampled met the minimum criteria for classification of good black-footed ferret habitat (Cranney and Day 1994).

In 1999, Eightmile Flat was remapped by the BLM resulting in a 9% increase in occupied habitat from 1985 (B. Zwetzig, BLM, personal communication). In 2002, Sunshine Bench and Twelvemile Flat were remapped by UDWR showing an increase in occupied habitat of 73% and 60%, respectively (Maxfield 2002).

Coyote Basin – This area was first mapped in 1985 by Cedar Creek Associates (1986; Figure 11). During this mapping effort 2424 ha (5990 ac) of occupied habitat was delineated. Remapping of this area in 1997 following Biggins et al. (1989, 1993) yielded an increase in occupied habitat to 7604 ha (18,789 ac; B. Zwetzig, BLM, personal communication).

Current occupancy. UDWR began a statewide mapping effort to quantify the current area occupied by WTPD colonies on public lands in 2002. Methods of data collection varied slightly among UDWR administrative regions, but all relied upon site visits to describe colony size and activity. The 2002 to 2003 surveys estimated that WTPD colonies occupied 57,463 ha (141,808 ac) in Utah. Colonies in Grand, Emery, and Carbon Counties in south central Utah occupied 10,869 ha (26,856 ac) on public lands (Seglund 2002). Within the Uintah Basin of northeastern Utah, 46,521 ha (114,951 ac) of occupied habitat were recorded (Maxfield 2002). In northern Utah, five colonies consisting of 73 ha (180 ac) were mapped in 2003 (A. Kozlowski, UDWR, personal communication).

Predicted range model. Sixteen percent of the WTPD gross range, and 13% of the predicted range occurs in Utah (Table 1; Figure 12). Three percent of the WTPD gross range in Utah is located on agricultural lands and 0.2% is impacted by urban development (Tables 6 and 7). Twenty percent of both the gross and predicted range occurs on private lands within the state (Table 14). Currently within Utah, 11,187 oil wells are located in the gross range and 8835 oil wells are located in the predicted range.

Limiting factors.
Disease – Sylvatic plague monitoring has been conducted by the USGS in Coyote Basin and Kennedy Wash since 2000 (Biggins 2003a). Blood samples have been collected from WTPDs, *Peromyscus maniculatus*, and *P. truei*. This monitoring is in response to the use of Deltamethrin as a tool to study the ecology of plague as well as examine its effectiveness at controlling flea populations. Plague was detected in Kennedy Wash in 2001 and 2002 and in Coyote Basin in 2002 (Biggins 2001, 2003a). Serological test results in 2002 found 2 sero-positive WTPDs in Coyote Basin (109 sampled) and one in Kennedy Wash (45 sampled; Biggins 2003a). Plague was not detected at either site in 2003 (D. Biggins, USGS, personal communication). Though low levels of plague have been detected in Coyote Basin and Kennedy Wash, surveys do not suggest an epizootic level of the disease.

Changing plant communities and drought – Within much of the WTPD habitat in Utah, cheatgrass establishment over native perennial grasses and forbs has been extensive (Boschen 1986; B. Maxfield, UDWR, personal communication). Cheatgrass competes for moisture with other more desirable species due to its winter and early spring growth (Whitson et al. 2000). After cheatgrass reaches maturity in early summer, it provides little nutrition and moisture either above or below ground for herbivores (Stubbendieck et al. 1997). This may hinder the ability of WTPDs to build sufficient fat reserves, resulting in decreased overwinter survival and subsequent reduced reproductive rates. UPD colony extinction rates have been found to increase as the number of native, locally occurring plant species declined (Ritchie 1999). Ongoing drought conditions in Utah over the past 5 years may have negatively impacted WTPD populations. In the past few years, WTPDs have been observed foraging on plant species during the early summer months that they usually do not use until early to late fall (B. Zwetzig, BLM personal communication). These species include Gardner's saltbush and cactus. They also have been seen foraging on ants throughout the summer months. The changes in observed foraging activities may indicate that preferred species are not available for consumption and that they instead are relying on alternative sources for nutritional needs. In addition, WTPDs have been observed emerging throughout the winter months, possibly indicating inadequate body condition to maintain hibernation (P. Schnurr, CDOW, personal communication; B. Zwetzig, BLM, personal communication). During the hibernation phase, mass losses of 26-30% have been recorded for yearling WTPDs (Cooke 1993). Thus, an inability of WTPDs to build sufficient mass to compensate for overwinter losses is detrimental to survival and subsequent reproduction. Rayor (1985) found that Gunnison's prairie dogs on lower quality habitats had lower overwinter survival than those occupying habitats with high quality vegetation.

Human disturbance – Human disturbances on WTPD habitats in Utah are limited mainly to shooting, oil and gas development, and agriculture. Shooting closures during the breeding season (1 April-15 June) were implemented in 2003 on all public lands. Previous to this closure, only Coyote Basin and Kennedy Wash were protected from shooting by having a year-round closure since 1999. The UDWR does not maintain harvest data on the number of recreational shooters or the number of WTPDs taken from areas, making it impossible to evaluate the impact of this disturbance. However, there does not appear to be a difference in population trends between the 2 areas closed to shooting in 1999 versus those left open. Continued research is needed to accurately determine the effects of this activity on the long-term viability of this species.

Oil and gas development within WTPD habitat has accelerated within the past few years. Utah ranked 14th in the United States in crude oil production and 12th in natural gas (marketed) production (including Federal Offshore areas) during 2002 (Utah Department of Natural Resources 2004). Most oil and gas activities occur in Uintah, Dueschne, and Carbon counties (Utah Department of Natural Resources 2004; Table 15). Oil and gas wells affect small areas averaging less than 0.8 ha (2 ac), but with the proposed 8.1 ha (20 ac) spacing of wells in Utah, this accelerated development will result in large amounts of habitat lost due to road development and well pad construction. States have reclamation rules that require impacted lands to be restored to their original condition after a well is abandoned, however for the life of a well, habitat will remain fragmented and lost. Conversely, these disturbances can cause reductions in shrub cover providing additional habitats for WTPDs to colonize after a well is removed.

Agriculture conversion is also a threat to WTPDs in Utah. Much of this land conversion is occurring in the Uintah Basin and in Rich, Carbon, and Emery counties. WTPDs in Carbon and Emery counties have seen declines in occupied habitat, while many sites in the Uintah Basin have increased in occupied habitat. Agriculture conversion can negatively impact WTPDs when associated with poisoning and shooting of animals on private lands. Possibly due to these disturbances, WTPDs become widely dispersed and isolated into colonies of less than a hectare to a few hectares in size. On the other hand, these hyper-productive lands can provide high quality nutrition leading to higher densities of animals and increased colonization.

Wyoming (authored by Martin Grenier and Bob Luce)
Historical information. The last known free-ranging black-footed ferret population was discovered in 1981 at a WTPD complex in Park County near Meeteetse, Wyoming. This discovery initiated the development of the Strategic Plan for Management of the Black-footed Ferret in Wyoming (WGFD 1987). The completion of the document spurred prairie dog mapping efforts for both BTPDs and WTPDs in Wyoming. The WGFD, with the assistance of the

University of Wyoming Cooperative Fish and Wildlife Unit (UW), mapped over 202,350 ha (500,000 ac) of prairie dogs throughout the state between 1987 and 1990 (B. Oakleaf, WGFD, personal communication). Mapping conducted during this time was a culmination of many efforts (e.g. reintroduction site evaluation, follow-ups of reported black-footed ferret sightings, Section 7 Clearance Surveys on pipeline, powerline, and other projects). The results were compiled, and townships were classified into 2 categories: 1) townships containing 405-810 ha (1000-2000 ac) of occupied prairie dog habitat; and 2) townships with over 810 ha (2000 ac) of occupied habitat (Figure 13).

As part of this effort, the WGFD identified 18 complexes within the range of the WTPD (Table 16; Figure 2). A rangewide survey has not been conducted in Wyoming since 1990. Therefore there are no current statewide data with which to compare 1987-1990 distribution and population with 2004 to document an occupied habitat or population trend for WTPDs in Wyoming. However, trend can be inferred from evaluation of quantitative data collected at several sites where data are available for both 1987-1990 and 2002-2004. The data presented below represent only a sample of the total occupied habitat, and a minimum estimate of both WTPD distribution and abundance.

Due to variation in sampling efforts attributed to the following: lack of resources and staff; weather; conflicts associated with other reintroduction program priorities; and inconsistencies in colonies surveyed between survey years, often due to lack of access to private land (P. Hnilicka, USFWS, personal communication); comparisons of occupied area, data evaluations and conclusions will be limited to areas that received consistent and similar sampling efforts between areas.

Monitoring efforts. The Meeteetse and Shirley Basin/Medicine Bow (Shirley Basin) complexes were the only 2 complexes in Wyoming seriously considered for the release of black-footed ferrets. These 2 complexes have been subjected to intensive prairie dog mapping efforts over the last 2 decades. The remaining 16 complexes, with the exception of those addressed in this section of the Conservation Assessment, have not been remapped since 1990 (B. Oakleaf, WGFD, personal communication). Despite obvious similarities (e.g. intensive monitoring, presence of sylvatic plague) between Meeteetse and Shirley Basin, the 2 complexes actually differ dramatically in at least 2 ways, and these differences have likely accounted for the differences in the trend in occupied hectares at these 2 sites. First, the 2 complexes varied significantly in size, 4865 ha (12,021 ac) in Meeteetse and 62,114 ha (153,483 ac) in Shirley Basin. Second, only the Meeteetse complex was surveyed in its entirety during multiple sample years (Biggins 2003b). From 1992 to 2001, transecting in Shirley Basin to evaluate black-footed ferret habitat potential focused only on portions of the Primary Management Zone 1 (PMZ1) rather than on the entire complex (Hnilicka and Luce 1993; Luce and Steiner 1994; Luce et al. 1997; Luce 1998; Luce 2000; Van Fleet et al. 2001; Grenier et al. 2002; Table 17).

Since the last known population of black-footed ferrets was discovered near Meeteetse, the area has been the focus of a great deal of research (Forrest et al. 1985; Clark 1986; Clark et al. 1986; Collins and Lichvar 1986; Forrest et al. 1988; Ubico et al. 1988; Clark 1989; Menkens and Anderson 1991). A standard mapping method was not used to map the Meeteetse complex in

1981 to 1984, but the complex was remapped in 1988 according to the Biggins et al. (1989, 1993) methodology (Black-footed Ferret Advisory Team 1990). The Biggins et al. (1989, 1993) methodology was subsequently adopted as a standardized survey method for evaluating black-footed ferret habitat potential, and all surveys completed after 1988 in Meeteetse utilized this methodology. The CDC in Fort Collins confirmed plague in the Meeteetse complex in 1985 (Clark 1989).

Shirley Basin was subdivided into 2 sub-complexes in order to prioritize black-footed ferret reintroductions and facilitate monitoring on the mega-complex: 1) PMZ1 includes the northern portion of the complex and has a higher proportion of public lands; and 2) Primary Management Zone 2 (PMZ2) includes the southern portion of the complex and is primarily private lands (Figure 14). PMZ1 represents approximately 31% of the potential habitat that existed in Shirley Basin in 1991. Prior to 2001, when cursory surveys indicated that little habitat potential existed (e.g. colonies sizes were small, dispersed, and appeared to be below the energetic threshold for ferrets) some colonies in PMZ1 were not remapped or surveyed. Unfortunately, the reported survey results for PMZ1 have become synonymous with trends (e.g. perceived declines) for the entire Shirley Basin complex between 1991 and 2001 (Biggins and Kosoy 2001a), although only a fraction of the entire Shirley Basin complex was transected on an annual basis (Table 17).

Following the initial black-footed ferret releases in 1991, active sylvatic plague was documented in PMZ1 by collection of prairie dog carcasses found during mapping (Hnilicka and Luce 1993). Survey efforts in Shirley Basin between 1992 and 2001 were focused entirely in PMZ1, and due to the constraints previously discussed; the survey efforts in any given year represented only between 18% and 85% of the available habitat within PMZ1, making trend analysis problematic. Furthermore, annual survey efforts only represented between 6% and 26% of the entire Shirley Basin complex (Table 17).

In addition to the above-mentioned monitoring efforts at Meeteetse and Shirley Basin, some of the 16 additional WTPD complexes in Wyoming, including Kinney Rim, Sweetwater, and several other smaller complexes have been evaluated for black-footed ferret habitat potential on at least 2 separate occasions. Those were as follows: 1) The Kinney Rim complex was sampled in 1989 (Conway 1989) and again in 1993 (Albee 1993); 2) Biggins (2003c) reevaluated 10 complexes in Wyoming between 1997 and 1998, which were originally surveyed from 1975 to 1981; because the Biggins (2003c) methodologies differed from the original survey efforts, results are not directly comparable but trend may be inferred; and 3) in 2002 the WGFD conducted surveys at 3 historic complexes (i.e. Dad, Moxa, Sweetwater) in an effort to evaluate historic versus current occupied hectares. The Dad and Moxa complexes had very low WTPD densities and were therefore not surveyed further, while the Sweetwater complex received additional survey effort.

Population analysis. Limited current data and lack of consistent past survey information for WTPD complexes in Wyoming makes long-term trend analysis biologically and statistically unsupportable for most individual complexes and at the statewide level. However, trends can be inferred from a few areas that have comparable survey efforts.

Declines in the WTPD estimate at the Meeteetse complex have been documented and reported by Biggins (2003b). Biggins (2003b) reported an estimated 25,494 WTPDs within the Meeteetse complex in 1988, but by 1989 the reported WTPD estimate decreased to 17,692, and then dropped to a low of 1299 in 1993. These declines followed, and were probably the result of, the sylvatic plague epizootic of the mid-1980s. By 1997, the WTPD estimate for Meeteetse had increased to 7095 (Table 18).

Sample transects in 10 of the 11 WTPD colonies (Colonies # 2-11) mapped by Luce in 2000 (Luce 2000) did not reveal any transects with greater than 8 total burrows, therefore sampling using Biggins et al. (1989,1993) was not conducted. Small areas of high WTPD densities and/or large areas of low WTPD densities both tended to fall out of the Biggins et al. (1993) model. Colony #1, with a mapped area of 35 ha (87 ac), was transected. However, only 3 transects had greater than 8 total burrows, and no transect had greater than 25 active burrows. All data combined indicate very low densities, and the colonies surveyed in 2000 combined for only 14% (1066) of the total WTPD estimate reported in 1997 by Biggins (2003b) for the same area. Data are not available to estimate population trends for the entire Meeteetse complex after 1997, however Biggins (2003b) suggests that WTPDs remained scattered throughout the larger area.

Sylvatic plague was first documented in Shirley Basin in 1987 (Orabona-Cerovski 1991) and impacted colonies to at least some extent through 1995. The WGFD conducted surveys of selected prairie dog colonies between 1992 and 2001 in Shirley Basin PMZ1. Results indicated that WTPD abundance appeared to have decreased as a result of sylvatic plague and, at least in 1 year, by flooding. However, Grenier et al. (2003) indicated a different trend. WTPD abundance appeared to be increasing in PMZ1 and adjacent areas, in part due to increases in occupied hectares both in areas previously mapped, and in new areas. This trend is difficult to document from the transecting data (Luce 2000; Grenier et al. 2003). Large annual fluctuations of WTPD estimates within colonies were reported in Shirley Basin (Luce 2000). Consistent comparative data are available for 4 colonies (#165, #166, #167, and #168). These colonies were surveyed during each year from 1991 to 2000, including in 1994 when only 6% of PMZ1 was transected (Figure 15). For example, Colony #166 decreased from an estimated high of 7321 prairie dogs in 1991 to low of 0 in 1995, then rebounded to 5480 in 1996, and decreased again to 0 in 1999 and 2000. Colony #168 decreased from an estimated 4066 prairie dogs in 1992 to 404 in 1995, then increased to 2433 in 1997, dropped to 0 in 1999, and increased again to 638 in 2000 (Figure 15). Despite those fluctuations, the changes in distribution of WTPDs within the Shirley Basin complex, especially pioneering of new colonies reported in Grenier et al. (2002), have increased the WTPD occupied area. Ocular estimates of WTPD populations within colonies mapped in 2004 indicate increased densities and abundance, although no quantified estimates of the population is available (Grenier et al. in press). Population trends for the entire Shirley Basin complex cannot necessarily be projected from the above-presented data, but the trend is inferred.

The Kinney Rim complex, when sampled in 1989, had a WTPD estimate of zero using Biggins et al. (1989, 1993; Conway 1989). Conway reported the area was very spotty with low densities, and suspected that sylvatic plague was impacting the complex. Four years later, the complex was re-sampled (Albee 1993) and only 10 of the original 38 colonies were transected. However, the 10 colonies had a WTPD estimate of 8111, an increase from 1989 (Albee 1993). In 1997, WGFD re-sampled 6 colonies within the complex. The 6 transected colonies had a WTPD estimate of 2822. No further attempts have been made to quantify trends at this complex.

Biggins (2003c) reported that 6 of the 10 (60%) complexes first mapped from 1975 to 1981, and reevaluated in 1997 and 1998 in Wyoming, had positive relative changes in total number of burrows, even though less area was surveyed in 1997 and 1998. These results indicate that the area occupied by WTPDs increased in density between sample years. Additionally, Biggins (2003c) stated that on a positive note, the detection of both declines and increases seems to suggest that WTPDs are not in imminent jeopardy, even if their ecological function has been impaired by the introduction of plague.

Changes in occupied habitat. Mapping efforts prior to 1989 did not follow Biggins et al. (1989, 1993), therefore it is impossible to project trends in populations of WTPDs between 1987-1990 versus 2002 within the majority of complexes, even though some complexes were resurveyed in 2002.

WTPD occupied habitat has been quantified in only a few complexes (Table 16). However, WGFD personnel have noted changes in occupied hectares resulting in both increases and decreases in occupied area since the mid-1990s in Carbon, Fremont, Park, and Sweetwater counties. However, because these changes were not quantified, our analysis in this section will be limited to areas where the magnitude of change has been quantified with on-the-ground surveys.

Declines of WTPD hectares at the Meeteetse complex have been documented and reported by Biggins (2003b) and Luce (2000). The Meeteetse complex was surveyed annually from 1988 to 1993, again in 1997 (Biggins 2003b; Table 18), and the Pitchfork Ranch portion was resurveyed in 2000 at the request of the landowner. The 1988 data delineated 15 prairie dog colonies encompassing 4861 ha (12,010 ac; Biggins et al. 1989). Remapping in 1989 increased the number of reported towns to 16 and occupied hectares to 4932 (12,186 ac; Biggins 2003b). By 1993, the occupied hectares had increased to 5170 (12,775 ac), and the same number of hectares was documented in 1997. Biggins (2003b) suggested that WTPDs remained scattered throughout the larger area. Small areas of high WTPD densities and/or large areas of low WTPD densities both tended to fall out of the Biggins et al. (1993) model. In 2000, Luce (2000a) surveyed the East Core, West Core, Pickett Creek, and Rose Creek colonies on the Pitchfork Ranch portion of the Meeteetse Complex. Luce reported that only 57 ha (141 ac) remained where approximately 2706 ha (6689 ac) previously existed, a net decline of 2648 ha (6543 ac).

At Shirley Basin, Grenier et al. (2002) reported a net increase of occupied hectares within approximately 20% of the surface area of the complex between 1991 and 2001 (Figure 16). Although overall, the number of prairie dog colonies declined from 14 to 11 in 1991 and 2001, respectively, the associated occupied hectares increased during that same time from 4894 ha (12,092 ha) to 5814 ha (14,366 ac).

During the summer of 2004 the survey effort within the Shirley Basin/Medicine Bow Black-footed Ferret Management Area (Figure 17) was expanded. Approximately 72% of PMZ1, originally mapped in 1990, and 83% of the colonies mapped in 2001 were all remapped in 2004. Mapping was conducted by circumscribing the perimeter of the colonies on-foot using a GPS unit. Sixty colonies were located and mapped in 2004 totaling 15,059 ha (37,212 ac; Grenier et al. in press). Results indicated that the number of colonies had doubled from the 1990 estimate of 30. Occupied habitat in 2004 represents approximately a 50% increase from the 1990 estimate of 10,427 ha (25,768 ac).

Similarly, Grenier et al. (2003) reported a net increase in occupied hectares for the Sweetwater complex. The number of prairie dog colonies mapped increased from 40 in the 1980s to 45 in 2002. In addition, the 2002 survey results indicated that approximately twice as many hectares were mapped in 2002, 4544 ha (11,228 ac), than were formerly mapped, 2428 ha (6000 ac; Figure 18). Occupied hectares within the areas surveyed in the Shirley Basin and Sweetwater complexes have increased for a combined 3036 ha (7502 ac) through 2001 and 2002, respectively.

The Kinney Rim complex was first sampled by Conway (1989). Conway (1989) reported that the area was very spotty with low densities and irregular activity making mapping difficult. In addition, a significant number of hectares also existed in Colorado in the same complex, as defined by (Biggins et al. 1989, 1993). Conway (1989), having documented several dead prairie dogs during transecting, suspected that sylvatic plague was impacting the complex during the 1989 survey, although no attempts were made to confirm presence of plague. The occupied hectares reported in 1989 were 7215 ha (17,828 ac; Conway 1989). In 1993, the complex was re-sampled again as part of the larger Little Snake Black-footed Ferret Management Area. Albee (1993) sampled 10 of the original 38 towns mapped by Conway (1989) and reported an increase in occupied hectares in Wyoming, a total of 7281 ha (17,991 ac). Albee (1993) credited this increase primarily to differences in delineating colony boundaries for at least 1 town on the Kinney Rim complex. Consequently, he questioned the mapping accuracy for the complex even in 1993 (Albee 1993).

Biggins (2003c), reported on a research project designed to compare prairie dog densities in selected complexes surveyed in 1975-81, and again in 1998. Due to differences in mapping methodologies, both the authors and Biggins caution that the 1975 to 1981 density and occupied area data presented for the 10 complexes in Wyoming (Biggins 2003c) cannot be compared directly to the more recent mapping efforts (1998) by Biggins. The comparison cannot be made due to use of different methods of defining colonies and complexes between the 1975-1981 and 1998 (D. Biggins, USGS, personal communication). It is however, important to note that overall, the net difference in occupied hectares among the 10 complexes was a potential decline of 1594 ha (3938 ac). Unfortunately, it is unclear whether the changes in occupied hectares between sample years are in fact declines, or simply an artificial result of differences in methodologies (D. Biggins, USGS, personal communication).

Although recent mapping efforts by the Kemmerer BLM Field Office are incomplete (J. Wright, BLM, personal communication) and therefore areas historically and presently occupied are not directly comparable. Historic records indicate that 14,312 ha (35,365 ac) may have been occupied within the area surveyed by BLM pre-1981. The 2003 surveys reveal that a minimum of 11,798 ha (29,153 ac) are still present in the Kemmerer BLM Field Office. If we limit our comparison to prairie dog occupied hectares known to present in both the pre-1981 and again in 2003, occupied hectares have increased from 8229 ha (20,334 ac) to 11,798 (29,153 ac). This supports data previously presented for Shirley Basin and Sweetwater that show shifts in occupied area occurring on a landscape scale. However, the actual trend for the entire area is unknown as mapping efforts are incomplete and therefore not directly comparable between years.

A potential black-footed ferret sighting was reported to the WGFD near the Saratoga complex in late July 2004. In order to investigate the report, on August 16, 2004 aerial surveys of the Saratoga complex were conducted in order to evaluate prairie dog occupancy within the area. The surveys were conducted from a low altitude fixed-wing aircraft with the observer having both the historic map of the complex and a BLM 1:100,000 map in hand. B. Oakleaf reported that the Saratoga complex and the Bolton Ranch complexes had grown dramatically from the previous estimate of 12,194 ha (30,132 ac) and 2718 ha (6717 ac), respectively. The 2 complexes occupied only a few selected townships previously (Grenier 2005). The exact increase in occupied hectares is unknown, however, B. Oakleaf, reported that WTPDs now occupied habitat south to Encampment, west to the Sierra Madre, east to the Elk Mountain, and north to I-80. The 2 complexes appeared to be 1 large complex, and the new complex is suspected to be connected to the Shirley Basin complex. B. Oakleaf also reported that the occupied habitat was very dense and that black-footed ferret surveys were warranted.

Current occupancy. There have been no efforts since 1995 to determine current statewide occupancy for the WTPD in Wyoming. Several incomplete estimates between 1987 and 1995 indicated that Wyoming probably had a minimum of 185,988 ha (459,576 ac) of WTPD colonies (Figure 19), although no effort was made to quantify active versus not active hectares during the surveys. Analysis indicates that greater than 61% (114,160 ha) of the WTPD colonies in Wyoming occur on public lands.

Predicted range model. Wyoming represents 62% of the gross range and 75% of the predicted range of the WTPD (Table 1). Thirty-five percent of the gross range and 33% of the predicted range of the WTPD in Wyoming is on private land (Table 19). From these data it appears that current occupancy on public versus private land is comparable to available habitat (65% of the gross range is public land and >61% of WTPD occupied habitat is on public land). Three percent of the gross range is impacted by agriculture and <1% by urban development (Tables 6 and 7). Within the predicted range of the WTPD in Wyoming, oil and gas is affecting 2,903,338 ha (7,174,051 ac) in low potential, 6,468,508 ha (15,983,466 ac) in medium potential, and 415,649 ha (1,027,057 ac) in high potential development areas, or 77% of the gross range in the state.

CURRENT MANAGEMENT STATUS BY STATE

COLORADO

The WTPD is classified as a small game species under the Colorado Wildlife Commission Regulation #300 A.2. Regulation #302.B sets method of take which includes rifles, handguns, shotguns, handheld bows, crossbows, pellet guns, slingshots, hawking, and toxicants. A small game license is required to take WTPDs, with the exception of private landowners, their immediate family members, and designees who may take WTPDs causing damage on their lands. The season statewide is year-round with no bag or possession limits (#308). However, participants in shooting contests can take no more than 5 WTPDs during an event (Regulation #302-1.a.1). No take is permitted on National Wildlife Refuges.

Colorado collects harvest information on small game, including prairie dogs. This information can be obtained online at the following web site:
http://wildlife.state.co.us/hunt/Small_Game/harvest_statistics/02-03/small_game_harvest.pdf.

All sportsmen who hunt small game in Colorado are required to sign up for the Harvest Information Program (HIP). HIP or MBHIP (Migratory Bird Harvest Information Program) is a national program originally designed to provide the USFWS with a means of improving nationwide harvest estimates of migratory birds. Sportsmen are required to sign up annually and to provide a current address (and in Colorado, a phone number). This enables the resource agency to contact hunters more effectively for post-season harvest surveys.

In Colorado, the decision was made to piggyback onto the national program and to include all small game hunters in the hopes of improving harvest estimates of resident small game species. A number of small game-related harvest surveys are conducted by phone. Surveys are conducted each spring, following completion of the majority of small game seasons. Prairie dogs (BTPD, WTPD, and GPD combined) are 1 of 23 species included in Colorado's General Small Game Survey. Each year, a random sample of 10% to 15% is drawn for the general small game survey from among the hunters signed up for HIP for the current "season". In 2002/03, there were 70,159 hunters signed up for HIP. A sample of 8289 hunters (12%) was drawn. The survey contractor attempts to reach each individual a maximum of 3 times before moving on to the next name. After a reasonable amount of time, the survey is terminated. In general, results from the small game survey provide a reasonably precise estimate of harvest for resident small game species. Unfortunately, this is not the case for prairie dogs.

There are several reasons for the inability to provide good harvest estimates for prairie dogs. First, Colorado regulations do not specify a bag limit for prairie dogs as is found with the majority of small game species. Secondly, because prairie dogs are not "hunted" in the traditional manner, there are relatively few hunters. Low hunter numbers make it difficult to sample (randomly) enough hunters to provide the basis for a reasonable estimate of harvest. This is difficult enough at a statewide level and becomes very problematic at the county level where 1 or 2 hunters may form the basis for the estimate.

Colorado has no bag limit for prairie dogs, hence the number reported harvested varies greatly. For the 2002/03 survey, hunters reported harvesting from 0 to 2000 prairie dogs. The large variation in prairie dogs harvested greatly increases the variance around the harvest estimate. In comparison, pheasant hunters (a bag limit of 3, and 9 in possession) reported harvesting between 0 to 90 birds and of those hunters 94% had harvested between 1 and 10 birds. The variance around this harvest estimate is much smaller and allows for a much greater level of precision.

Coupling the variance in numbers harvested with the relatively small number of hunters contacted through the survey (especially at the county level) makes the situation even worse. In 2002/03, the survey began with a sample of 8289 hunters. A total of 3562 hunters were contacted. Of these, 212 reported hunting prairie dogs and 189 reported harvesting prairie dogs. In comparison, the number of pheasant hunters contacted was 843.

The limitations of the survey for prairie dogs are further illustrated by noting the number of hunters contacted for individual counties. Hunters reported hunting prairie dogs in 43 counties. The number of hunters contacted for a given county ranged from 1 (8 counties) to 23 (1 county). The number of counties with 10 or fewer hunters contacted was 37.

Because of the wide variation in numbers harvested as well as the need to estimate harvest based on the response of a small number of individuals, Colorado's prairie dog estimates should always be accompanied with the standard errors and ranges around the estimates that are provided on the CDOW home page. This information makes it clear that the estimates are not nearly as precise as others generated via the General Small Game Survey.

The CDOW recognizes the limitation of current surveys for accurately estimating prairie dog harvest. Steps are underway to revise the hunting survey to improve the prairie dog harvest estimates. These improvements will be in place for the next survey period, spring 2005.

Some toxicants may be used by licensed applicators to control WTPDs and are regulated by the Colorado Department of Agriculture or the EPA. Gas cartridges can be used without a license. Relocation of prairie dogs requires a permit and the permit must include a management plan specifically addressing the applicant's long-term plans for maintenance or control of relocated WTPD populations (Regulation #302A.3). Colorado currently has no management or conservation plan for WTPDs and they are not included on the State Species of Concern or State threatened and endangered list.

MONTANA

In January 2002, the Montana Prairie Dog Working Group released the "Conservation Plan for Black-tailed and White-tailed Prairie Dogs in Montana". This plan was approved by Montana Fish Wildlife and Parks, the Montana Department of Agriculture and the Montana Department of Natural Resources and Conservation, and cooperation was pledged by the BLM, U.S. Forest (USFS), the Bureau of Indian Affairs (BIA), Natural Resources Conservation Service (NRCS), and the USDA/Animal and Plant Health Inspection (APHIS). The plan can be accessed online at www.fwp.state.mt.us/publicnotices and following the links through 'management plans' to the prairie dog plan. The stated goal of the plan is to "*provide for management of prairie dog populations and habitats to ensure the long-term viability of prairie dogs and associated species*". The 5 objectives deemed necessary to achieve this goal are as follows: 1) Confer legal status that is consistent with policy provisions of Sections 87-5 102 and 103, MCA (completed, see designation below), 2) Develop statewide and regional prairie dog distribution and abundance standards (underway), 3) Develop a management protocol for prairie dog conservation on federal, state, and private lands, 4) Develop and implement a prairie ecosystem education program, and 5) Identify and support or conduct research designed to form solutions to short-term and long-term biological and social problems related to prairie dogs. The proposed translocation of WTPDs to augment Montana colonies is described in the Conservation Plan.

WTPDs are listed on the Species of Concern List compiled by the Montana Natural Heritage Program and Montana Fish, Wildlife, and Parks (MFWP; 2001). Status is defined as critically imperiled because of rarity or because some factor(s) of its biology make it extremely vulnerable to extinction. The informal designation of Species of Concern does not change the legal status of a species and is used by MFWP to prioritize research and management needs among nongame wildlife species.

WTPDs are designated "nongame wildlife in need of management" in the Nongame and Endangered Species Conservation Act of Montana (87-5-101, MCA et seq.). An annual rule regulating prairie dog recreational shooting jointly adopted by the Montana Fish Wildlife and Parks Commission under the authority of 87-5-105, MCA in 2002 and 2003 applies to public lands only (not including state school trust lands). This rule was adopted again in 2004. The regulations will be in effect until 28 February 2006. The department and the Montana Fish Wildlife and Parks Commission will determine management regulations for prairie dogs annually.

By order of MFWP and the Montana Fish Wildlife and Parks Commission, the recreational shooting of WTPDs occupying public lands other than state school trust lands within the following described portion of Carbon County will be closed year-round, beginning 1 March 2003: where the Beartooth highway (Highway 212) crosses the Wyoming state line, then north along highway 212 to its junction with Highway 72 at Rockvale, then south along Highway 72 to Edgar, then east along the Edgar to Pryor Road to the Crow Reservation boundary, then south and east along the Crow Reservation boundary to Bighorn Lake, then south along the west shore of Bighorn Lake to the Wyoming state line, then west along the Wyoming state line to its junction with the Beartooth Highway (Highway 212), the point of beginning. Within this area, WTPDs occupy approximately 48.5 ha (120 ac). This area includes the entire known range of WTPDs in Montana. Additionally, the Department of Natural Resources and Conservation has closed prairie dog shooting on the Warren colony, which occurs on school state trust land.

The Montana Department of Agriculture continues to provide technical assistance to private landowners with regard to prairie dog control. In Montana, poisoning of prairie dogs is conducted primarily by private individuals and is geared toward containment rather than landscape-scale eradication (Montana Prairie Dog Working Group 2002). Any use of toxicants for control must follow EPA label directions. No take is permitted on National Wildlife Refuges.

The 2002 Montana Prairie Dog Conservation Plan addressed both WTPDs and BTPDs. Accomplishments to date that have benefited WTPDs include the reclassification of WTPDs as "nongame wildlife species in need of management", the application of a year-round shooting closure on WTPDs occupying federal lands, and a draft Environmental Assessment anticipating translocation of prairie dogs from Montana and Wyoming sites to formerly occupied colonies.

UTAH

The WTPD is designated as a "nongame" mammal in Utah under Rule R657-19-2, Taking Nongame Mammals. This Rule provides the standards and requirements for taking and possessing nongame mammals under authority of State Statute (23-13-3, 23-4-18, 23-14-19). The live capture of WTPDs and other nongame mammals is governed by Rule R657-3; Collection, Importation, Transportation and Subsequent Possession of Zoological Animals.

No license is required to take WTPDs (R657-19-10); they may be taken 24-hours-a-day, without bag or possession limits (R657-19-5). Take of WTPDs is prohibited on public lands from 1 April through 15 June, but they may be taken on private lands year-round. WTPDs may be taken in the following counties, which describe the limits of their gross range in Utah: Carbon, Daggett, Duchesne, Emery, Morgan, Rich, Summit, Uintah, and all areas west and north of the Colorado River in Grand County. No take of WTPDs is permitted within the Primary Management Zone for black-footed ferret recovery bordering Colorado in eastern Uintah County (R657-19-2(b)). This year-round shooting closure was imposed in 1999 [Subsection (2)(b)(i)]. The closed area boundary begins at the Utah-Colorado state line and Uintah County Road 403, also known as Stanton Road, northeast of Bonanza, southwest along this road to SR 45 at Bonanza, north along this highway to Uintah County Road 328, also known as Old Bonanza Highway, north along this road to Raven Ridge, just south of US 40, southeast along Raven Ridge to the Utah-Colorado state line, and south along this state line to point of beginning.

In 2003, UDWR (2003) added the WTPD to the agency's Sensitive Species List. The State Sensitive Species list was prepared pursuant to The State of Utah, Division of Wildlife Resources Administrative Rule R657-48. By rule, wildlife species that are federally listed, candidate for federal listing or for which a conservation agreement is in place are automatically placed on the list. Additional species on the Utah list are those "wildlife species of concern" for which there is credible scientific evidence to substantiate a threat to continued population viability. The list is intended to stimulate development and implementation of management actions to preclude federal listing of these species under the ESA. However at this time, Utah does not have a management or conservation plan for the WTPD.

WYOMING

Under the Wyoming Game and Fish Commission Regulations, the WTPD is classified as a nongame wildlife species (Chapter 52 [Nongame Wildlife], Section 6) and is classified as a Species of Special Concern with Native Species Status of 4 (NSS4) by the WGFD (Wyoming Game and Fish Commission 2001). Although Wyoming does not have a specific management or conservation plan for the WTPD, a significant portion of the occupied WTPD range (e.g. Shirley Basin, Laramie Plains) is included in their Department's forthcoming Grassland Conservation Plan. Within the state of Wyoming, WTPDs may be taken throughout the year without a permit. The Wyoming Department of Agriculture classifies the WTPD as a pest under statute W.S. 11-5-101 through 11-5-119 (Weed and Pest Control Act of 1973) and unregulated take is allowed.

RISK ASSESSMENT

The July 11, 2002 petition to list the WTPD as threatened under the ESA asserted that all 5 USFWS ESA listing criteria apply to the WTPD (Center for Native Ecosystems et al. 2002). In this Risk Assessment, current information regarding threats was summarized, followed by an evaluation based on our current understanding of each identified threat. From this evaluation, options to be considered in a conservation strategy, and research needs required to adequately understand their impacts, were presented.

The threats to the WTPD that will be evaluated in the USFWS's 90-day finding are:

1) The present or threatened destruction, modification, or curtailment of its habitat or range
2) Over-utilization for commercial, recreational, scientific or educational purposes
3) Disease or predation
4) Inadequacy of existing regulatory mechanisms
5) Other natural or man-made factors affecting its continued existence

1) PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF HABITAT OR RANGE

Current Information

During the 1900s, lasting changes resulting from conversion of rangelands to seeded pastures and croplands, urbanization, oil/gas exploration and extraction, intensive livestock grazing, alteration in fire regimes, and proliferation of non-native plant species have occurred within the WTPD range. How these changes have affected WTPD populations is difficult to determine since information regarding WTPD populations prior to human induced alterations across the western landscape is not available. Possible consequences (positive and negative) of these impacts are presented below.

Agricultural land conversion. Agricultural land conversions in conjunction with historic eradication efforts caused significant declines for all prairie dog species (Knowles 2002). This is because prairie dogs were not tolerated on agricultural croplands and disturbance by them on cultivated lands brought about control of local populations. Agriculture currently affects 6% of the gross range in Colorado, 7% in Montana, and 3% in both Utah and Wyoming (Table 6).

Agricultural lands can be beneficial to WTPDs by providing highly productive foraging habitat in place of their native arid landscape. In many areas, WTPD burrows can be found located adjacent to productive agricultural fields that provide WTPDs with highly nutritious forage. Due to this new abundant resource, WTPD populations may inhabit previously unsuitable areas and experience higher densities. This has been demonstrated for the UPD where densities were found to be lower at sites not associated with agriculture (16 prairie dogs/ha [6.5/ac]) and higher (36 prairie dogs/ha [14.6/ac]) at sites associated with alfalfa fields (Crocker-Bedford 1976). The differences in densities were attributed to differing nutritional planes based upon quantity and quality of available forage.

Urbanization. Urbanization impacts 0.2% of the WTPD range making it a localized situation and not a significant rangewide threat. In urban areas direct eradication of prairie dogs occurs, habitats become fragmented, dispersal corridors are removed, and colony isolation can occur. The impact of urbanization on WTPD populations has not been studied, however Collinge (2003) found that burrow and prairie dog densities were higher in BTPD colonies that were surrounded by urbanization and roads. These higher densities of prairie dogs created greater competition for resources and reduced habitat quality, leading to eventual population declines. Furthermore, dispersal was reduced or eliminated in urbanized landscapes making re-colonization after a plague epizootic or other population decline improbable. Irrigation of lawns and pastures, which accompanies urbanization, may somewhat offset the negative impact of urbanization by providing succulent forage.

Oil/gas exploration and extraction. A large portion of WTPD range is classified as valuable for oil and gas development (Center for Native Ecosystems et al. 2002). Individual oil and gas wells affect an area averaging less than 0.8 ha (2 ac), but with close spacing of wells and significantly more wells proposed in the WTPD's range, this development has the potential to significantly decrease the amount of available WTPD habitat. However, states have reclamation rules that require impacted lands to be restored to their original condition after a well is abandoned.

Possible direct negative impacts associated with oil and gas development include clearing and crushing of vegetation, reduction in available habitat due to pad construction, road development and well operation, displacement and killing of animals, alteration of surface water drainage, and increased compaction of soils (USFWS 1990). Indirect effects include increased access into remote areas by shooters and OHV users. Gordon et al. (2003) found that shooting pressure was greatest at colonies with easy road access as compared to more remote colonies. Another indirect effect includes vibroseis (seismic exploration) which could affect prairie dogs by collapsing tunnel systems, cause auditory impairment, and disrupt social systems (Clark 1986). Menkens and Anderson (1985) however, found no evidence of prairie dog burrow collapse or population declines that were correlated with vibroseis in the Laramie Plains of Wyoming.

Many initial surveys of WTPD colonies were conducted in response to oil and gas companies evaluating potential black-footed ferret habitat within project areas, as required by the USFWS (USFWS 1990). In Wyoming, each field office has had numerous "small scale" inventories of prairie dog colonies that were conducted as part of activity clearances, including clearances for oil and gas applications for permits to drill and associated road, pipeline, and powerline rights-of-way. These clearances were conducted using the 1989 USFWS procedures for black-footed ferret clearances. In some instances, intensive prairie dog colony mapping efforts were the direct result of terms and conditions and conservation measures, required by ESA Section 7 consultations with the USFWS (e.g. Continental Divide/Wamsutter II O&G EIS) for other species, usually the black-footed ferret. In other cases, the BLM Field Office funded, or cost shared on the funding of updated, baseline prairie dog inventories (e.g. Pinedale and Kemmerer PDT inventories).

Coalbed methane wells are a relatively new technology that relies on the extraction of methane gas from coal 61-1666 m (200-5500 ft) below the surface. The Rocky Mountain Region has extensive coal deposits with untapped resources of coalbed methane in the Greater Green River Basin of Wyoming, Atlantic Rim in Carbon County, Wyoming (M. Read, BLM, personal communication), and the Uintah-Piceance Basin of Colorado and Utah. Wells are currently being developed near Price, Utah where small colonies of WTPDs exist, and in the Piceance Basin in Western Colorado where WTPDs occur (E. Hollowed, BLM, personal communication).

Potential problems associated with coalbed methane development are increased human disturbance and habitat losses or fragmentation due to well development, pipelines, roads, and compressor sites; increased potential for shooting due to additional road development; and direct project-induced mortality. In addition, water disposal from methane extraction activities may have negative impacts on sagebrush-steppe habitats due to the high alkalinity of the water released.

Natural gas development has the potential to impact large areas in the WTPD range. The Continental Divide/Wamsutter II Project in Sweetwater and Carbon Counties, and Desolation Flats Project, Pinedale Anticline, Seminoe, Pathfinder, and Myton Bench are examples where exploration is taking place.

BLM offices in the respective states within the range of the WTPD address management of the species in relation to oil and gas development in colonies and/or complexes using different approaches. The BLM in Wyoming has no consistent, statewide policy for the management of WTPDs on Public Lands at this time (D. Roberts, BLM, personnel communication; Appendix C). There are 8 resource areas in Wyoming within the range of the WTPD (Worland, Cody, Rawlins, Rock Springs, Lander, Casper, Kemmerer, and Pinedale), and 6 (excluding Rawlins and Casper) of these resource areas are exclusively in WTPD range. All of these resource areas are conducting some form of prairie dog management and the WTPD has been declared a BLM sensitive species in Wyoming.

BLM land use planning efforts (Resource Management Plan [RMP] revisions) are underway at this time in the WTPD range in Wyoming (Rawlins, Pinedale, Casper, Kemmerer, and Lander). These RMP revisions are primarily driven by the recent emphasis on oil and gas development activity. Each of these land use planning efforts is currently, or will be, addressing WTPDs in the plan revisions. BLM also has had nominations submitted by several environmental groups for the designation of prairie dog colonies as "areas of critical environmental concern" (ACECs) in the land use plans for public lands within WTPD range. A BLM statewide, programmatic, biological evaluation is being prepared for WTPDs, the results of which will be incorporated into RMPs. The State of Wyoming, through WGFD, recently completed a draft conservation plan for black-tailed prairie dogs in Wyoming. While this plan was never adopted by the Wyoming Game and Fish Commission, it did contain a number of management recommendations and planned actions that could apply to WTPDs. The BLM has referred to the state conservation plan to help focus WTPD management efforts and budgeting requests.

In Colorado, the WTPD range occurs within the jurisdiction of 6 BLM Field Offices, with 4 of these having no stipulations for oil and gas development in WTPD habitat (R. Sell, BLM, personal communication; Appendix D). The Little Snake and White River Field Offices include black-footed ferret reintroduction areas and have stipulations related to black-footed ferret habitat protection, but do not specifically address WTPD conservation. The WTPD is not on the Colorado BLM Sensitive Species List.

Little Snake Field Office, Colorado

- Black-footed Ferret Management Plan objective is to maintain at least 90% of the known or potential WTPD habitat mapped on BLM surface in 1989.
- BLM Lease Notice LS-13 has the following stipulation:

  > "No surface disturbance activities will be allowed that may significantly alter the prairie dog complex making it unsuitable for reintroduction of the black-footed ferret", meaning that a lease could not be developed in a manner that would harm the integrity of a WTPD complex.

- Design and location of proposed development may be adjusted per standard lease rights to request delays of implementation up to 60 days and relocation of operations up to 200 meters to avoid or minimize direct impacts to active WTPD colonies.

White River Field Office

- Black-footed Ferret Management Plan objective is to maintain at least 90% of the occupied prairie dog acreage on BLM surface in the Wolf Creek and Coyote Basin Black-footed Ferret Management Areas.
- Black-footed Ferret Plan states: "Whenever possible, mineral development and utility installation activities will be designed to avoid adverse influence on prairie dog habitat. In the event adverse impacts to prairie dog habitat are unavoidable, activities will be designed to influence the smallest area practicable and/or those areas with the lowest prairie dog densities and compensatory mitigation may be required".
- Design and location of proposed development may be adjusted per standard lease rights to request delays of implementation up to 60 days and relocation of operations up to 200 m.

In Utah, the WTPD range occurs within the jurisdiction of the Vernal Field Office which includes Coyote Basin Black-footed Ferret Reintroduction Area and has stipulations related to black-footed ferret habitat protection, but does not specifically address WTPD conservation (B. Zwetzig, BLM, personal communication). The WTPD range also occurs within the jurisdiction of the Price and Moab Field Offices, which do not have directives with regard to WTPD management. However, both of these field offices are currently revising their Land Use Plans and the new plans will consider the WTPD in special status species alternatives (S. Madsen, P. Riddle, BLM, personal communication).

Vernal Field Office
Diamond Mountain RMP

- WTPD is on the list of Special Status Species
- WTPD occupied habitat is recognized only as potential black-footed ferret habitat
- Only active WTPD colonies are considered
- Coyote Basin is the designated black-footed ferret reintroduction area
- Focuses on maintaining 4047 ha (10,000 ac) of WTPD colonies

Diamond Mountain Record of Decision (ROD)

- Maintain existing WTPD colonies as potential black-footed ferret habitat
- In Eight Mile Flat, new surface disturbing activities will be limited to a maximum of a cumulative total of 10% within the potential black-footed ferret habitat area
- WTPD occupied habitat will be allowed to expand 10% from the ROD date
- Vegetation treatments will be planned to replace Animal Unit Months (AUM) lost to WTPD expansion
- FW33: Authorize no action in suitable habitat for Threatened and Endangered species
- Surface disturbing activities will avoid potential black-footed ferret habitat
- If black-footed ferret habitat cannot be avoided, impact will be confined to areas with <4 burrows/hectare (<10 burrows/acre) or disturb sites not currently being used by WTPDs

Moab Field Office
Proposed wording for new RMP

- The WTPD and the GPD are proposed for listing under the ESA. Should these species become listed and the BLM determines that a proposed action might affect these species or their habitat; formal or informal consultation with the USFWS will be initiated.
- Manage habitat for prairie dogs according to USFWS and UDWR recommendations and Recovery Plans
- Develop cooperative agreements with other agencies to inventory prairie dog densities and provide suitable habitat for expansion
- Protect occupied colonies. Place and protect a 0.8 km (0.5 mile) buffer around active colonies to allow for expansion
- OHV use restricted to designated roads
- No new road development within active colonies and buffer zones
- No new oil and gas development or exploration in or within 0.8 km (0.5 miles) of active colonies
- Adjust grazing to allow spring plant growth (livestock off by March 31)
- Ban prairie dog poisoning on BLM lands
- Develop an ACEC for the Cisco complex

The Montana policy regarding WTPDs is related to potential black-footed ferret reintroductions (J. Parks, BLM, personnel communication; Appendix E). "Prior to surface disturbance, prairie dog colonies and complexes of 32 ha (80 ac) or greater in size will be examined to determine the absence or presence of black-footed ferrets." Currently Montana has only about 48 ha (118 ac) of active WTPD habitat, so the state currently has no conflict with oil and gas leasing. Biologists do review lease parcels and will identify any parcels involving WTPD colonies in order to minimize any conflicts or disturbance. Because occupied habitat in the state is so small, Montana has not encountered any conflicts to date.

Livestock grazing. Domestic livestock grazing in the intermountain west began in the latter 1800s. Since that time landscapes across the west have dramatically changed (Wagner 1978; Crumpacker 1984). Though grazing by ungulates occurred prior to the introduction of domestic livestock, it differed with respect to species composition, timing, and selective pressure (Miller et al. 1994 in Crawford et al. in press). Evaluating the influence of domestic livestock on WTPD populations is difficult because ungrazed habitats within WTPD range are rare or nonexistent resulting in no clear ecological benchmark to evaluate changes. Overall assessments of livestock grazing throughout the west indicate that it has had profound ecological consequences including alteration in species composition within plant communities, disruption of ecosystem function and alteration of ecosystem structure (Fleischner 1994).

Alteration of plant species composition by grazing resulted from livestock selection of preferred species and differential vulnerability of plants (Fleischner 1994). Some of the long-term habitat changes due to grazing were alterations of grasslands to browse ranges (Cottam and Stewart 1940 in Collier and Spillett 1975), loss of early cool season forage, and proliferation of non-native annual grasses (Crocker-Bedford 1976; Beck 1994; Young et al. 1972, 1976 in Crawford et al. in press). Changes in plant species composition could have affected the suitability of the environment for the WTPD by decreasing availability of forage during critical periods (e.g. as juveniles emerge, prior to hibernation, during the reproductive season), degrading the overall quality and quantity of forage, and reducing biological diversity that had historically allowed WTPDs to consume different plant species and parts of plants as plant phenology progressed. Ritchie (1999) found that frequency of extinction at UPD colonies declined dramatically as the number of locally occurring plant species increased.

Disruption of ecosystem function by livestock grazing in arid environments is partly due to the degradation of cryptogamic crusts (Fleischner 1994). These crusts play a major role in nutrient cycling (Rychert et al. 1978), provide favorable sites for the germination of vascular plants (St. Clair et al. 1984), and are important to soil hydrology (Fleischner 1994). Research on UPDs indicates that these changes could impact WTPD by affecting forage availability (Ritchie 1999).

Livestock grazing in arid areas resulted in the formation of deep, erosive gullies (Cottam 1961), increased soil compaction, and decreased water infiltration (Kauffman and Krueger 1984; Abdel-Magid et al. 1987; Ordoho et al. 1990). The culmination of these impacts resulted in an altered ecosystem structure. One of the most important impacts of this alteration is the lowering of water tables leading to desertification of habitats (Fleischner 1994). There are estimates that over 1,618,800 ha (4,000,000 ac) of western rangeland have undergone desertification (Dregne 1983 in Fleischner 1994). This desertification could severely impact WTPDs by decreasing the availability of forage and causing a reduction in the vigor of cool season grasses.

Arid areas inhabited by UPDs and WTPDs simply are not adapted to heavy grazing by large ungulates. This practice has caused a decline in occupied habitat and population densities for the UPD (Collier and Spillett 1975). Similar impacts to the closely related WTPD are suspected, although unproven at present, due to lack of research.

Altered fire regimes. Since the 1860s, the ecological role of fire has changed within sagebrush-steppe habitats and grasslands. At lower elevation grasslands, an increase in non-native annual species has increased fire frequencies resulting in fluctuations in herbaceous cover, shortened seasonal availability of green plant material, and absence of forage in the late summer (Crawford et al. in press). In higher elevation sagebrush habitats, fire frequency has declined resulting in expansion of woody species (shrubs and trees) and contraction of perennial forbs and grasses (Crawford et al. in press).

Evaluation

Agricultural land conversion. Within the gross range of the WTPD, agriculture impacts 748,538 ha (1,849,612 ac) or 3.7% of the gross range (Table 6). Although WTPDs may not be tolerated on these lands, they represent only a small fraction of habitat within the gross range of the species and thus overall habitat loss to agriculture is significant only on a local scale and not on a rangewide scale.

Urbanization. In the gross range of the WTPD, few large metropolitan areas exist. Within the gross range of the WTPD, only 0.2% is impacted by urbanization (Table 7). Thus overall habitat loss due to this type of disturbance is significant only at a local scale and is not a rangewide concern.

Oil/gas exploration and extraction. Oil and gas development is occurring at an unprecedented rate and because much of this development is occurring on BLM lands, the BLM should incorporate WTPD management into Land Use Plans. The WTPD Working Group recommends that the BLM add the WTPD to their list of sensitive species to insure long-term, effective management of this species. Many BLM Field Offices currently do not consider this species in oil and gas development unless it is associated with black-footed ferret reintroduction efforts. Because of this, the BLM does not address WTPD species-specific needs, but addresses the WTPD as black-footed ferret habitat. In addition, they do not address maintaining habitat for expansion or shifts in occurrence outside of currently mapped colonies. The BLM also addresses impacts at a colony level rather than a complex or landscape level. Finally, RMPs do not address the impacts of road development and the potential for an increase in shooting/direct take of WTPDs as a result of oil and gas development. The WTPD Working Group recommends that the BLM should clearly designate where WTPD habitat protection will be a priority. The Working Group also recommends that BLM WTPD management emphasis be shifted from black-footed ferret management to management of WTPDs as a sensitive species.

Livestock grazing. The number of sheep and cattle on western rangelands peaked in the early 1900s (Cottam and Stewart 1940 in Collier and Spillett 1975; Young and Sparks 1985 in Crawford et al. in press). Within the last 40 years, stocking rates have been reduced by more than 25% (BLM 1990) resulting in an improvement in the health of public rangelands (Box 1990; Laycock et al. 1996 in Crawford et al. in press). Although improvements have occurred, the BLM considers over 68% of the lands they manage to be in "unsatisfactory" condition (US General Accounting Office 1991 in Fleischner 1994). Riparian areas impacted by grazing have been able to recover upon reduction and removal of livestock, but xeric uplands are difficult to restore. In addition, most management of upland habitats has focused on restoration of livestock forage rather than restoring native systems.

Since the early 1930s, grazing in WTPD habitats has centered on winter/spring/fall sheep grazing, but due to a declining sheep market within the last 10 to 15 years spring cattle grazing was instituted in some areas. The BLM attempts to manage grazing with the objective of providing adequate rest during the critical growing season to allow for reproduction and replenishment of plant reserves (E. Hollowed, BLM, personal communication). However, there currently is no formal drought management, and range health assessments may not be adequate to adjust for environmental conditions and current grazing levels. For example in 2002, grazing operators held 18,142 BLM grazing permits and leases. These permits and leases allowed for as many as 12.7 million AUMs of grazing use, with 7.9 million AUMs authorized as active use and 4.8 million AUMs authorized as temporary nonuse or conservation use. In 2003, AUM usage declined to 6.9 million. This decline was the result of decreased forage growth due to extended drought, fire, and other factors. This decrease in forage resulted in ranchers reducing their herds and using fewer AUMs than allowed under grazing permits and leases.

Altered fire regimes. A majority of the research conducted on changes in fire frequency and the effects on ecosystem function have been in the Great Basin. The arid grasslands and shrub-steppe ecosystem comprising the WTPD range differs from the Great Basin, and therefore direct inference of Great Basin research to WTPD range is questionable. Similar research efforts are needed across the range of the WTPD to adequately assess the effects of altered fire regimes on WTPD habitat.

Conservation options for a Conservation Strategy

The ability of resource managers to address the impacts of habitat alteration and loss on the management of species at a landscape scale has improved due to the advancement in technologies such as GIS, which can be used to discern the spatial pattern of suitable habitat. Knowledge of where habitat changes have and will occur on both local and landscape scales and in what spatial patterns is essential for proper management of WTPDs. Identifying suitable habitat and dispersal corridors among suitable habitat will help evaluate the long-term viability of populations, probability of dispersal among populations, and areas important for conservation. Critical areas identified during these analyses must be incorporated into Land Use Plans (e.g. RMPs) with conservation actions focusing on protecting unoccupied and occupied habitat, protecting corridors for immigration and emigration, and allowing maintenance and expansion of WTPD colonies and complexes. In addition, protection of WTPD habitat on private lands may be addressed by modeling private landowner incentive programs after the High Plains Partnership Initiative developed for black-tailed prairie dogs. In addition, programs such as the UDWR habitat initiative have potential to improve WTPD habitat.

Oil and gas development must be designed to minimize adverse impacts on existing WTPD colonies/complexes, and areas identified for expansion of colonies/complexes. To assess impacts at proposed sites, WTPD occupied and potential habitat should be documented prior to development. A minimal analysis should include mapping of WTPD suitable and occupied habitat, use of GIS to determine spatial distribution of these areas, estimate of local population densities, and evaluation of dispersal potential between suitable habitat patches within each complex (e.g. between colonies). Baseline information will help determine whether the loss of occupied and suitable habitat due to resource extraction activities could be compensated for by better managing other suitable habitat within a proposed project site and/or avoiding suitable and occupied habitat entirely by allowing development only in habitat not suitable for WTPD occupation. In addition, project design of oil and gas facilities in and adjacent to occupied and suitable habitat should include location of wells and roads outside of these areas, consideration of directional drilling when wells are proposed within suitable and occupied habitat, timing restrictions of vehicle travel to periods when WTPDs are less active, and regulation of vehicle traffic type. Finally, because knowledge of the effects of resource extraction on WTPD populations is limited, monitoring at sites before, during, and after development should be required.

It is beyond the scope of this document to provide a complete review of land management practices related to livestock grazing, but the WTPD Working Group believes that a reevaluation of management goals and strategies on BLM public lands to improve native habitats that benefit WTPDs should be instituted using additions and/or amendments to Land Use Plans. In general, based on individual land manager decisions, ecological health could be improved by instituting the following practices in WTPD occupied areas:

1. Allow periodic rest from grazing during critical growth, seed dispersal, and establishment. Fencing of high priority areas may be considered.
2. Develop grazing management practices that consider the season, duration, distribution, frequency, and intensity of grazing use on areas to maintain sufficient vegetation on both upland and riparian sites. Emphasize maintenance of native plant species and natural re-vegetation. Reseeding of disturbed and burned areas should be done using native, locally adapted plant species where appropriate.
3. Where appropriate, institute the use of mechanical, chemical, and/or biological methods of weed control to eradicate noxious weeds.
4. Incorporate fire, drought, flooding, and prescribed land treatments into livestock management practices.

Studies of fire regimes in the Great Basin do not necessarily mimic those on the Colorado Plateau. CDOW is currently completing a Best Management Practices guideline document for shrub-steppe and sagebrush systems, and when completed it will include sections on fire regimes and recommendations for management of shrub-steppe and sagebrush ecosystems. These recommended conservation actions, which will be included in the Conservation Strategy, should be integrated into habitat management planning and implemented by land management agencies.

Conservation actions developed should be implemented on a rangewide scale and coordinated on a multi-state level. After conservation actions are implemented, continued long-term monitoring of WTPD populations should be conducted to evaluate the effectiveness of programs. A monitoring protocol has been developed by Colorado State University, CDOW, and UDWR (Andelt et al. 2003), and is currently being implemented in Colorado and tested in Utah. This protocol uses occupancy rate, instead of mapped occupied habitat, to monitor spatial and temporal population changes throughout the range of the WTPD. This methodology provides an objective, repeatable estimation technique to measure the response of WTPD populations to factors affecting their viability.

Research needs

Studies should be conducted to identify habitat characteristics required to maintain viable populations and that address the direct and indirect effects of land conversions on WTPDs. Research needed to better manage WTPD populations includes, but are not limited to:

1. Determine the effects of timing and intensity of grazing regimes on the use of habitats by WTPDs
2. Determine the positive and negative effects of agricultural land conversions on population densities, reproductive output, and long-term viability
3. Determine the effects of fragmentation and development of barriers due to urbanization and agricultural development on dispersal and maintenance of colonies
4. Determine the spatial and temporal effects of fire on WTPD colonization rates and re-colonization rates
5. Determine the difference between non-native annual grasses and native plants on population trends, reproductive output, and viability over the long-term
6. Determine the dispersal ability of WTPDs, impacts of barriers on dispersal, and types of corridors needed for dispersal to occur
7. Evaluate changes in distribution and population densities at sites prior to, during, and after oil and gas development
8. Evaluate colonization rates after wells are removed
9. Monitor vegetation changes after wells are constructed and when they are removed
10. Further evaluate the effects of vibroseis on WTPDs
11. Examine the genetic structure of metapopulations of WTPDs

2) OVERUTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC, OR EDUCATIONAL PURPOSES

Current information

Shooting. Limited research exists on the affects of shooting on prairie dog populations, and all research conducted to date has focused on BTPDs. Extrapolation of the data to WTPDs can only be inferred, but in general the data are probably relevant. Below is a summary of studies conducted:

- Vosburgh and Irby (1998) compared 18 prairie dog colonies from 1994 to 1995 in areas protected from recreational shooting to those open to it. Colonies subjected to shooting declined by 20% (15% versus 35%) more than colonies that were not subjected to shooting, and prairie dogs were more vigilant in shot colonies. The authors postulated that recreational shooting might, with additional research, be an effective management tool to limit populations but was not a viable technique to eliminate prairie dogs.
- Vosburgh (1999) compared 4 colonies subjected to shooting to 3 colonies without shooting on Fort Belknap Reservation in Montana. The number of prairie dogs declined by 20% on shot colonies, and 10% on colonies without shooting.
- Knowles (1988) conducted a controlled shooting experiment on 2 colonies subjected to shooting and 1 that was not. The results of the study showed that shooting reduced prairie dog activity levels, and by the second year of shooting, the smallest colony had been extirpated.
- Stockrahm and Seabloom (1988) compared reproductive rates on 2 colonies that experienced intensive recreational shooting to 2 colonies that did not. They found that colonies experiencing heavy recreational shooting pressure had fewer males, smaller litter sizes, and very few females breeding as yearlings. These authors suggested that shooting disrupted the social system of the BTPD.
- Buskirk and Pauli (2003) examined 10 colonies on private lands surrounding Thunder Basin National Grassland in northeastern Wyoming. The colonies were paired, one a treatment and one a control colony. Shooting events were implemented between June and mid-July. Results from this study are preliminary, but so far have shown that treatment colonies exhibited reduced above ground activity, decreased foraging and sociality, juveniles experienced reduced body condition, and animals on treatment plots had increased ectoparasite loads.
- Gordon et al. (2003) also examined the effects of shooting BTPDs at the Thunder Basin National Grassland. They found that shooting did not appear to substantially affect BTPD behavior, short-term population levels, or physiology. High levels of shooting did result in mass emigration from the study plot.

A review conducted by CDOW, BLM, and the USFWS (2002) described the effects of shooting closures on prairie dog populations at black-footed ferret reintroduction sites. The sources of information for this review included black-footed ferret allocation proposals and communication with individuals participating in reintroduction efforts. The non-quantified results of the review showed that shooting restrictions at some sites positively influenced the abundance of BTPDs. There were no data to adequately address shooting closures and their effectiveness on WTPD populations. Though shooting closures have been established in some states, currently there are no data to adequately measure their effectiveness in maintaining and/or expanding WTPD populations. In Utah, WTPD population estimates derived from black-footed ferret habitat surveys in Coyote Basin (closed to shooting) do not appear to differ significantly from similar surveys conducted in the Uintah Basin at sites that have not been closed to shooting (Table 11; Figure 7).

Shooting in WTPD habitat mainly consists of local shooters and not the large number of nonresidents participating in shooting of BTPDs (Knowles 2002). Gordon et al. (2003) found that there was a dichotomy between local and out-of-state shooters, with out-of-state shooters spending more time shooting prairie dogs and using customized guns, rests, and other equipment to improve their accuracy. The reason that out-of-state shooters prefer to shoot BTPDs over WTPDs primarily is due to the differences in habitats and life history of the two species. Black-tailed prairie dogs are the preferred target because colony boundaries are easily discernable, colonies have higher densities of prairie dogs, mounds are more conspicuous, and the colony generally is more open and devoid of plants to obscure a shooter's vision.

Many shooters today use weapons that enable them to be consistently accurate at distances of greater than 366 m (400 yd) and to take significant numbers of prairie dogs per day. A study conducted by the BLM and Montana Fish, Wildlife, and Parks indicated that the average shooter hits 60 BTPDs per day during 7 hours of shooting (Knowles and Vosburgh 2001). Additional studies have documented shooters discharging approximately 150 rounds per day, hitting 40 to 50 BTPDs, and others documented shooters spending 2 to 3 days shooting and killing about 200 BTPDs during their visit (Vosburgh and Irby 1998, Vosburgh 1999). The Lower Brule Sioux Reservation in central South Dakota provided 8 years of BTPD harvest data (1993-2000) indicating that hunters shot an average of 15,000 BTPDs per year. Each hunter killed an average of 119 BTPDs per year or 38 per day of hunting (Reeve and Vosburgh 2003).

Peak shooting pressure on WTPD colonies tends to occur in May and June when the weather is cooler and juveniles are emerging. This timing in shooting pressure makes lactating females and young of the year more vulnerable and causes loss of dependent young when females are killed. Significant take of these individuals reduces the yearly reproductive output of a population and may be additive to natural mortality.

Lead poisoning has been suggested as an indirect consequence of shooting and a source of mortality for bird species associated with prairie dog colonies. Stephens et al. (2003) examined lead concentration in ferruginous hawk and golden eagle (*Aquila chrysaetos*) nestlings, and feather samples of burrowing owls for clinical signs of lead poisoning in Thunder Basin National Grasslands, Wyoming. They failed to detect lead poisoning in any of the raptors and concluded that low-intensity shooting does not contribute to lead poisoning, but high intensity shooting impacts remain unclear.

Commercial, scientific, or educational purposes. Wild prairie dogs of all species are collected and shipped to Asian markets as part of the commercial pet trade. However, the number of prairie dogs taken from the wild for this purpose is insignificant.

Evaluation

Shooting. Shooting closures for WTPDs have been implemented year-round in Coyote Basin, Utah to improve black-footed ferret habitat. In 2003, a seasonal shooting closure from April 1 to June 15 was implemented on all public lands throughout the state of Utah. MFWP and the Montana Fish, Wildlife, and Parks Commission adopted a year-round shooting closure on WTPDs throughout their range in Montana (not including school state trust lands, private, or tribal lands) beginning March 2002. An extension of this closure was approved in 2003 and 2004. In both Montana and Utah, shooting closures have been well accepted by the public. In Wyoming, a permanent shooting closure was implemented on a conservation easement in the Shirley Basin/Medicine Bow Management Area covering approximately 1917 ha (4737 ac). In Colorado, no shooting closures have been instituted in WTPD habitat.

The effect of shooting on the long-term viability of WTPD populations is unknown because shooting can introduce a level of uncertainty in the demographics of WTPD populations. Shooting, can result in removal of pregnant females and young of the year, promote increased emigration, and affect behavior. Also the time of year that shooting takes place will have differing effects on WTPD populations. Shooting has the potential to locally reduce population densities and could slow or preclude recovery rates of colonies reduced by plague or other disturbances by being an additive factor to mortality. Conversely, if shooting can be managed to regulate populations and maintain them at a threshold density, it may be a useful management tool for prairie dog conservation.

Commercial, scientific or educational purposes. In 2003, a BTPD within the commercial pet trade industry became infected with monkey pox (Department of Health and Human Services, Food and Drug Administration 2003). As a result, the Food and Drug Administration banned all transfer of wild prairie dogs within the commercial pet trade in order to protect wild populations. Overutilization from commercial, scientific, and/or educational purposes is not considered to be a threat to the long-term viability of the species.

Conservation options for a Conservation Strategy

Shooting. Shooting, unlike plague, is a manageable threat to prairie dogs. State wildlife agencies should develop programs to evaluate their current regulatory authorities and measures to ensure that they have mechanisms to regulate take of WTPDs. With the exception of Colorado, states within the range of the WTPD do not gather harvest information. The Colorado Harvest Program extrapolates estimates of the number of harvested prairie dogs from phone survey responses of hunters, but they have no statistics on proportion of the population harvested and/or geographic areas of take, making interpretation of the influence of shooting on WTPD populations impossible.

Shooting restrictions should include seasonal closures when females and pups are most vulnerable (1 April-15 July) and a requirement that shooters obtain a prairie dog shooting permit. This would give state wildlife agencies, through harvest surveys, the ability to quantify annual harvest. In addition, states need to develop monitoring techniques to assess the impacts of shooting and the potential need for regulations to limit take.

Research needs

No research has been conducted on the effects of shooting on WTPD distribution and population viability. Therefore research is needed to evaluate this disturbance and provide managers with information needed to regulate the take of WTPDs on public lands.

1. Studies comparing exploited and non-exploited WTPD populations should be conducted. Analysis should include effects on social interactions, foraging, distribution, emigration, population trends, and reproductive output. Studies should be conducted on a large scale over an extended time period to accurately evaluate effects of this disturbance.
2. Studies should be conducted that evaluate different levels of take on WTPD populations. This would provide information to help manage harvest levels and seasonal take.
3. Development of a monitoring technique that would allow managers to adjust harvest quotas to make shooting sustainable over time and avoid causing extirpation of populations.

3) DISEASE OR PREDATION

Current information

Disease. The primary factor limiting WTPD populations and distribution today is sylvatic plague, a flea-transmitted disease caused by the bacterium *Yersinia pestis* (Heller 1991; Cully and Williams 2001). Plague is a non-native pathogen that was first recorded in native mammals in California in 1908 (Barnes 1982). Since then the disease has spread from the Pacific Coast, east to the 100th meridian, infecting 76 species in 6 mammalian orders (Barnes 1993). The first confirmation of plague in WTPDs was in Wyoming in 1936 (Eskey and Haas 1940). Today, plague-free WTPD populations do not exist (Biggins and Kosoy 2001b).

Susceptibility to plague varies among mammalian species. Some species display no symptoms and are carriers of the disease (primary host). Others, such as prairie dogs, are highly susceptible and transmit and amplify the disease (secondary host; Barnes 1982; Cully 1997; Gage 2004). One or more primary hosts can maintain plague in the environment for extended periods of time in a given geographical area (polyhostal; Gage 2004). These host species vary in their susceptibilities to plague and the circulation of the pathogen among them may be the mechanism maintaining plague in the environment (Baltazard 1960; Kalabukhov 1965; Kartman et al. 1962; Pollitzer and Meyer 1961 in Turner 2001). A characteristic of sylvatic plague is that it has a local (foci) and discontinuous distribution (Heller 1992). Local foci are the reservoir mechanism that perpetuates the pathogen between outbreaks (Stark 1958 in Turner 2001; Stark et al. 1996 in Turner 2001).

WTPDs have been found to experience slower rates of transmission and less consistent population declines (85%-96%) than other prairie dog species (Clark 1977; Anderson and Williams 1997). BTPDs and GPDs experience nearly 100% mortality during epizootics, and eradication of populations can occur within one active season (Lechleitner et al. 1962, 1968; Rayor 1985; Cully 1989; Cully and Williams 2001). The susceptibility of populations to epizootics is thought to be a function of high population densities in addition to abundant flea vectors and uniformly low resistance (Biggins and Kosoy 2001a). WTPD populations, which generally occur in low-density colonies with dispersed aggregations of animals, may experience lower transmission rates due to their spatial pattern and distribution. However, possible long-term consequences of continued plague infection on WTPD populations may be local extirpation of colonies, extreme fluctuations in densities and occupied habitat, and inbreeding.

Tularemia (*Francisella tularensis*), a native pathogen to North America, can cause disease-related declines in WTPD populations (Davis 1935). The long-term impact of this disease on WTPD populations is unknown (Barnes 1982). Another new disease that may be of a concern is West Nile Virus. A BTPD was reported to have died of this disease in Boulder, Colorado in 2003. The susceptibility of WTPDs to this disease and long-term consequences of it cannot currently be determined.

Predation. WTPDs are a prey species for many predators including black-footed ferrets, hawks, eagles, badgers (*Taxidea taxus*), and coyotes (*Canis latrans*). However, predation does not appear to exert a controlling influence on density (King 1955; Tileston and Lechleitner 1966; Clark 1977).

Evaluation

Disease. Research on plague has clarified aspects of the ecology of the disease, but questions relating to how plague maintains itself in natural foci and under what conditions epizootics will occur, remain unanswered (Gage 2004). Without answers to these questions it is currently impossible to predict the movement, impact and/or timing of plague epizootics. In addition, information is needed to investigate the effects of changes in population demographics and recovery rates on colonies following a plague epizootic.

Recovery rates of colonies within localized WTPD populations have been reported to occur within as little as 1 to 2 years (Menkens and Anderson 1991; Anderson and Williams 1997) or greater than 10 years (Cully and Williams 2001; this document). Some of the difficulty in predicting recovery rates may be due to the continued re-infection of colonies over time and/or lack of immigration into areas. Research on the recovery rates of GPD and UPD colonies 2 years post-epizootic found GPDs experienced 100% mortality and remained depopulated (Turner

2001). The UPD colony however, maintained 1 adult female and 11 untagged individuals after infection and the population was able to rebound to 37% of the pre-plague population of adults 2 years post-epizootic. Following the severe reduction by plague, the percent of females weaning litters and juvenile survival both increased, contributing to the recovery of the population. It is extremely important to note that immigration may be an important mechanism in supporting recovery. The absence of immigrants into the GPD population may have been the reason for lack of colony recovery.

When evaluating the overall impacts of plague in WTPDs, both temporal and spatial scales are important to consider. Evaluation on a large scale, examining complexes across hundreds of square-kilometers for extended time periods, would result in a more informative portrayal of plague across the range of WTPDs. For example, since recovery rates appear to be quite different among localized populations and shifts in occupied habitat may occur after plague epizootics, investigation of impacts on a small scale may not adequately characterize the effect of the disease on the rangewide status of WTPDs. Cully (1997) found that after plague invaded an area, individual GPDs remained widely dispersed. In the following breeding season however, remaining individuals aggregated into new colonies that expanded into suitable habitat. Biggins (2003b) also observed this pattern at Meeteetse, Wyoming. In Shirley Basin, between 1991 and 2001, the number of prairie dog colonies on a monitored portion of the complex declined from 14 to 11, but the associated occupied hectares increased during that same period from 4894 ha (12,092 ac) to 5814 ha (14,366 ac; Grenier et al. 2002). Conversely, Seery (2004) found that during and after a plague epizootic, the number of BTPD colonies increased while the amount of occupied habitat declined.

Evaluation of plague over longer time periods may provide better insight into how WTPD populations are able to cope with this introduced pathogen. Environmental stochastic events and anthropogenic disturbances in combination with plague could ultimately decrease the ability of a population to recover to historical densities and jeopardize the long-term persistence of WTPD populations. In addition, a loss of genetic diversity due to periodic population bottlenecks caused by epizootics may occur. WTPDs have been found to have lower genetic variation than either BTPDs or ground squirrels and reduced gene flow between populations could be a concern (Cooke 1993).

There is evidence that some mammalian species are evolving a reduced susceptibility to plague (Williams et al. 1979; Thomas et al. 1988 in Cully 1993). Resistance to plague may differ among populations of the same species, and it may change depending on the amount of exposure (Biggins and Kosoy 2001b). Antibody titers have been found in UPDs, GPDs, and WTPDs indicating individual exposure to plague and subsequent recovery (Cully and Williams 2001; Biggins 2003a). The long-term consequence of repeated exposure to plague in WTPDs may lead to selection of individuals that are genetically more resistant to the disease and are able to maintain plague in an enzootic form in the environment. However, populations of WTPDs thus far have remained highly susceptible to plague even after being subjected to repeated exposure (Biggins and Kosoy 2001b).

Plague will likely continue to be an ever-present threat throughout the range of the WTPD in the foreseeable future. WTPD responses to plague epizootics have not been intensively studied, but at the complex and possibly the colony level, they have been found to survive plague epizootics better than other prairie dog species (Clark 1977; Anderson and Williams 1997). One reason for this could be that transmission rates of plague are density dependent (Cully 1989) and because WTPDs occur at lower densities, transmission may be slowed or stopped before it affects the entire colony or complex. While these "characteristics" may prove to aid WTPDs in maintaining population numbers in the face of plague, dramatic die-offs of 85% or greater can negatively impact WTPD populations in the long-term. Biggins (2003b) states that though detection of both declines and increases seems to suggest that WTPDs are not in imminent jeopardy of extinction, their ecological function has been impaired by the introduction of plague.

Human actions may compound the impacts of plague, at least in the short term, and should be addressed where possible to lessen the impacts or duration of plague. The effects of plague may be amplified and recovery rates slowed when additional stresses such as shooting, poisoning, and habitat loss/conversion occur. All of these pressures acting together may exacerbate isolation of WTPD populations. If plague infiltrates isolated areas and localized populations are eradicated, source animals may not be present to re-colonize the area.

Predation. Although WTPDs are susceptible to predation from a wide array of sources, predation is not believed to be limiting populations and currently is not believed to be a significant threat to the long-term viability of the species. Only the black-footed ferret preys exclusively on prairie dogs. Other predators are known to utilize a wide array of prey species and generally are opportunistic prairie dog predators.

<u>Conservation options for a Conservation Strategy</u>

Disease. The effect of plague on the long-term viability of WTPDs is unknown. Currently there are no techniques available for effective control or management of plague on large scales because the ecology of plague differs among habitats, populations, and prairie dog species. Also, current methods are costly and labor-intensive. Flea control can be used successfully on small scales (D. Biggins, USGS, personnel communication). An integral part of managing this disease and protecting WTPD populations will be to understand the rangewide dynamics of plague. Technologies that may be useful in doing this will include GIS/Remote Sensing and population and climate modeling.

The long-term impact of tularemia on WTPD populations is unknown (Barnes 1982) but is not considered a significant threat to the long-term viability of the species. The susceptibility of WTPDs to West Nile Virus and the long-term consequences of the disease currently cannot be determined.

Predation. As previously stated, WTPDs are susceptible to predation from a wide array of sources, but predation is not believed to be limiting populations nor a significant threat to the long-term viability of the species. Therefore, no action is necessary to address predation as a threat.

Research needs

1. Determine what happens to the disease between epizootics (maintenance mechanisms)
2. Determine the role of associated mammals in the maintenance and transmission of plague
3. Further examine under what conditions the disease is likely to flare up (e.g. climate)
4. Examine flea biology including ability to reproduce during epizootics, depression of flea numbers after an epizootic, and time to recovery for fleas
5. Evaluate ramifications of plague to long-term persistence of WTPD populations at a landscape scale
6. Examine recovery rates and population dynamics of infected colonies
7. Determine consequences of inbreeding depression in recovering colonies
8. Evaluate metapopulation dynamics – dispersal/movement, colonization, and gene flow
9. Institute a plague monitoring protocol to document plague events annually and maintain a rangewide database similar to that recommended for the BTPD (Luce 2003)
10. Continue research to develop an oral plague vaccine that can be economically dispersed over large areas occupied by WTPDs
11. Continue research on dusting with pesticides for flea control as a management tool. WTPD colonies with plague have been found to have both a higher percentage of burrows infested with fleas and a greater number of fleas per infested burrow than plague free colonies, indicating that fleas may drive the cycle (Heller 1991).

4) INADEQUACY OF EXISTING REGULATORY MECHANISMS

Current information

All states within the range of the WTPD classify it as a pest and permit poisoning and killing year long on private lands. Wyoming classifies the WTPD as a Nongame Species of Special Concern with a Native Status Species of 4 (NSS4), but take is unrestricted. Poisoning on private lands in Wyoming currently is limited to reduction of occupied hectares or limiting colony expansion rather than colony elimination (R. Reichenbach, Wyoming Dept. of Agriculture, personal communication). The situation is similar in Utah, Montana, and Colorado, with a large percentage of the poisoning in Colorado attributed to either control adjacent to agricultural areas or where urban expansion is taking place. Montana has a Conservation Plan that includes both BTPDs and WTPDs and, with the Montana Natural Heritage Program, has designated WTPDs as S1 (critically imperiled) on the Species of Concern List. In Utah, UDWR (2003) added the WTPD to its Sensitive Species List in 2003. Management programs are to be developed to proactively prevent listing under the ESA for species placed on this list.

The BLM manages the bulk of WTPD habitat, but currently state Field Offices do not manage this species unless it is associated with black-footed ferret reintroduction efforts. Thus, the BLM does not address WTPD species-specific needs, but only addresses the WTPD as black-footed ferret habitat. Implementation of land management actions on public lands across the gross range of the WTPD vary somewhat from office to office. A number of prairie dog colonies, and some major complexes, are intermingled with oil and gas development and production activities. However, most Field Offices do not afford prairie dogs any special management status, although to the extent deemed reasonable, most offices attempt to avoid prairie dog colonies, and particularly complexes, with surface disturbing activities. The terms and conditions, and conservation measures, resulting from ESA Section 7 consultations with the USFWS for other species sometimes dictate the actual prairie dog management measures applied (e.g. distance setbacks from colonies, monitoring). Some offices attach lease notices to oil and gas leases, and some offices apply conditions of approval. The BLM in Wyoming has issued limited policy for BTPD dog management (IM No. 99-146, IM No. WY-2000-46, and IM No. 2000-140), and some of this policy instruction has been carried over to WTPDs where it regards commercial hunting activities, shooting, and use of rodenticides for animal damage control.

Small amounts of WTPD habitat can be found on National Monuments, National Recreation Areas, Wildlife Refuges, and USFS lands where management of this species is not addressed. However, poisoning is either banned or closely controlled.

Shooting is not addressed by current federal regulations on federal lands. The CDOW and the WGFD permit unlimited shooting of WTPDs year-round. Utah recently implemented a shooting closure on public lands from 1 April to 15 June and Montana has a year-round shooting closure on WTPDs on public lands (not including school state trust lands).

Evaluation

On federal lands, impacts due to shooting, oil and gas development, livestock grazing, road development, poisoning, and mineral extraction are not addressed by current regulations. However, protection from conversion of habitat to agriculture and urbanization is afforded. In areas where black-footed ferrets have been reintroduced, programs are in place to monitor WTPD populations in order to protect black-footed ferret habitat.

The Wyoming Game and Fish Commission and the WGFD recently reviewed existing regulatory regulations that address both the WTPD and BTPD and agreed that current regulations would allow the Commission to implement a shooting closure if necessary for conservation of the species. The Commission and WGFD concur that existing data does not warrant a statewide shooting closure at this time. As stated previously, Montana recently completed a Conservation Plan for BTPDs and WTPDs and has a seasonal shooting closure in effect. Utah has implemented a seasonal shooting closure on public lands. Colorado is the only state that has addressed shooting by conducting shooter harvest surveys to establish the level of take. To date Colorado has not implemented a shooting closure.

Conservation options for a Conservation Strategy

State and federal agencies should review and evaluate current laws and regulations regarding WTPDs. State wildlife agencies and the BLM should cooperate on the development of new RMPs to address the conservation of WTPDs and their habitat with regard to oil and gas development, livestock grazing, poisoning, shooting, and road development. Special protection for large WTPD complexes should be employed by designating them as ACECs or "special management areas" on public lands. Standardized rangewide monitoring and management strategies for WTPD colonies and complexes, other than those associated with reintroduction of black-footed ferrets, should be implemented to measure and potentially mitigate the impacts of disturbances. Research addressing many of the issues associated with WTPD biology, ecology, and responses to disturbances should be funded. Coordination with private land owners to protect and promote colonization on private properties should be instituted. Mitigation options for development in areas currently occupied by WTPDs and design and implementation of a translocation program, primarily in Montana, should be explored.

Research needs

1. Develop a rangewide technique to monitor WTPD distribution and rate of occupancy
2. Refine habitat suitability models on a state-by-state basis to better manage WTPD habitat

5) OTHER NATURAL OR MANMADE FACTORS AFFECTING ITS CONTINUED EXISTENCE

Current information

Poisoning. As settlement of the Intermountain West occurred, prairie dog species became the focus of widespread eradication campaigns as a result of their reputation as range and agricultural pests (Clark 1989). The Biological Survey initiated systematic prairie dog control programs in 1915, and by 1919, cooperative poisoning campaigns had begun in all 4 states where the WTPD occurs. The majority of poisoning efforts were targeted at BTPDs, but major efforts were also initiated to exterminate the Wyoming ground squirrel (*Spermophilus elegans*), resulting in indirect take of WTPDs (Center for Native Ecosystems 2002). In portions of their range, the WTPD was specifically targeted for eradication. After the 1970s some toxicants (e.g. strychnine and 1080) previously used for prairie dog control were banned, and although prairie dog control continues today, it occurs at a reduced rate with less effective toxicants. Broad-scale control programs essentially removed all animals from treated areas and directly contributed to vegetation changes that may have limited future re-colonization, as was the case for the BTPD (Van Pelt 1999). Populations are impacted at a landscape level if control is 100% effective, not only directly, but because immigration sources are removed, genetic exchange is obstructed, and susceptibility to stochastic events are magnified.

Between 1903 and 1912, efforts to exterminate prairie dogs in Colorado were initiated primarily by individual cattlemen (Clark 1989). Organized statewide efforts began with the Pest Inspection

Acts of 1911 and 1915, and in 1912, the first systematic efforts of eradication began (Clark 1989). From 1915-1964, 9,380,192 ha (23,178,959 ac) of all 3 species of prairie dogs in Colorado were poisoned (Forrest 2002). Colorado was still poisoning approximately 53,000 ha/year (130,966 ac/year) into the 1960s (Forrest 2002).

In Utah, poisoning of 1,099,098 ha (2,715,930 ac) of Gunnison's, Utah, and white-tailed prairie dogs occurred from 1914 – 1964 (Forrest 2002). Poisoning to eliminate the UPD began in 1920 and was successful at reducing UPDs from approximately 37,232 ha (92,000 ac) in 1920 to 971 ha (2400 ac) in 1971 (Collier and Spillett 1975).

Prairie dog control programs began in the 1880s near Meeteetse, Wyoming (Edgar and Turnell 1978) and continued sporadically in the state until the 1930s. Kill rates were estimated at 50-100% during federal poisoning programs (Tietjen 1976 in Clark 1986). Limited poisoning after the 1930s suggested that this campaign was effective at eliminating a majority of prairie dogs. The poison 1080 was introduced in 1946 and was very effective and popular. Clark (1989) summarized the poisoning program in Wyoming from 1966 to 1972. During this period an average of 33,860 kg (74,649 lb) of strychnine-poisoned grain, 4730 kg of 1080 (10,428 lb), and 39,401 gas bombs were used annually on an average of 27,140 ha (67,062 ac).

In Montana, historic prairie dog declines are partially attributed to intensive eradication programs (Anderson et al. 1986). The Biological Survey Program for rodent control was used in Montana from 1916 to 1940 (Montana Prairie Dog Working Group 2002). Use of the compound 1080 was initiated in 1948 and tapered off after 1974.

Drought. Annual moisture is thought to be one of the most important factors influencing the distribution of UPDs (Collier and Spillett 1975). Drought conditions produce negative effects on plant cover and vegetative moisture (Collier and Spillett 1975). Studies have found that UPDs found on productive, wet sites have greater body mass, higher population densities, and faster expansion rates (Crocker-Bedford and Spillett 1981; Collier 1975). WTPD colonies located on sites lacking sufficient quality and quantity of vegetation may have a difficult time obtaining adequate nutrition and water, resulting in animals spending less time foraging and longer periods in aestivation. WTPDs have been found to graze preferentially on watered plots and were more active on these plots than on unwatered ones (Beck 1994). Higher quality habitats also promoted higher weaning success for both adult and yearling female WTPDs (Cooke 1993).

The effects of drought have been amplified within the past century due to land use practices that have resulted in the invasion of non-native plant species, alterations in plant species composition and lowering of water tables. The proliferation of exotic annual weeds over native perennial grasses and forbs may impact the ability of WTPDs to meet their dietary needs especially during drought years (Ritchie 1999). This is because invasive species may not provide sufficient above or below ground forage or water stores which WTPDs need to subsist. They also out-compete and eradicate native species with which WTPDs have evolved. UPD colony extinction rates have been found to increase as the number of locally occurring plant species declined (Ritchie 1999). Because much of the WTPD range occurs in arid shrub-steppe habitats, prolonged drought may have serious adverse impacts on WTPD populations by lowering animal body condition resulting in lower overwinter survival rates and subsequent lowered reproductive output.

Evaluation

Poisoning. Evaluating the affect of poisoning on WTPD populations is difficult because the accounts of poisoning are not site or species specific. BTPDs were the main focus of eradication campaigns, but WTPDs were targeted both directly and indirectly. Poisoning became less common after the 1970s due to federal regulation of poisons. Poisoning on private lands still continues today, but often is used for local containment rather than large-scale eradication. Only toxicants registered by the EPA may be legally used to control prairie dogs.

Knowles (1982) and Apa et al. (1990) found that BTPDs were able to recover from poisoning within a relatively short time frame due to an increase in the intrinsic rate of growth. For example, colonies reduced by 45% were able to rebound within 10 months while those completely controlled required 5 years or more to return to pre-control densities. These data provide evidence that if BTPDs are protected from landscape-scale eradication efforts that they can rebound, implying similar potential for the WTPD. Long-term impacts to WTPDs and their habitats from poisoning are unknown, and may or may not mimic the BTPD. The Wyoming Game and Fish Commission and Wyoming Department of Agriculture are currently developing a Memorandum of Understanding that would allow the state to curtail or halt toxicant application in Wyoming for either the short-term or long-term if necessary, in order to effectively manage both the BTPD and the WTPD. Colorado, Utah, and Montana are not considering this approach at the current time.

Drought. WTPDs have evolved to live in arid areas that experience periodic droughts. However, livestock grazing throughout the west has had profound ecological consequences including alteration in species composition within plant communities, disruption of ecosystem function, and alteration of ecosystem structure (Fleischner 1994). Because of this, WTPDs may not be able to survive prolonged drought conditions as well as they did historically. Also, due to global warming, the number and duration of drought periods may be increasing making it more difficult for WTPDs to survive. Thus, drought may be a significant factor limiting WTPD distribution and affecting population trends.

Conservation options for a Conservation Strategy

Poisoning. Ultimately, poisoning must be managed either by state wildlife agencies or state departments of agriculture if regulation of WTPD take is warranted. These entities should have the authority to limit or prohibit take by poisoning. The development of incentive programs to motivate private landowners to maintain WTPD colonies on their lands should also be advocated. Translocation options to supplement existing complexes and colonies or create new ones and/or rescue individuals from colonies threatened with imminent destruction could be incorporated into management plans to help maintain or recover population densities.

Drought. Climate conditions negatively impacting prairie dogs are difficult to manage on a site-specific basis, but perhaps can be addressed on a rangewide scale through multi-state cooperation and planning. GIS data layers could be used to rate sites on their ability to sustain WTPDs during times of drought based on the composition of vegetation and location of the habitat. Areas that are composed of native/nutritious vegetation would be considered to be at less risk than those areas dominated by a greater proportion of cheatgrass or other vegetation less suitable to WTPD survival and productivity. This would aid land managers in focusing their energies in improving high risk areas by better managing timing and intensity of grazing to promote forb and perennial grass production, control invasive weeds, and restore the historical density of woody species. Also managers could work to alleviate additional stressors such as shooting, which may impact the amount of time a WTPD spends foraging, to help during times of unfavorable environmental conditions.

Research needs

Information is needed to provide better management decisions regarding land use practices such as grazing, habitat restoration, and resource extraction. These data will aid in design of management strategies that alleviate additive stresses during difficult environmental conditions and provide information on when poisoning may be warranted and what level of control will be adequate to address the concerns.

1. Monitor WTPD populations during various environmental conditions over a significant part of their range
2. Examine land use practices and their ability to influence WTPD responses to environmental changes
3. Work on developing non-lethal options for controlling WTPDs
4. Examine the ability of WTPD populations to rebound after use of poisons on colonies

The Working Group's Recommendation Regarding the Need to List the White-tailed Prairie Dog as Threatened Under the ESA

The WTPD Working Group of the 12-state PDCT has examined the data presented in this Conservation Assessment and evaluated if it provides sufficient justification for listing the WTPD as threatened under the ESA. Based on the data, the Working Group does not support listing at this time. The Working Group believes the following factors argue against the need to list:

1) PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF HABITAT OR RANGE

Agricultural land conversion

Neither past nor current levels of land conversion rise to the level of a threat to the continued existence of the WTPD in the foreseeable future, and therefore listing under the ESA is not justified. Loss of habitat due to agricultural land conversion occurred historically, but at a relatively low level. Data presented in Table 6 do not indicate that a significant portion of the range in any individual state is impacted, and current trends in agricultural land conversion discussed in this Conservation Assessment suggest this impact likely will not increase in the foreseeable future.

Urbanization

This impact does not rise to the level of a threat to the continued existence of the WTPD in the foreseeable future, and therefore does not justify listing under the ESA. Data presented in Table 7 show that less than 1% of the gross range is impacted by urbanization. Loss of WTPD habitat due to urbanization almost exclusively is localized in the area of Grand Junction, Colorado. Throughout the remainder of the range it is a very minor impact.

Oil/gas exploration and extraction

This impact has the potential to rise to the level of a threat to the continued existence of the species, and therefore has the potential to justify listing under the ESA in the foreseeable future. Oil and gas exploration is occurring at a phenomenal rate on public lands. Since the BLM manages 55% of the land in the WTPD predicted range, significant impacts are possible, primarily during development of oil and gas fields with close well spacing and associated roads. As previously stated in this Conservation Assessment, recent data from Colorado, Wyoming, and Utah indicate that WTPD complexes shift on a landscape scale, possibly in response to plague or other factors not currently identified. Therefore all suitable habitat within and adjacent to complexes must be protected from direct habitat loss on a landscape scale if expansion opportunities are to be retained. Current BLM policies do not adequately protect WTPDs during oil and gas development. With the increased amount of leasing and oil and gas development in the WTPD range (77% of the WTPD gross range in Wyoming has the potential to be impacted by oil and gas development) this could lead to the need for listing the species under the ESA. Revision of BLM Land Use Plans to control leasing and development in WTPD complexes to address prairie dog management needs and maximize habitat potential must be initiated on a state-by-state basis to prevent further, more drastic actions, including listing the WTPD under the ESA.

Livestock grazing

Livestock grazing has negatively impacted the WTPD range by disrupting the ecosystem and drastically altering the landscape. Many of the changes brought about by this practice, such as the presence of non-native annuals, increased shrub cover, loss of cool season grasses, and lowered water tables, will continue to impact the WTPD. This impact could rise to the level of a threat to the continued existence of the species. However, as previously stated in this Conservation Assessment, the BLM manages 55% of the WTPD predicted range and has been working to reduce stocking rates. Though improvements have been made, upland habitats are difficult to restore and currently, options for their restoration are lacking. Information is needed to clearly evaluate the effects of grazing practices on WTPD populations. Until this information is available, the influence of this altered landscape on the population status and viability cannot be determined.

Altered fire regimes

This impact does not rise to the level of a threat to the continued existence of the species in the foreseeable future, and therefore does not justify listing under the ESA. No evidence exists that there is a significant impact to WTPDs from altered fire regimes.

2) OVERUTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC OR EDUCATIONAL PURPOSES

Shooting

Shooting does not rise to the level of a threat to the continued existence of the species over a significant portion of its range, and therefore does not justify listing under the ESA. Shooting, if managed correctly, is not a threat that will significantly limit the distribution of the WTPD, or a threat that will adversely affect population size and density such that recovery cannot be achieved in subsequent years. It is however, a threat that may act in conjunction with other threats to slow or preclude recovery rates of colonies reduced by plague or other disturbances.

Currently, there is a lack of scientific data suggesting that shooting has a significant impact on the viability of WTPD populations. Anecdotal information and field observation by state and federal biologists suggest that impacts are not widespread or significant. In addition, in states that have both BTPDs and WTPDs, biologists are unanimous in their opinion that shooting is of longer duration and more intense on BTPD colonies than on WTPD colonies. Therefore, we consider it to be significant that in the 2002 Black-tailed Prairie Dog Candidate Assessment, the USFWS stated: “we are not aware of data that support a conclusion that reductions in density are sufficient to reduce population persistence at a given site”, and that “no information is available that demonstrates that any black-tailed prairie dog population has been extirpated or nearly extirpated by this activity.” The USFWS’s conclusion was that, for the BTPD, the effects due to shooting do not rise to the level of a threat pursuant to the definitions and constraints of the ESA. The best data available to the state wildlife agencies in the range of the WTPD and Knowles (2002) indicate it is reasonable to assume that the situation is at least similar, if not less threatening, for the WTPD.

3) DISEASE OR PREDATION

Disease

Sylvatic plague has the potential to rise to the level of a threat to the continued existence of the species, but the threat is non-imminent. Concern over the long-term viability of WTPD populations is warranted. However, current available population trend and occupied hectare data do not show that this species is in imminent danger of extinction due to plague. It does appear that individual colonies and complexes are prone to significant declines during epizootics, but some colonies/complexes also exhibit rapid recovery. Thus, there is significant temporal and spatial variation in size of colonies and densities of WTPDs within colonies. Populations across the range may or may not occur at lower densities than they did historically, but the fact remains that they are continuing to maintain populations even when faced with plague. The role that plague has played and will play in the overall decline of WTPDs is a critical question for future management and research. Plague remains the unknown factor in the equation for conserving the WTPD. Though work is being conducted on the ecology of the disease and possible oral vaccine development, managing for the effects of plague epizootics will be an immense challenge for resource managers and scientists.

The biggest concern is that the ecosystem as a whole is not as productive as it was historically. Research presented in this Conservation Assessment indicates that continued re-infection by plague may be the reason that colonies and complexes show such dramatic oscillations in densities and spatial variation in occupied habitat. Prior to the introduction of the disease, populations may have been more stable and provided a reliable prey source for such species as ferruginous hawks and a specialized predator like the black-footed ferret. With populations now more dynamic, there is concern over the viability of species dependent on WTPD populations. It is therefore imperative that the approaches to plague management presented in this Conservation Assessment be implemented by state and federal agencies.

Predation

No scientific evidence exists to indicate that predation at the level currently experienced limits WTPD populations or distribution.

4) INADEQUACY OF EXISTING REGULATORY MECHANISMS

The Working Group believes that current regulatory mechanisms of both state and federal agencies should be improved to help conserve the WTPD. The development and implementation of appropriate management actions such as developing accurate survey techniques, incorporating progressive grazing and fire management especially during times of drought, incentive programs for private landowners, long-term monitoring of populations, and public outreach and education will all contribute to the long-term viability of this species. The BLM must also consider the WTPD in their Land Use Plans. Shooting seasons should be implemented. Plague monitoring should be instituted and research funded. The majority of the WTPD range is on public lands and agencies need to develop conservation strategies for this species if it is to remain off the ESA. It will also be imperative that conservation programs for this species take into account the interests of all affected parties so that alienation of segments of populations or stakeholders such as private and public land ranchers does not occur. Successful preservation of this species will require involvement by tribal, state, federal, private and local parties that agree to participate in the conservation effort.

5) Other Natural or Man-made Factors Affecting its Continued Existence

Poisoning

The Working Group does not believe that poisoning is a threat to the continued existence of the species, and therefore does not justify listing under the ESA. Control by poisoning on BLM lands, which contain 55% of the predicted range, is currently banned. Data presented in this Conservation Assessment indicate that poisoning is mostly a threat near cultivated or irrigated agricultural areas. In addition, the Working Group believes that less poisoning takes place in the WTPD range than in the BTPD range. Therefore, the USFWS's 2002 Candidate Assessment for the BTPD, which considers the threat to be moderate but non-imminent for the species, supports the supposition that it is also non-imminent for the WTPD.

Drought

The Working Group does not believe that drought is a threat to the continued existence of the species, and therefore it does not justify listing under the ESA. In the state sections of the Conservation Assessment, no pattern emerged within the population analysis to account for the affects of drought. For example in Utah during the 6 years of drought, some populations have declined as others increased. In Colorado, Wolf Creek east has remained relatively stable, whereas Wolf Creek West declined and then began to increase at the same time Utah populations were declining. In Wyoming, Shirley Basin increased occupied habitat by 50% in 2004. If drought alone was driving these fluctuations, assuming widespread drought, all populations would be following the same cycle and this does not appear to be the case. The Working Group does believe that drought can negatively impact WTPD populations, and the differences observed between areas may be due to habitat quality. If land managers can work to improve habitat conditions within the range of the WTPD, the negative affects of drought can be lessened.

Conclusion

After careful analysis of the information presented in this Conservation Assessment, the WTPD Working Group of the 12-state PDCT believes that while active management and development of conservation strategies for the species and its habitat is needed, justification does not exist for listing the WTPD as threatened under the ESA at the current time. However, the threat posed by oil and gas exploration and extraction may justify listing unless it is addressed on public lands managed by the BLM. It is critical that the BLM, through its Land Use Plans, manage oil and gas leasing and development in WTPD complexes to maximize prairie dog habitat potential. Land Use Plans must be revised on a state-by-state basis and WTPD protection should be initiated in order to prevent further, more drastic actions, possibly including listing the WTPD under the ESA.

The threat posed by plague could also justify listing. The reason that some occupied habitat has declined and not recovered (e.g. Little Snake, Colorado; Meeteetse, Wyoming; Cisco, Utah) is unknown. Continued re-infections may ultimately decrease the ability of a population to recover to historical densities and occupied habitat levels. The Working Group recognizes that plague may be the primary cause of large fluctuations in population densities that could lead to extermination on a landscape scale if additive impacts from a variety of sources combine with plague. Therefore, the Working Group believes that state wildlife agencies should continue to explore agreements to monitor plague on a rangewide scale, reduce and eliminate impacts from other anthropogenic sources, and encourage research on ways to control plague.

Other potential impacts will be addressed in the Conservation Strategy to prevent them from rising to the level of a threat. These include:

1) BLM, through Land Use Plans revision, should investigate grazing practices on WTPD habitats. Options explored may include adequate rest during the critical growing season to allow for reproduction and replenishment of plant reserves such that lack of quantity and quality of forage does not become an additive impact to the impacts of plague, shooting, poisoning and oil/gas exploration and extraction. In addition, all practices may need to be revised and monitored during times of drought to ensure that the habitat is not being further degraded during these extreme environmental conditions.

2) Although the Working Group believes that shooting alone is not a threat that significantly limits the distribution of the WTPDs on a landscape scale, state wildlife agencies should continue to explore options and/or regulations to establish shooting closures to prevent take during the breeding and whelping season. States should also measure the level of take by implementing harvest surveys.

3) Data presented in this Conservation Assessment indicate that poisoning is mostly a threat near cultivated or irrigated agricultural areas, but state wildlife agencies should continue to work to acquire adequate regulatory authority for conservation of WTPDs by establishing through law, regulation, or cooperative agreement the ability of the state to limit or prohibit take by poisoning if necessary. To address the threat to the species posed by unregulated poisoning, the states must not only have the regulatory authority, but also be willing to use it. In addition, state wildlife agencies and other interested parties should continue to pursue laws or regulations to require reporting amount and location of use of toxicants by control agencies so the amount and location of toxicant use can be tracked on an annual basis. Control by poisoning should continue to be prohibited on BLM lands, which contains the bulk of the gross and predicted range.

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Table 1. Estimate of WTPD occupied habitat per state and hectares within gross range and predicted range of each state based on the Predicted Range Model.

State	Estimate of Occupied Habitat (ha)[a]	WTPD Gross Range[b] (ha)	% of Gross Range[b]	WTPD Predicted Range[c] (ha)	% of Predicted Range[c]
Colorado	96,669	4,213,595	21	1,470,390	11
Montana	48	181,663	0.9	111,694	0.9
Utah	57,765	3,200,492	16	1,693,108	13
Wyoming	185,988	12,629,083	62	9,791,694	75
Total	**340,470**	**20,224,807**		**13,066,887**	

[a] Colorado, Montana and Utah WTPD habitat estimates are from the most current statewide surveys (2002-2003). Wyoming estimates of WTPD occupied habitat are from mapping of statewide complexes pre-1995.
[b] Gross range is the outer boundary identifying WTPD distribution and does not imply that all lands contained within the boundary are occupied or have the potential to be occupied by WTPDs.
[c] The predicted range was developed from a GIS model to depict a more accurate, spatial range of the WTPD. This model does not imply that the area could be or is appropriate for WTPD occupation.

Table 2. NLCD Landcover classes found to be suitable and not suitable for development of the Predicted Range Model.

NLCD Land Cover Classification System Key - Rev. 20 July 1999	
Open Water	Not Suitable
Perennial Ice/Snow	Not Suitable
Low Intensity Residential	Not Suitable
High Intensity Residential	Not Suitable
Commercial/Industrial/Transportation	Not Suitable
Bare Rock/Sand/Clay	Not Suitable
Quarries/Strip Mines/Gravel Pits	Not Suitable
Transitional	Not Suitable
Deciduous Forest	Not Suitable
Evergreen Forest	Not Suitable
Mixed Forest	Not Suitable
Shrubland	Suitable
Orchards/Vineyards/Other	Not Suitable
Grasslands/Herbaceous	Suitable
Pasture/Hay	Not Suitable
Row Crops	Not Suitable
Small Grains	Not Suitable
Fallow	Not Suitable
Urban/Recreational Grasses	Not Suitable
Woody Wetlands	Not Suitable
Emergent Herbaceous Wetlands	Not Suitable

Table 3. WTPD population analysis determined from surveys evaluating suitability of habitat for black-footed ferrets at Wolf Creek Black-footed Ferret Management Area, Colorado.

Year Surveyed		Size (ha)	% of Good Habitat [i]	WTPD/ha Good Habitat[j]	Population Estimate for Good Habitat	WTPD/ha for Entire Area Sampled	Population Estimate for Entire Area Sampled
1989/90 (BLM/FWS)[a]		11,426	42	6.3	30,102	--	--
1993/94 (CDOW)		6830	87	7.4	43,967	--	--
2000 (USU/BLM) [b]		3998	56	7.7	17,274	4.9	19,719
2001 (USU/BLM) [c]		2823	37	7.5	7782	3.7	10,331
2002	Total[d]	5878	38	6.6	14,846	3.2	18,843
	West[e]	4050	18	5.5	3922	1.8	7266
	East[f]	2840	30	6.5	5554	2.9	8212
	East[g]	1828	83	7.2	10,924	6.3	11,576
2003	Total[h]	5878	41	6.8	16,564	3.4	19,968
	West[e]	4050	23	6.8	6275	2.3	9214
	East[f]	1828	83	6.8	10,289	5.9	10,754

[a] The 1989/90 data was derived from mapping that included all lands showing evidence of WTPD occupation, past and present. Subsequent mapping was more selective and did not include inactive sites.
[b] Transecting conducted by USU/BLM crew. Transecting was completed on the west side of the complex (colonies #1-13).
[c] Transecting conducted by USU/BLM crew. Transecting was completed on the east side of the complex (colonies #14-26).
[d] Entire complex was transected by USU/BLM crew and L. Renner (contracted by CDOW). USU/BLM crew transected colonies #1-13 (west side). Renner transected the east side using two different mappings (see [f] and [g] below). Totals calculated using the west side data and Renner's transects based on his new mapping in 2002.
[e] Transecting based on BLM mapping by USU/BLM crew on colonies #1-13. This data was used in calculation of complex totals for 2002-2003.
[f] Transecting based on BLM mapping by L. Renner on colonies #14-26.
[g] Transecting based on mapping conducted in 2002 by L. Renner. These colonies overlap previously mapped colonies on the east side of the complex and have been designated #'s 27-39. This data used in calculation of complex totals for 2002-2003.
[h] Totals for complex calculated using USU/BLM west side data and L. Renner's east side data based on the 2002 east side mapping. Numbers are comparable to the 2002 totals.
[i] Estimated area of good habitat was determined by multiplying proportion of good habitat by colony size.
[j] Good Habitat (equal to habitat capable of supporting black-footed ferret reproduction) is the number of transects with at least 25 active WTPD burrows per ha divided by the total number of transects.

Table 4. Summary statistics for surveys evaluating suitability of black-footed ferret habitat at Management Areas in Colorado from 1997-2003. Statistics have been calculated for the entire sample area and not just for good habitat.

Black-footed Ferret Management Area	Mean Population Estimate	Standard Deviation	Coefficient of Variation (%)	Monitoring Period (years)
Wolf Creek West[a]	12,066	6698.594	55	3
Wolf Creek East[b]	9765	1362.04	14	3
Coyote Basin	3931	1954.154	49.7	6

[a] Transecting was completed on the west side of the complex (colonies #1-13).
[b] Transecting was completed on the east side of the complex (colonies #4-26)

Table 5. WTPD population analysis determined from surveys evaluating suitability of habitat for black-footed ferrets at Coyote Basin Black-footed Ferret Management Area, Colorado.

Year	Size (ha)	% of Good Habitat [a]	WTPD /ha Good Habitat [b]	Population Estimate for Good Habitat	WTPD /ha for Entire Area sampled	Population Estimate for Entire Area Sampled
1997	708	52.2	6.84	2527	4.42	3132
1998	-	-	-	-	-	-
1999	529	85.9	11.57	5260	10.41	5509
2000	529	100	12.60	6666	12.60	6666
2001	529	85.9	7.38	3355	6.70	3545
2002	529	94.4	7.22	3604	6.95	3677
2003	529	16.6	6.39	571	1.99	1055

[a] Estimated area of good habitat was determined by multiplying proportion of good habitat by colony size.
[b] Good Habitat (equal to habitat capable of supporting black-footed ferret reproduction) is the number of transects with at least 25 active WTPD burrows per ha divided by the total number of transects.

Table 6. The amount of hectares impacted by agriculture within the gross range of the WTPD.

State	Colorado	Montana	Utah	Wyoming
Orchards/ Vineyards	1284	0	78	0
Pasture/Hay	183,231	4980	80,230	275,395
Row Crops	74,330	3605	9270	70,971
Small Grains	182	2458	3605	21,767
Fallow	235	1756	2	15,153
Total	**259,263**	**12,799**	**93,189**	**383,287**
Percent of Gross Range	**6%**	**7%**	**3%**	**3%**

[a] Gross range is the outer boundary identifying WTPD distribution and does not imply that all lands contained within the boundary are occupied or have the potential to be occupied by WTPDs.

Table 7. Urban areas located within the gross range of the WTPD.

Urban Area[a]	Urban (ha) in Gross Range[b]
Battlement Mesa, CO	601
Cody, WY	1783
Craig, CO	1287
Delta, CO	1309
Eagle, CO	230
Evanston, WY	2436
Fruita, CO	1038
Grand Junction, CO	14,547
Green River, WY	1002
Gypsum, CO	517
Kemmerer, WY	323
Lander, WY	613
Laramie, WY	3644
Montrose, CO	2767
Powell, WY	1039
Price, UT	1817
Rawlins, WY	1199
Riverton, WY	2074
Rock Springs, WY	3114
Roosevelt, UT	572
Steamboat Springs, CO	798
Thermopolis, WY	555
Vernal, UT	3090
Worland, WY	613
Total	**46,968**
Percent	**0.2%**

[a] Urban designations were derived from the 2000 Census data.
[b] Gross range is the outer boundary identifying WTPD distribution and does not imply that all lands contained within the boundary are occupied or have the potential to be occupied by WTPDs.

Table 8. Landownership within the gross and predicted range of the WTPD in Colorado.

Landownership	**% of Landownership in WTPD Gross Range[a] (ha)**	**% of Landownership in WTPD Predicted Range[b] (ha)**
Private	42 (1,753,944)	37 (536,717)
BLM	45 (1,908,349)	56 (825,648)
USFS	6 (272,631)	0.5 (7629)
NPS	2 (77,173)	0.9 (14,409)
USFWS	0.3 (272,631)	0.4 (6594)
State	4 (169,749)	5 (79,024)
Other Federal	0.5 (19,776)	0.00 (367)

[a] Gross range is the outer boundary identifying WTPD distribution and does not imply that all lands contained within the boundary are occupied or have the potential to be occupied by WTPDs.
[b] The predicted range was developed from a GIS model to depict a more accurate, spatial range of the WTPD. This model does not imply that the area could be or is appropriate for WTPD occupation.

Table 9. WTPD colonies located in Montana during surveys in 1975-1977 and in 2003.

Colony Name	Colony Size (ha) 1975-1977	Colony Size (ha) 1999-2003
1	2-4	-
2	0.8	-
3 (Chance Bridge)	30-34	5.1
4	8	-
5 (Robertson Draw)	100	16.4
6	1	-
7	28-40	-
8	4-8	-
9	32	-
10	20-32	-
11	16-24	-
12	8-20	-
13	1	-
14	0.4-1	-
15	1-4	-
Duplex		9.1
S. Sage Creek		5.9
Warren		7.5
Inferno Creek		4.2
Total	**15 colonies = 280 ha**	**6 colonies = 48 ha**

Table 10. Landownership within the gross and predicted range of the WTPD in Montana.

Landownership	**% of Landownership in the WTPD Gross Range[a] (ha)**	**% of Landownership in the WTPD Predicted Range[b] (ha)**
Private	47 (84,496)	49 (54,760)
BLM	37 (67,846)	44 (48,824)
USFS	12 (21,329)	2 (2314)
State	4 (7804)	5 (5719)
Other Federal	0.00 (87)	0.00 (29)

[a] Gross range is the outer boundary identifying WTPD distribution and does not imply that all lands contained within the boundary are occupied or have the potential to be occupied by WTPDs.
[b] The predicted range was developed from a GIS model to depict a more accurate, spatial range of the WTPD.

Table 11. WTPD population analysis determined from surveys evaluating suitability of habitat for black-footed ferrets at 4 Black-footed Ferret Management Areas in Utah.

Black-footed Ferret Management Area	Year	Size (ha)	% of Good Habitat[b]	WTPD/ha Good Habitat[c]	Population Estimate for Good Habitat	WTPD /ha Entire Area Sampled	Population Estimate for Entire Area Sampled
Coyote Basin	1997	4075 [a]	91.2	11.45	42,541	10.60	43,205
	1998	4539 [a]	91.4	9.30	38,605	8.72	39,565
	1999	4544	77.8	10.12	35,783	8.40	38,180
	2000	4527[a]	74.7	9.47	32,035	7.39	33,438
	2001	4544	74.8	10.33	35,108	8.24	37,424
	2002	4544	91.5	12.86	53,451	11.98	54,444
	2003	4544	30.4	6.73	9300	3.09	14,031
Kennedy Wash	1998	1196	82.2	10.41	10,240	8.94	10,697
	1999	1196	52.6	8.13	5118	5.36	6411
	2000	1196	47.9	8.65	4949	4.79	5725
	2001	1196	30.7	7.73	2840	3.07	3670
	2002	1196	73.6	10.80	9504	8.60	10,282
	2003	1196	33.0	5.76	2272	2.77	3313
Shiner Basin	1997	1774 [a]	95.7	8.76	14,877	8.49	15,065
	1998	4327 [a]	99.3	11.04	47,447	10.99	47,551
	1999	3057 [a]	10.3	7.03	2221	1.76	5383
	2000	4332 [a]	40.4	6.24	10,915	3.16	13,707
Snake John	2001	5020	89.9	10.71	48,319	9.83	49,346
	2002	5020	81.3	11.93	48,680	10.05	50,437
	2003	5020	61.1	9.06	27,803	6.20	31,118

[a] Differences in ha surveyed from year-to-year are due to small colonies being either surveyed or not surveyed in a given year.
[b] Estimated area of good habitat was determined by multiplying proportion of good habitat by colony size.
[c] Good Habitat (equal to habitat capable of supporting black-footed ferret reproduction) is the number of transects with at least 25 active WTPD burrows per ha divided by the total number of transects.

Table 12. Summary statistics for surveys evaluating suitability of black-footed ferret habitat at 4 Management Areas in Utah from 1997-2003.

Black-footed Ferret Management Area	Mean Population Estimate	Standard Deviation	Coefficient of Variation (%)	Monitoring Period (years)
Coyote Basin	37,184	12185.871	33	7
Kennedy Wash	6683	3177.7921	48	6
Shiner Basin	20,427	18582.633	91	4
Snake John	43,633	10852.6	25	3

Table 13. Comparison of mapped WTPD occupied habitat in Utah from 1985-2002.

Survey Area	Year	Mapped ha	No. of Colonies	% Annual Change in Mapped ha
Huntington	1994	2352	31	-10.8
	2002	321	6	
Buckhorn	1985	2684	11	2.3
	2002	3739	3	
Woodside	1985	871	6	-4.7
	2002	169	1	
Crescent Junction	1985	4089	33	-0.16
	2002	3973	10	
Cisco	1985	16,729	122	-4.9
	2002	2684	12	
Eightmile Flat	1985	2673	3	0.7
	1999	2936	24	
Twelvemile Flat	1985	363	3	8.7
	2002	901	24	
Sunshine Bench	1993	2085	7	30.6
	2002	7837	38	
Coyote Basin	1985	2424	26	17.8
	1997/98	7604	44	

Table 14. Landownership within the gross and predicted range of the WTPD in Utah.

Landownership	% of Landownership in WTPD Gross Range[a] (ha)	% of Landownership in WTPD Predicted Range[b] (ha)
Private	20 (636,908)	20 (343,413)
BLM	58 (1,857,259)	60 (1,022,606)
USFS	0.7 (2222)	0.4 (6733)
NPS	1 (36,347)	0.9 (15,123)
BIA	9 (281,593)	7 (111,949)
State	11 (353,846)	11 (188,908)
USFWS	0.1 (3622)	0.1 (2416)
Other Federal	0.2 (7867)	0.09 (1490)

[a] Gross range is the outer boundary identifying WTPD distribution and does not imply that all lands contained within the boundary are occupied or have the potential to be occupied by WTPDs.
[b] The predicted range is a more accurate, spatial depiction of the range of the WTPD. This model does not imply that the area could be or is appropriate for WTPD occupation.

Table 15. Annual drilling results from completion reports submitted by well operators as of 3/26/04 for total wells drilled by county in Utah within the gross range of the WTPD.

County	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**	**19994**	**1993**	**1992**	**1991**
Carbon	34	51	103	122	110	74	41	13	19	47	28	35	5
Daggett	0	0	0	0	0	0	0	0	0	1	0	0	1
Duchesne	89	44	74	63	10	123	160	151	57	50	43	31	37
Emery	14	53	44	55	16	3	23	12	18	8	0	6	2
Grand	6	4	6	4	1	6	4	2	1	8	7	2	13
Rich	0	0	6	2	0	0	0	0	0	0	0	0	0
Summit	0	0	1	0	2	3	5	5	5	7	3	1	1
Uintah	333	226	386	288	140	186	154	63	99	76	33	262	141

Table 16. WTPD complexes and estimated hectares in Wyoming.

Complex	**Pre-1995 Estimated Ha**
Big Piney	5581
Bolton Ranch	2718
Baxter Basin	2827
Carter	2236
Cumberland	9159
Dad	2746
Fifteen Mile	4060
Flaming Gorge	2436
Kinney Rim	7215
Manderson	4553
Meeteetse	4371
Moxa	13,219
Pathfinder	5061
Saratoga	12,194
Seminoe	698
Shamrock Hills	8005
Shirley Basin / Medicine Bow	56,453
Sweetwater	5752

Table 17. WTPD population analysis determined from surveys evaluating suitability of habitat for black-footed ferrets at Shirley Basin/Medicine Bow Black-footed Management Area, Wyoming.

Year	Total Uncorrected Ha	Total Corrected Ha[a]	Percent of Complex Transected[b]	No. of Colonies Transected	Prairie Dogs/Ha	Prairie Dog Estimate
1991	19,274	17,025	31%	26	15.30	30,389
1992	16,301	14,373	26%	24	15.30	29,828
1993	13,656	11,609	22%	14	14.53	14,551
1994	3444	3363	6%	4	14.99	5916
1995	12,306	10,821	20%	17	13.96	7564
1996	11,538	10,293	19%	27	15.43	19,876
1997	9835	8240	16%	25	14.59	10,343
1998	9928	8956	16%	26	14.26	6547
1999	11,116	8681	18%	26	13.26	7161
2000	10,196	8402	16%	24	14.42	6669
2001[c]	11,491	10,165	19%	20	17.21	34,698

[a] Corrected area was calculated by proportionally discounting area attributed to transects with < 8 total burrows in the uncorrected area.
[b] Percent of complex transected per survey year was calculated taking the Total Uncorrected Ha and dividing by 62,114 ha (1991 complex estimate Parrish and Luce 1991), therefore, the percentage does not account for remapping efforts.
[c] A total of 6444 (56%) uncorrected hectares were not surveyed between 1991 and 2000.

Table 18. WTPD population analysis determined from surveys evaluating suitability of habitat for black-footed ferrets at Meeteetse Black-footed Ferret Management Area, Wyoming.

Year	Hectares	No. of Colonies Transected	Prairie Dogs/Ha	Prairie Dog Estimate
1988	4861	15	9.72	25,494
1989	4932	16	7.34	17,692
1990	4999	16	7.88	14,278
1991	5107	16	7.83	10,390
1992	5107	16	5.76	2169
1993	5107	16	6.70	1299
1997	5107	16	7.51	7095

Table 19. Landownership within the gross and predicted range of the WTPD in Wyoming.

Landownership	% of Landownership in WTPD Gross Range[a] (ha)	% of Landownership in WTPD Predicted Range[b] (ha)
Private	34 (4,362,479)	33 (3,244,833)
BLM	49 (6,142,433)	54 (5,301,009)
USFS	5 (620,696)	0.8 (82,552)
NPS	0.06 (7990)	0.03 (3457)
BIA	3 (411,381)	3 (322,574)
State	6 (724,714)	6 (575,991)
USFWS	0.09 (12,045)	0.1 (10,696)
Other Federal	3 (346,295)	3 (249,939)

[a] Gross range is the outer boundary identifying WTPD distribution and does not imply that all lands contained within the boundary are occupied or have the potential to be occupied by WTPDs.
[b] The predicted range distribution model was produced as a more accurate, spatial depiction of the range of the WTPD. This model does not imply that the area could be or is appropriate for WTPD occupation.

Figure 1. WTPD gross range, predicted range and location of identified WTPD colonies from 1985-2003.

Figure 2. Location of known WTPD complexes/sub-complexes within the gross range of the species identified from 1985-2003.

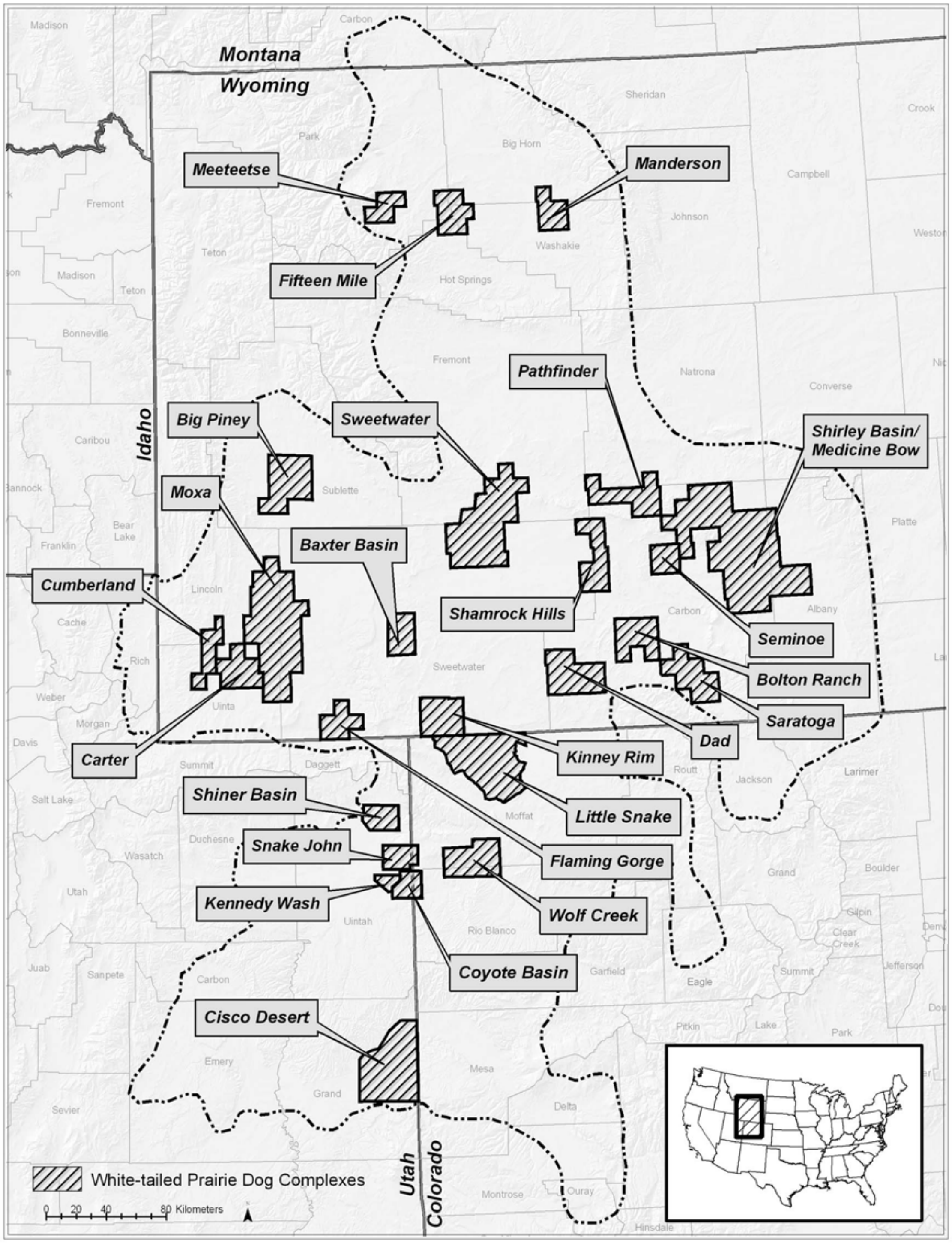


Figure 3. WTPD population analysis determined from surveys evaluating suitability of habitat for black-footed ferrets at Coyote Basin and Wolf Creek Black-footed Ferret Management Areas in Colorado and average population estimates across all surveys.

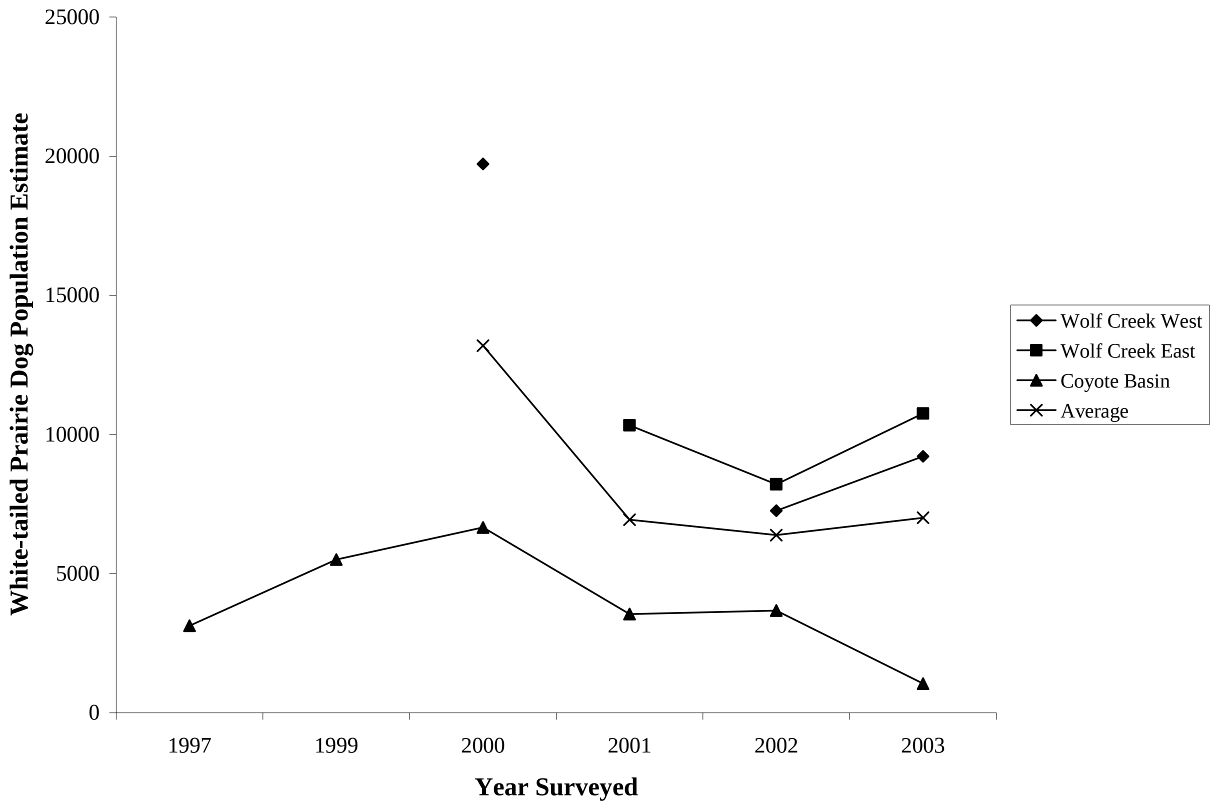


Figure 4. Change in mapped WTPD occupied habitat in the Little Snake Black-footed Ferret Management Area in Colorado between 1989 and 1999.

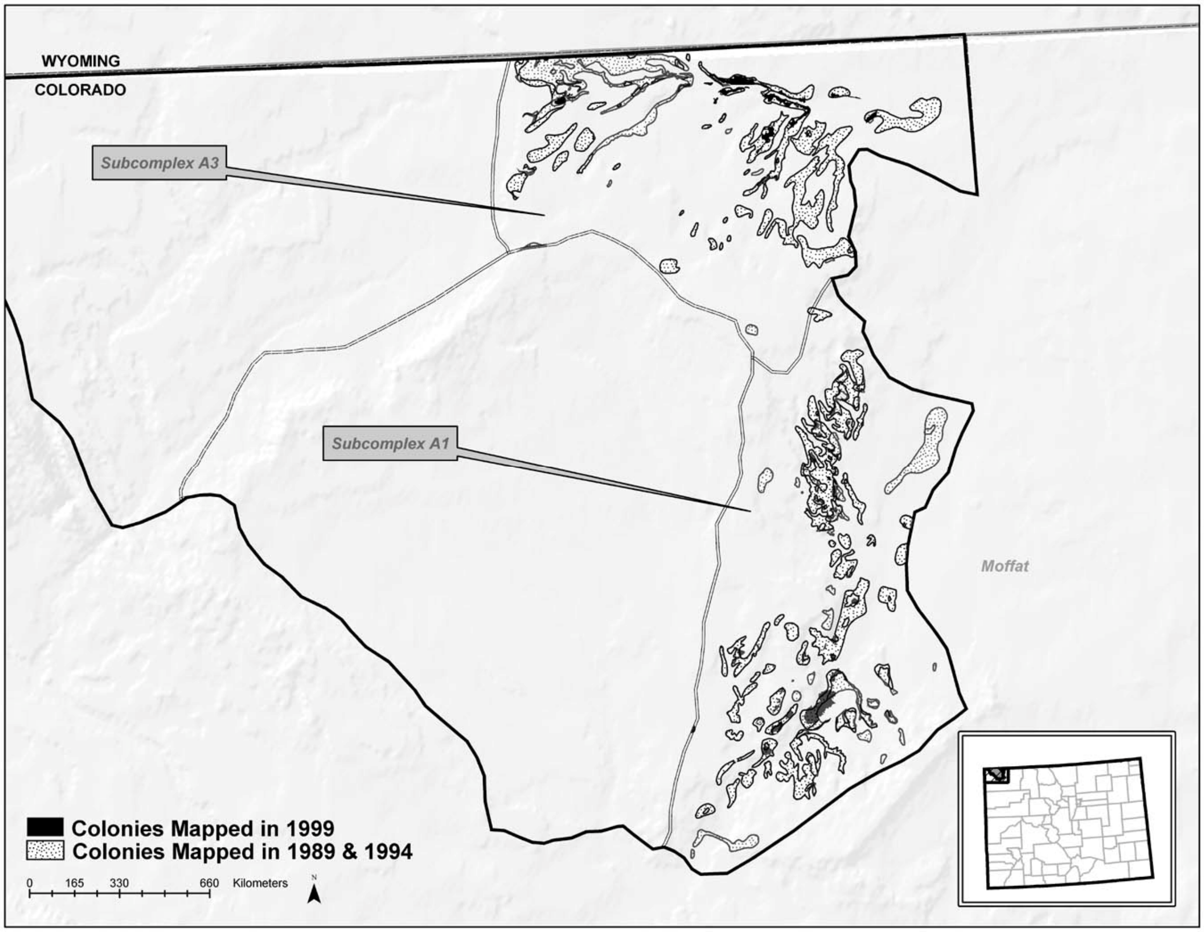


Figure 5. WTPD gross range, predicted range and location of identified colonies in Colorado from 1989-2003.

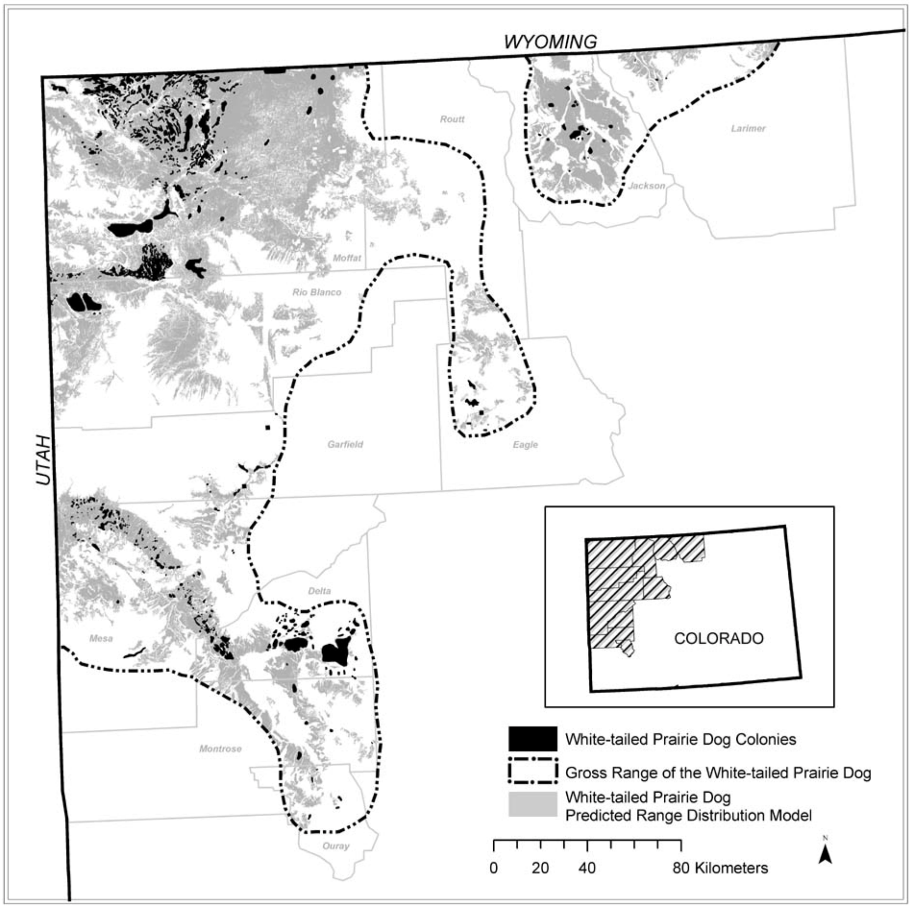


Figure 6. WTPD gross range, predicted range and location of identified colonies in Montana from 1975-2003.

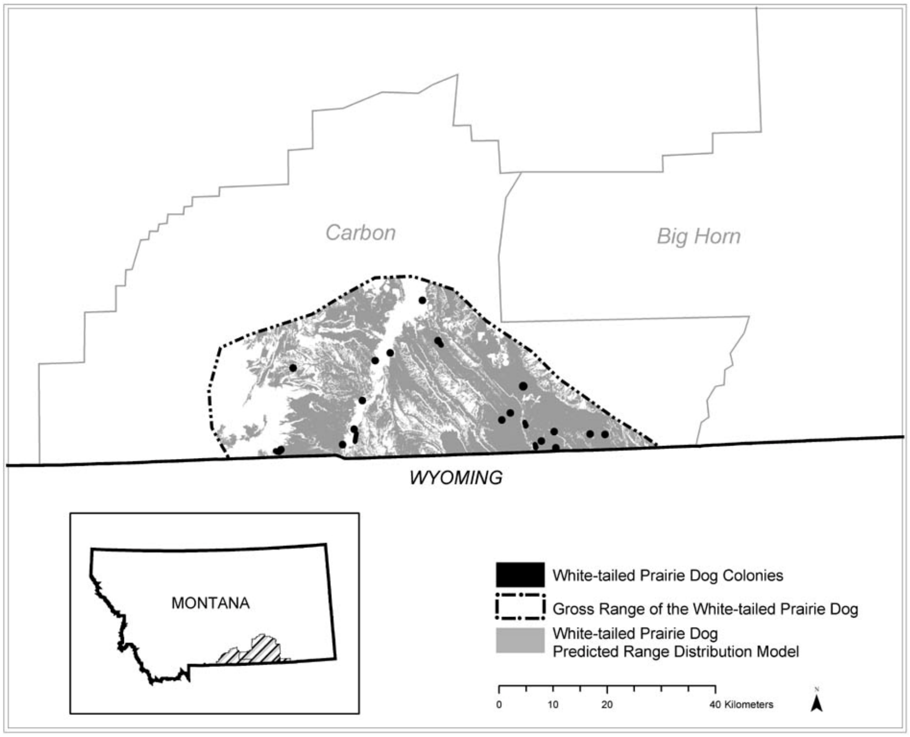


Figure 7. WTPD population analysis determined from surveys evaluating suitability of habitat for black-footed ferrets at 4 Black-footed Ferret Management Areas in Utah and average population estimates across all surveys.

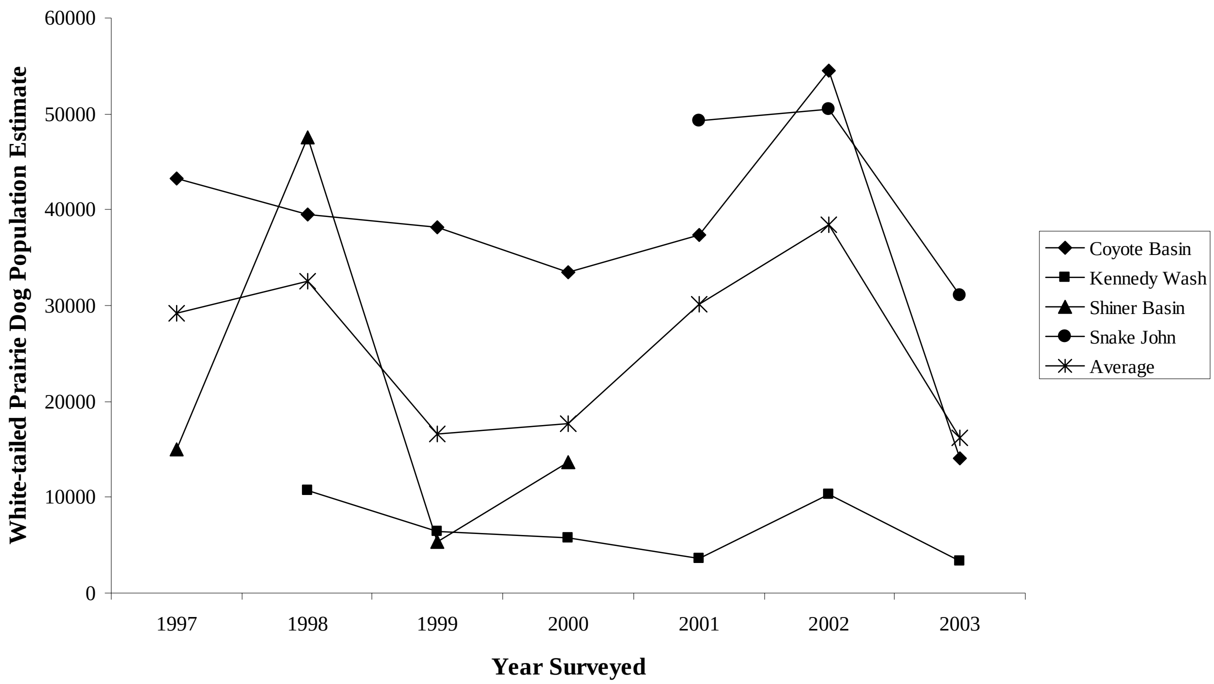


Figure 8. Changes in WTPD occupied habitat at selected areas mapped in Utah from 1985-2002.

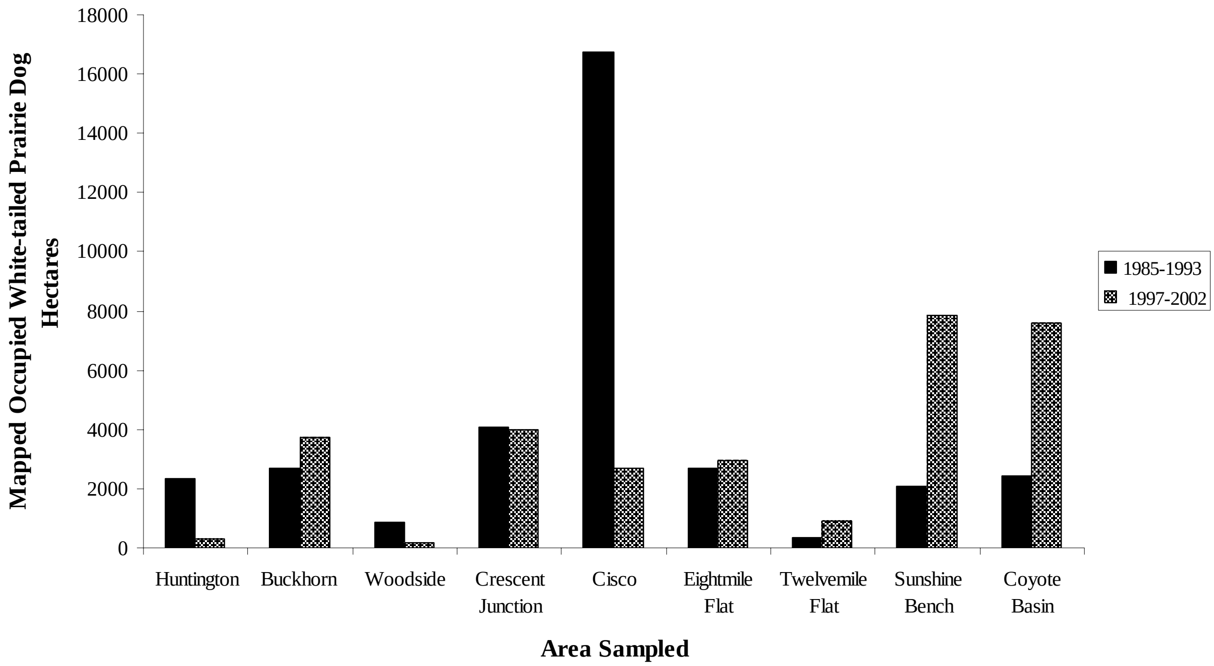


Figure 9. Study areas in Utah where comparisons were made to document changes in WTPD occupied habitat from 1985-2002.

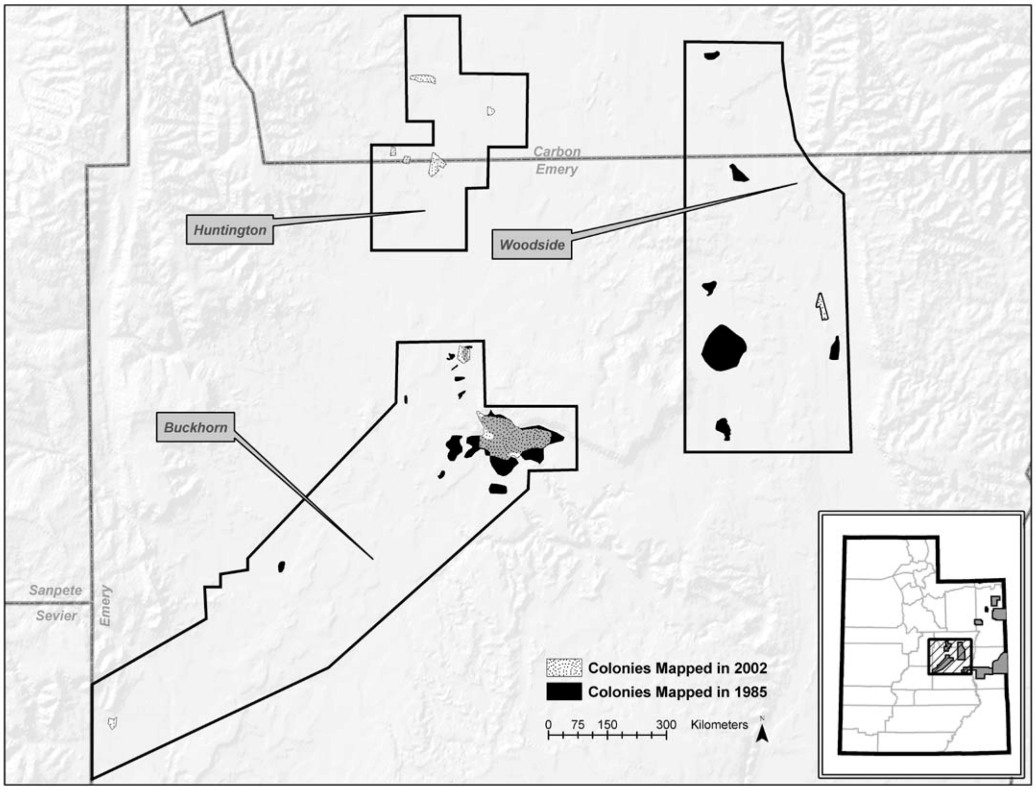


Figure 10. Study areas in Utah where comparisons were made to document changes in WTPD occupied habitat from 1985-2002.

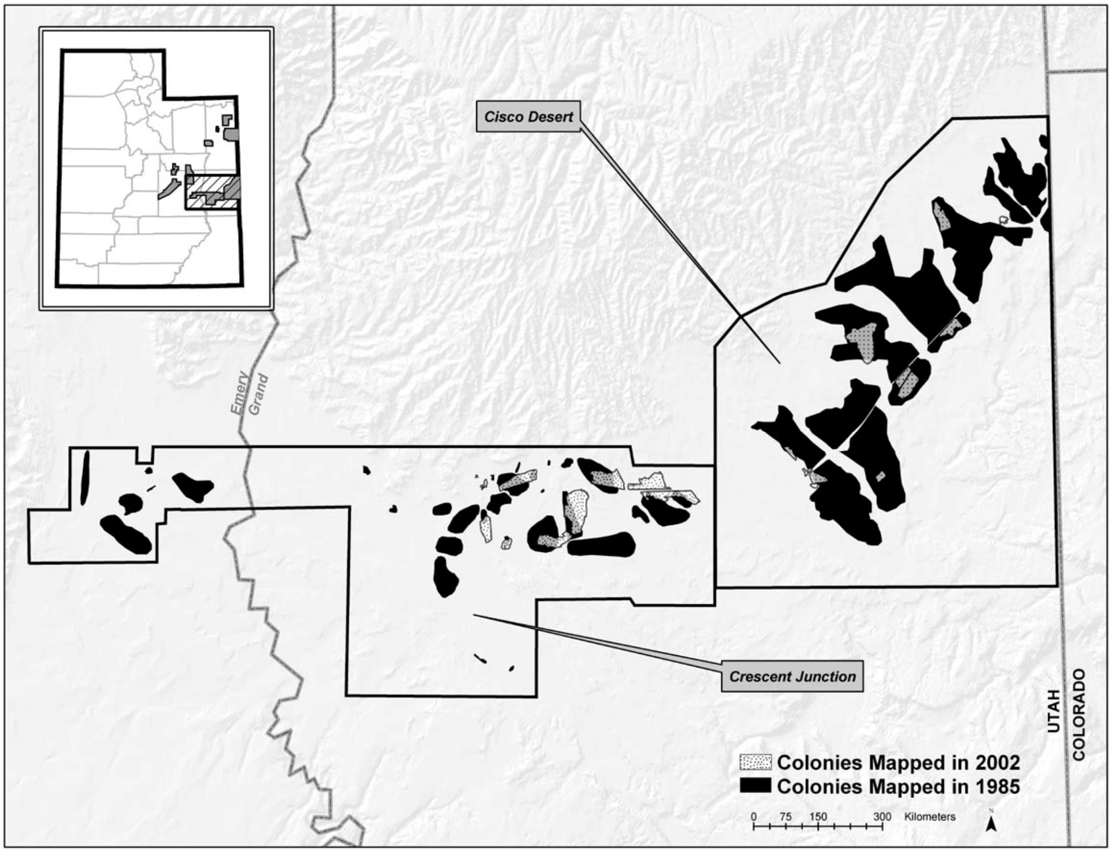


Figure 11. Study areas in Utah where comparisons were made to document changes in WTPD occupied habitat from 1985-2002.

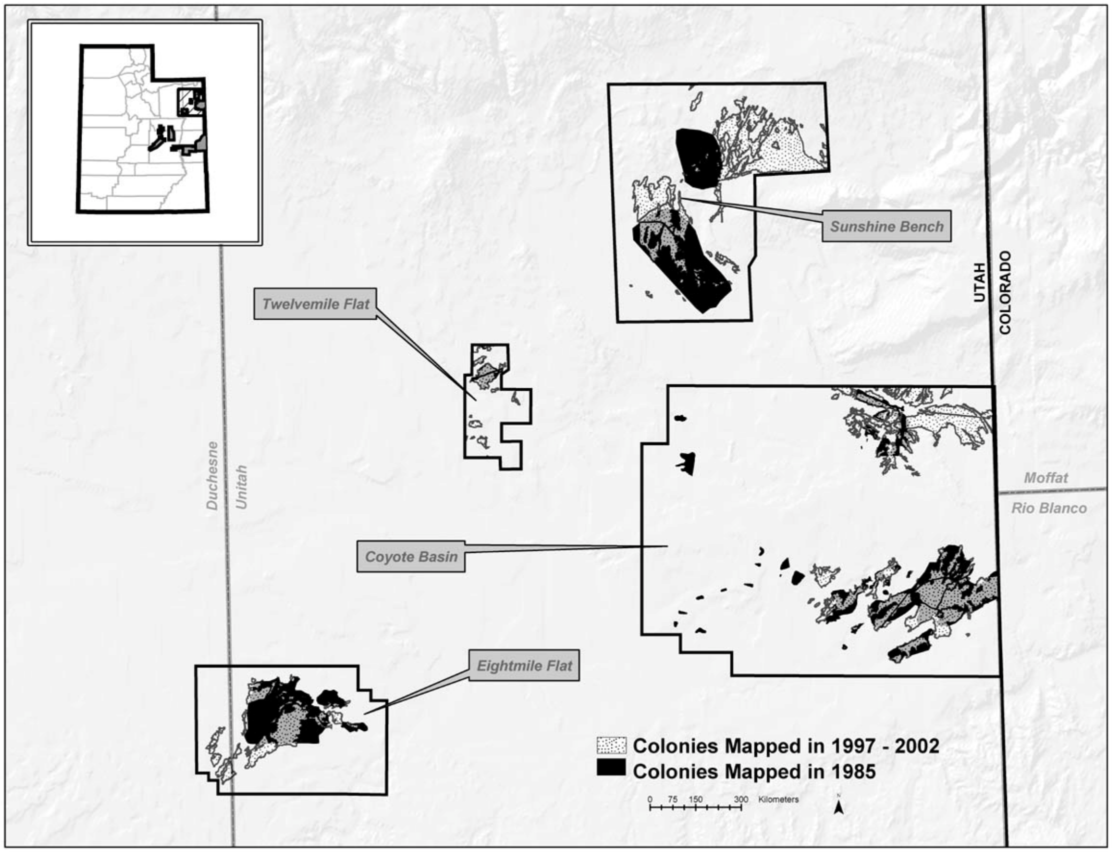


Figure 12. WTPD gross range, predicted range and location of identified colonies in Utah from 1985-2003.

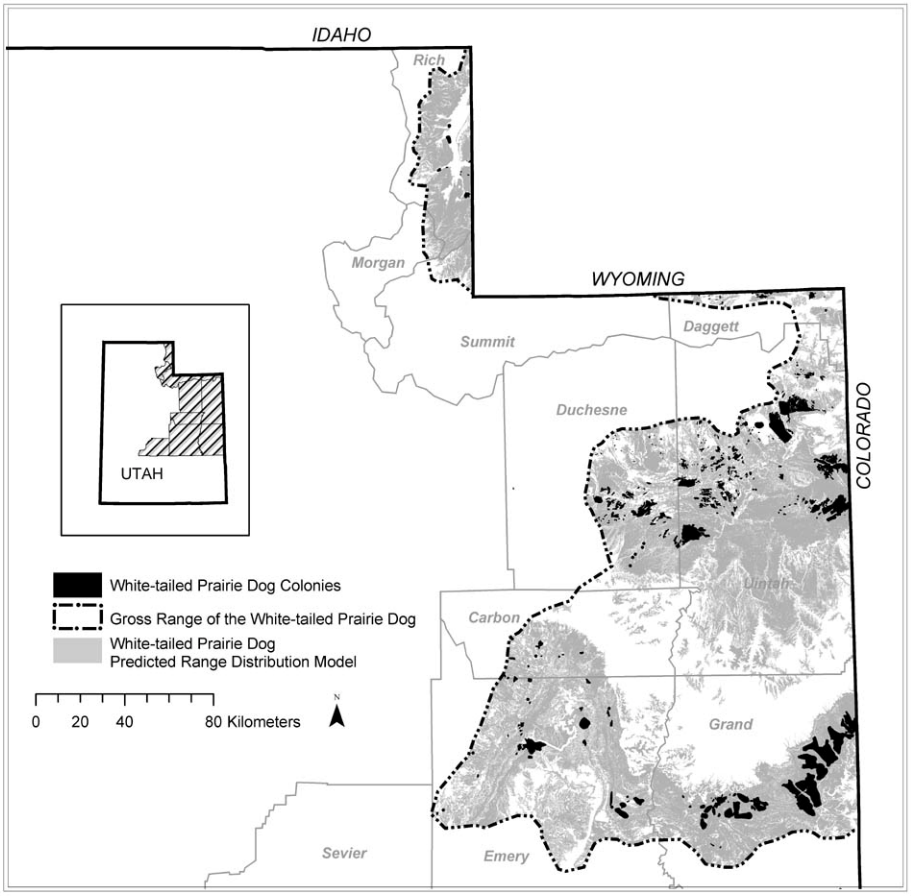


Figure 13. Distribution of townships with at least 405 ha (1000 ac) of occupied WTPD habitat prior to 1995 in Wyoming.

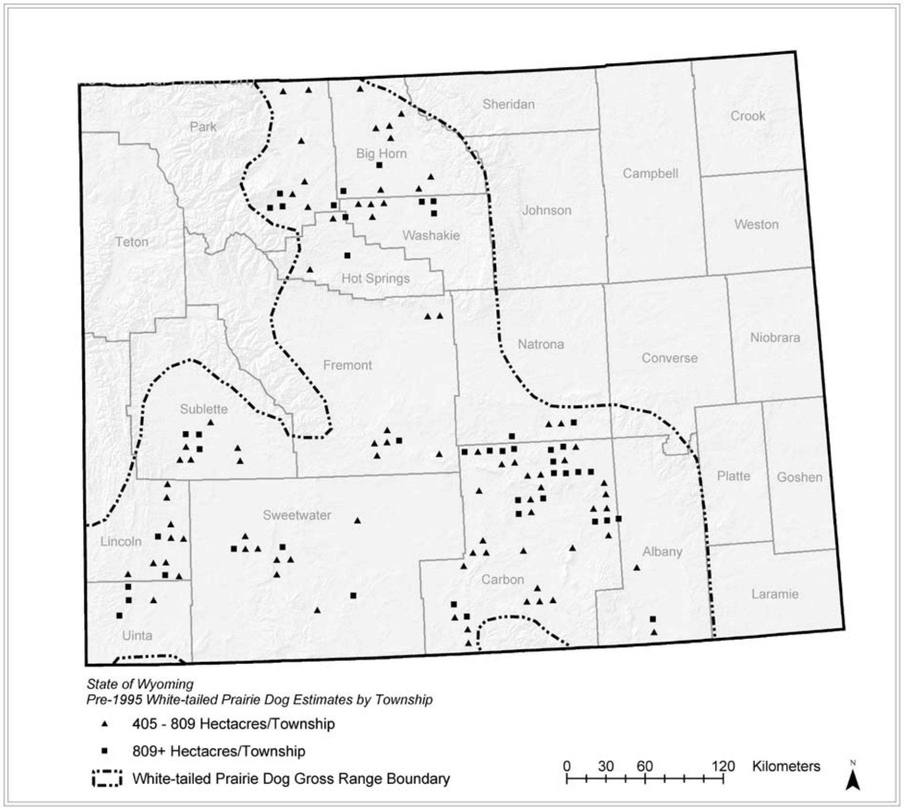


Figure 14. Shirley Basin/Medicine Bow Black-footed Ferret Management Area, Wyoming.

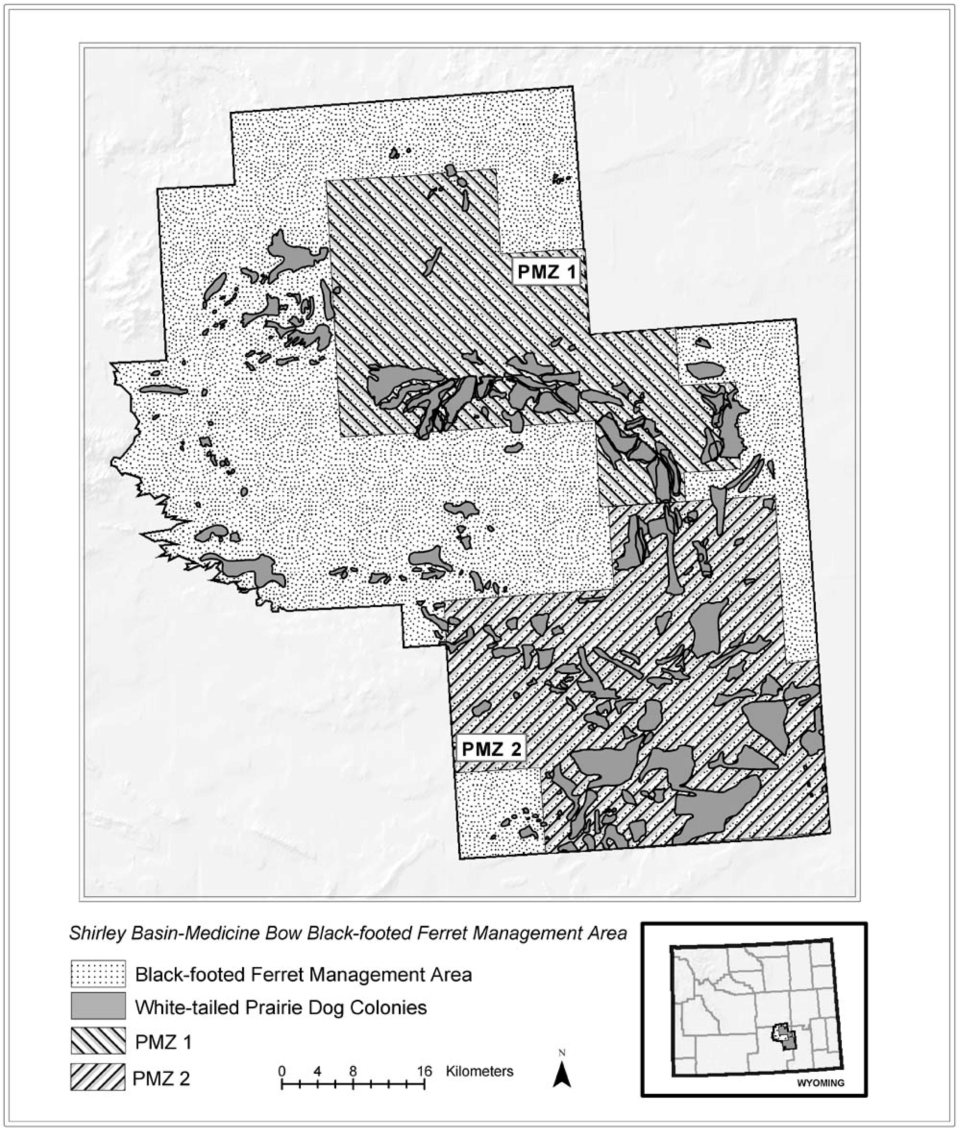


Figure 15. Comparison of WTPD estimate for 4 colonies monitored at the Shirley Basin/Medicine Bow Black-footed Ferret Management Area, Wyoming, from 1991 to 2000.

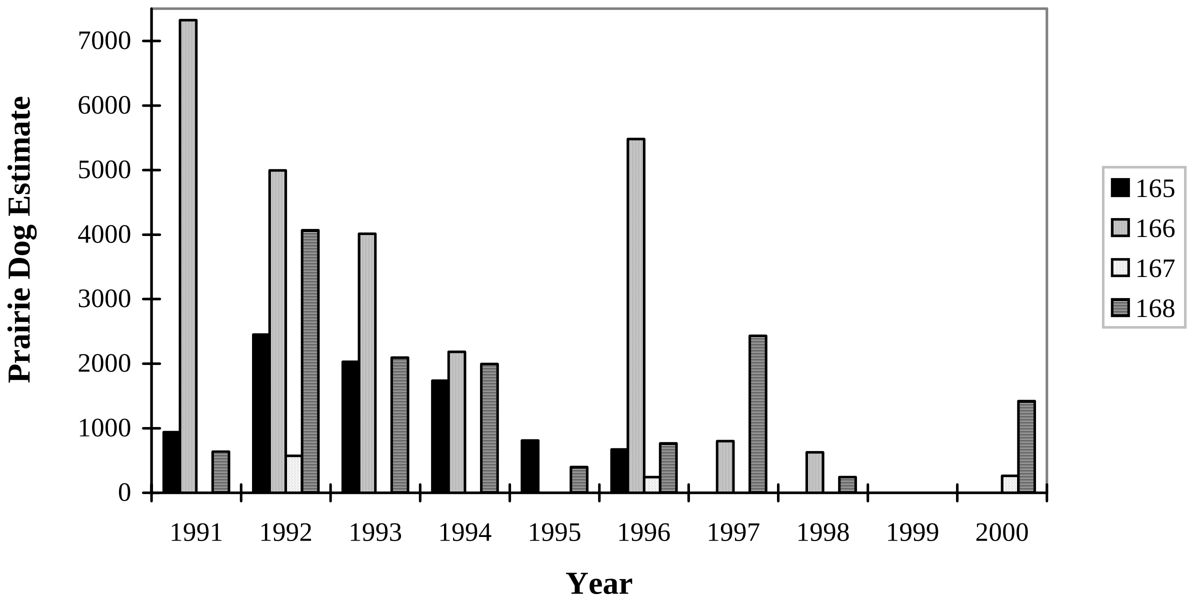


Figure 16. Comparison of 1991 and 2001 mapping efforts within the Shirley Basin/Medicine Bow Black-footed Ferret Management Area, Wyoming.

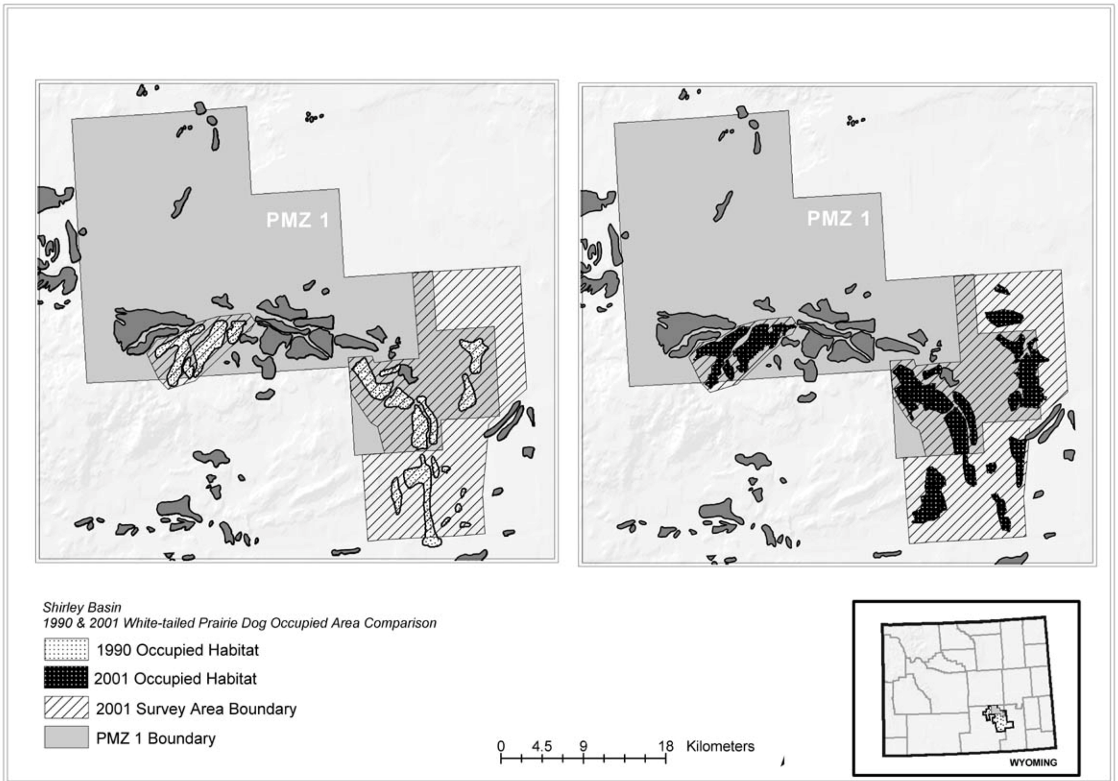


Figure 17. Comparison of 1991 and 2004 mapping efforts within the Shirley Basin/Medicine Bow Black-footed Ferret Management Area, Wyoming.

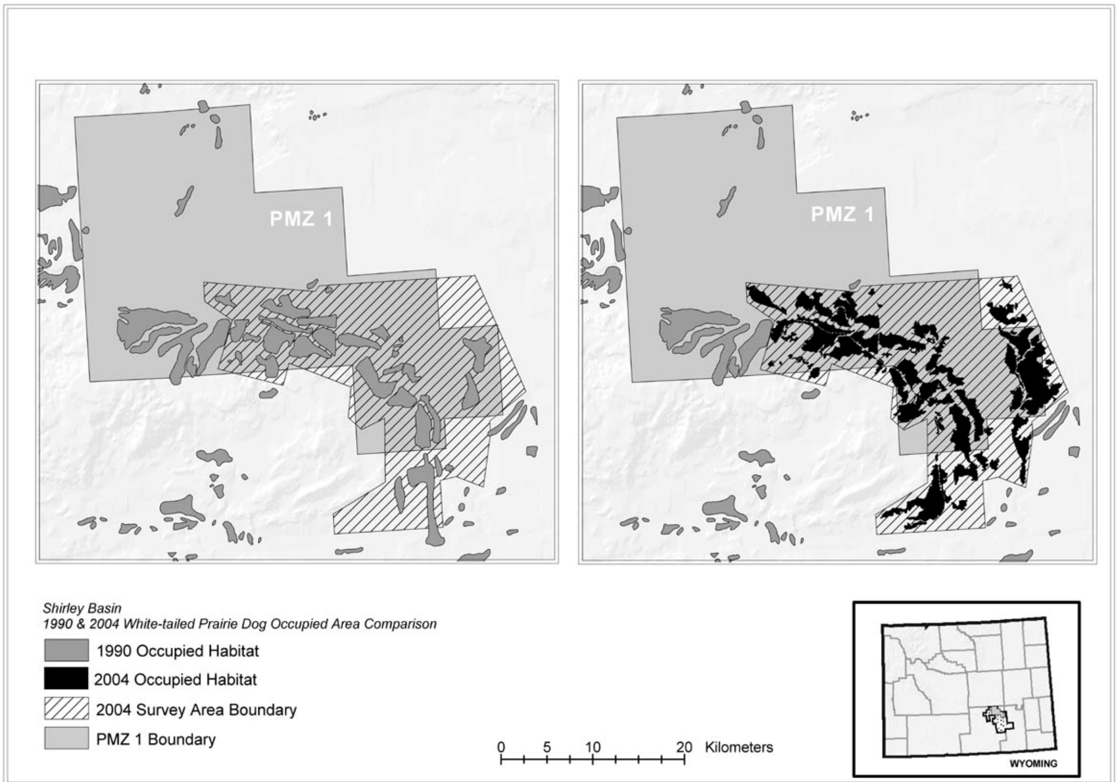
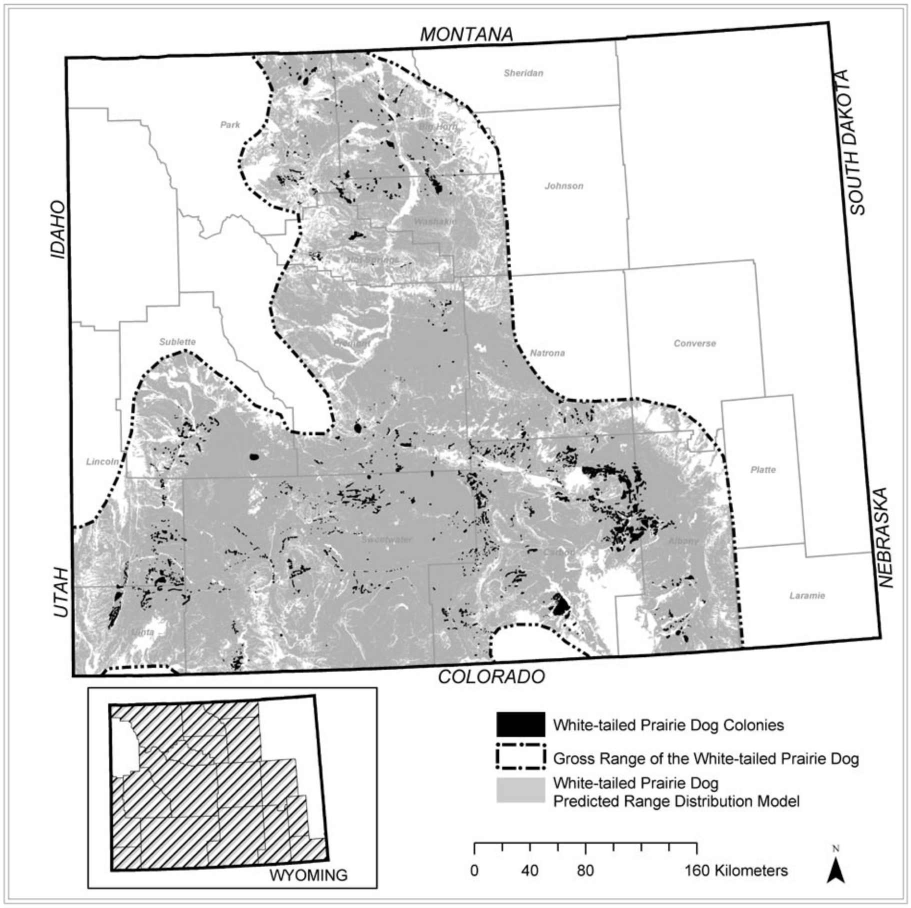


Figure 18. Comparison of WTPD mapping efforts within the Sweetwater Complex, Wyoming from pre-1995 to 2002.

Figure 19. WTPD gross range, predicted range and location of identified colonies in Wyoming from surveys before 1995.



Appendix A. Glossary of terms.

Associated Species- Species that benefit from WTPDs, either directly or indirectly, but are not dependent on them for survival.

Candidate Species- Plants and animals that the USFWS, through review of available information, has determined should be proposed for addition to the federal threatened or endangered species list.

Colony- A concentration of WTPDs with a minimum of 20 burrow openings per ha on 5 ha parcels (Biggins et al. 1993).

Complex- A group of WTPD colonies distributed so that individual black-footed ferrets can migrate between them commonly and frequently. Colonies within a complex are not separated from the nearest adjacent colony by more than 7 km and no impassable barriers exist between colonies that would hinder black-footed ferret movement.

Conservation- (a) From section 3(3) of the federal Endangered Species Act: "… the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided under {the} Act are no longer necessary;" (b) The retention of natural balance, diversity, and evolutionary change in the environment.

Control Measures- Actions taken to reduce the numbers and/or occupied habitat of WTPDs, primarily through lethal means.

Corrected ha - The occupied habitat of the WTPD colony where there is $\geq$8 burrows per survey transect.

Coterie- A territorial, harem-polygynous family group of prairie dogs, typically consisting of a breeding adult male, two or three adult females and several yearlings or juveniles (Hoogland 1995).

Dispersal- The outward spreading of organisms from their point of origin or release; the outward extensions of a species' range.

Ecosystem- Dynamic and interrelating complex of plant and animal communities and their associated nonliving (e.g., physical and chemical) environment.

Endangered Species- A species which is in danger of extinction throughout all or a significant portion of its range [ESA§3(8)].

Extirpated Species- A species no longer occurring in a region that was once part of its range.

Good Black-footed Ferret Habitat – This is equal to habitat capable of supporting black-footed ferret reproduction. It is determined from transect data and is the number of transects with at least 25 active WTPD burrows per ha divided by the total number of transects.

Gross Range- The outer boundary identifying WTPD distribution. This does not imply that all lands contained within the boundary are occupied or have the potential to be occupied by WTPDs.

Habitat- The local environment occupied by an organism and those components required to complete its life cycles, including air, food, cover, water, and spatial requirements.

Historic Range- Those geographic areas the species was known or believed to occupy in the past.

Incentive- Assistance, financial payment or other action which encourages individuals or organizations to participate in an effort or activity, or which offsets any sacrifices an individual or organization may make to participate in an effort or activity.

Listing - The formal process through which the USFWS adds species to the Federal List of Threatened and Endangered Wildlife and Plants.

Mapping – Estimates amount of area occupied by WTPDs by locating colonies and plotting a line around the outermost burrows within a colony. Most mapping includes both active and inactive burrows.

Petition (for Listing)- A formal request, with the support of adequate biological data, suggesting that a species be listed, reclassified, or delisted, or that critical habitat be revised for a listed species: section 4(b)(3)(A) of ESA.

Predicted Range - The predicted range was determined using a GIS model to produce a more accurate, spatial depiction of the range of the WTPD. This model is not meant to imply that the entire area could be or is appropriate for WTPD occupation.

Population - All individuals of one species occupying a defined area and usually isolated to some degree from other similar groups.

Occupied Habitat- Land (hectares) that has WTPDs in residence.

Obligate Species- Species that, either directly or indirectly, are dependent on black-tailed prairie dogs for survival.

Re-establish- To restore (reintroduce) a species to an area that it historically inhabited.

Species- A group of individuals that can actually or potentially breed with each other and produce fertile offspring under natural conditions, but cannot breed with other such groups.

Species of Concern- An informal term, conferring no legal status, given to species that are of management concern due to declining numbers and/or loss of habitat. State wildlife agencies maintain a list of species of special concern that identifies species whose occurrence may be in jeopardy.

State Trust lands- Lands entrusted to the state by the Federal government and managed by the State Land Department for revenue for Trust beneficiaries (e.g., public schools, colleges, hospitals, charitable institutions). These are not public lands except in Arizona, Montana and Wyoming (access permit required) and South Dakota (no access permit required).

Sub-complex - An aggregation of colonies not separated from the nearest adjacent group by more than 7 km, but due to various factors (e.g. state boundaries, land ownership) the whole complex is not surveyed and management occurs on only a portion of the entire complex.

Subspecies- A group of interbreeding natural populations differing morphologically and genetically, and often isolated geographically from other such groups within a biological species but interbreeding successfully with them where their ranges overlap.

Sylvatic Plague- An acute, infectious disease caused by the bacteria *Yersinia pestis* that primarily affects rodents, rabbits, and associated carnivore and scavenger species. The agent is transmitted through the bite of an infected flea or through direct contact with an infected carcass. It is known as bubonic plague in humans and sylvatic plague in the wild.

Threatened Species- A species that is likely to become endangered throughout all or a significant portion of its range.

Tularemia- Is a pathogen native to North America that can cause disease-related declines in WTPD populations (Davis 1935).

Uncorrected Hectares - Includes the total area of a WTPD colony regardless of activity levels.

Appendix B. Summary of Biggins et al. (1989, 1993) methodology used in Colorado, Utah and Wyoming.

The Biggins et al. (1989, 1993) methodology is based on estimated prairie dog biomass as food for black-footed ferrets to maintain themselves within given stages of life. Reproductive stages (e.g. gestation, lactation, post-weaning, post-dispersal replenishment, and young development) represent 70% of the estimate and were determined to be the most restrictive, highest demand of prairie dog biomass for black-footed ferrets. The methodology then works backwards from the estimated prairie dog biomass to derive a prairie dog estimate that can theoretically support reproductive states of black-footed ferrets.

Biggins Methodology used to evaluate black-footed ferret habitat suitability:

1 Use strip transects 1000 m x 3 m within mapped prairie dog colonies.
2 Run strip transects along the width (long axis) of a colony.
3 Provide a 60 m spacing from the end of one transect to the start of another transect as well as a 60 m side-to-side spacing between transects.
4 Number of transects varies year-to-year depending on colony size and distribution of animals
5 Maintain a straight line while transecting and reverse course and continue transects after reaching colony boundary. Results in U-shaped transects.
6 Select random starting point for transecting each year.

Alterations in methodology made by Colorado and Utah:

1 Strip transects are 3 m wide but may not equal 1000 m. Transects < 1000 m are proportionately corrected for in the analysis.
2 Many transects are conducted along the short axis of the town.
3 250 m side-to-side spacing between transects. Utah (Coyote Basin) has 2 groups of transects run at much narrower spacing, for higher sampling intensity. The majority are at the lower sampling intensity, and only these are used in calculations.
4 Number of transects is permanently fixed and repeated every sample year regardless of change in animal distribution.
5 Fixed annual starting point, repeated every sample year.

Alterations in methodology made by Wyoming:

1 200 m side-to-side spacing between transects.

The Wyoming Game and Fish Department discussed changes in side-to-side spacing with D. Biggins, and he agreed that a smaller sample could be taken by shifting distance between parallel transects from 60 m to 200 m without adversely affecting the output (B. Luce, Interstate Coordinator Prairie Dog Conservation Team, personal communication). The subsequent change to the methodology in 1990 has since served as the basis for all transecting conducted by the WGFD in Wyoming.

Appendix C. Letter from Wyoming BLM to the White-tailed/Gunnison's Prairie Dog Working Group with regard to oil and gas development in the WTPD gross range.

"The BLM in Wyoming has no consistent, statewide policy for the management of WTPDs on Public Lands at this time." That's not to say that we are not doing anything for W-T Prairie Dogs, however. We have 8 resource areas in Wyoming within the range of the WTPD (Worland, Cody, Rawlins, Rock Springs, Lander, Casper, Kemmerer, and Pinedale), and 6 of these resource areas are exclusively WTPDs (excluding Rawlins and Casper). The Cody Resource Area contains a couple of small, isolated, black-tailed prairie dog colonies of unknown origin. All of these resource areas are conducting some form of prairie dog management. The WTPD is declared a BLM sensitive species in Wyoming. Black-footed ferrets have been reintroduced into WTPD colonies in Shirley Basin as a "non-essential, experimental population", and seem to be thriving.

We have old inventories for prairie dogs of various extents and quality in each resource area, some of which date back decades. Each field office has numerous "small scale" inventories of dog towns that were conducted as part of activity clearances, including clearances for oil and gas (O&G) applications for permit to drill (APDs) and associated road, pipeline, and powerline Rights-of-Way (ROWs). While these clearances were conducted using the 1989 U.S. Fish and Wildlife Service (FWS) procedures for black-footed ferret (BFF) clearances, they yielded a lot of de facto prairie dog information, particularly temporal data on the geographic extent and activity of prairie dog colonies. In some instances, intensive prairie dog colony mapping efforts were the direct result of terms and conditions, and conservation measures, coming from ESA Sec. 7 consultations with the FWS (e.g., Continental Divide / Wamsutter II O&G EIS, etc.) conducted for other species. In other cases, the field office funded, or cost shared on the funding, of up-dated, baseline, prairie dog town inventories (e.g., Pinedale and Kemmerer PDT inventories). The new (i.e., February, 2004) FWS policy on "block clearances" for BFFs, while good in some respects, now makes many routine clearances unnecessary, thereby eliminating some PD town inventories that might otherwise occur.

In regard to planning – there are several BLM land use planning efforts (Resource Management Plan [RMP] revisions) underway at this time in W-T PD range in Wyoming (Rawlins, Pinedale, Casper, Kemmerer, and Lander). These RMP revisions are primarily driven by the most recent emphasis on oil and gas development activity. Each of these land use planning efforts are currently, or will be, addressing W-T PDs in the plan revisions. BLM has also had nominations submitted by several environmental groups for the designation of prairie dog "areas of critical environmental concern" (ACECs) in the land use plans for Public Lands within W-T PD range. A statewide, programmatic, biological evaluation is being prepared for WTPDs, the results of which will be incorporated into the RMPs when it is finished. As you well know, the State of Wyoming, through the Wyoming Game and Fish Department (WGFD), completed a conservation plan for black-tailed prairie dogs in Wyoming a couple of years ago. While this plan was never adopted by the Game and Fish Commission, it did contain a number of management recommendations and planned actions that could apply to WTPDs, as well as B-T PDs. The BLM (WY) has referred to the state conservation plan (even in its unadopted form) to help us focus our prairie dog management efforts and budgeting requests. And, of course, we are anxiously awaiting the completion of the W-T PD Conservation Assessment for the same reasons.

Implementation of land management actions on Public Lands across the state varies somewhat from office to office. A number of prairie dog towns, and some major complexes, are intermingled with oil and gas development and production activities. Generally speaking, most offices do not afford prairie dogs any special sanctuary, although to the extent deemed reasonable, most offices do attempt to avoid prairie dog colonies, and particularly complexes, with surface disturbing development activities. The terms and conditions, and conservation measures, resulting from ESA Sec. 7 consultations with the FWS for other species sometimes dictate the actual prairie dog management measures applied (e.g., distance setbacks from towns, monitoring, etc.). Some offices attach lease notices to O&G leases, and some offices apply conditions of approval (COAs) to APDs. BLM (WO and the WSO) have issued some limited policy for black-tailed prairie dog management (IM No. 99-146, IM No. WY-2000-46, and IM No. 2000-140), and some of this policy instruction has been carried over to WTPDs where it regards commercial hunting activities, recreational shooting, and use of rodenticides for animal damage control.

Monitoring and evaluation of management activities on prairie dogs on BLM administered Public Lands in Wyoming has been nearly non-existent. What little monitoring has occurred has been the result of the outcome of ESA Sec. 7 consultations for other species, or has been incidental discoveries while managing other resource activities. We do hope to collaborate with the WGFD for population and habitat monitoring, as funding allows, when they complete their monitoring protocols for the conservation strategy implementation.

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Appendix D. Letter from Colorado BLM to the White-tailed/Gunnison's Prairie Dog Working Group with regard to oil and gas development in the WTPD gross range.

Colorado BLM
WTPD Management related to O&G development
July 12, 2004

There are 6 field offices in Colorado that have some population or geographic distribution of WTPDs (WTPD) within their administrative boundaries. Two of these offices, Little Snake Field Office (FO) and White River FO, include 'Experimental Non-essential Population' Areas for re-introduction efforts of the Black-footed Ferret (BFF), thus providing protection for WTPD through management for BFF's. The following are stipulations and/or management regularly applied to oil and gas development by office.

LSFO – Per local BFF management plan, prairie dog (WTPD) management on Bureau lands will be designed to maintain at least 90 % of the known or potential prairie dog acreage mapped on those lands in 1989.

WTPD colonies are protected by the BLM through lease notice LS-13, which states that "No surface disturbing activities will be allowed that may significantly alter the prairie dog complex making it unsuitable for reintroduction of the black-footed ferret". A leaseholder would not be permitted to develop a lease in a manner that would harm the integrity of a WTPD colony.

WRFO – BFF management objectives include maintaining at least 90% of the occupied extent of prairie dog (WTPD) habitat on BLM surface in the Wolf Creek Management Area (i.e. 15,500 acres) and in the Coyote Basin, CO Management Area (i.e. 700 acres).

The Plan states "Whenever possible, mineral development and utility installation activities will be designed to avoid adverse influence on prairie dog habitat. In the event adverse impacts to prairie dog habitat are unavoidable, activities will be designed to influence the smallest area practicable and/or those areas with the lowest prairie dog densities and compensatory mitigation may be required".

For both field offices, design and location of proposed development may be adjusted per standard lease rights to request delays of implementation up to 60 days and relocation of operations up to 200 meters. There is no standard language related to this protection, but one example could read as follows – 'Proposed well locations will be moved out of active prairie dog towns to minimize direct impacts to the species or associated burrow complex.'

The remaining field offices (Glenwood Springs, Uncompahgre, Grand Junction, and Kremmling) do not have stipulations for oil & gas exploration specific to WTPD's. All offices use to require prairie dog inventories prior to exploration for evaluation of potential BFF habitat (1980's/early 1990's). FWS no longer requires this due to past inventory efforts. In addition, all offices have a stipulation recognizing that modifications of a proposed activity may occur to protect special status species (could apply controlled surface use stipulation, timing stipulation etc). Currently WTPD's are not on the CO BLM sensitive species list. This list is due to be reviewed and/or updated in the near future and WTPD's may be considered for inclusion at that time.

Of these four offices, none have large WTPD complexes, and very few/if any have been in close proximity to recent oil and gas development. Two of the offices said they would request a permittee to locate well sites out of an active PD town within standard lease rights, and the other two have stated this has not been an issue to date.

There are no restrictions, protective measures or discussions related to WTPD expansions within complex boundaries in the state. The focus to date has been maintenance of existing towns and burrows in relation to potential habitat for BFF. Formal protection for the species is incorporated into the local RMP through an associated O&G/BFF amendment (LSFO, WRFO). A few other field offices are incorporating conservation measures informally on a case by case basis. We are in the process of conducting a biological evaluation for this species statewide, analyzing potential impacts from management on BLM lands. Any conservation measures adopted thru this effort will be amended on to all applicable RMP's in 2005 and 2006.

The minerals staff also reviewed the WTPD CA quickly and added a point of clarification. They felt the discussion on potential loss of habitat was misleading. Average well spacing may well be 8.1 ha (20 acres). However, while the initial development of a single well pad affects about 2 acres, shortly after the well is drilled, interim reclamation takes place and the well pad is reduced in size from 2 acres to about .75 acres. Interim reclamation includes seeding of BLM approved plants, and in some cases may actually improve habitat for the species. In addition, co-located wells (as a result of directional drilling) affect proportionately fewer acres than a cumulative well number might represent. Local biologists may agree with this general conclusion as the Rangely oil field in Colorado is a good example of a densely developed production area that appears to have a thriving WTPD population.

Appendix E. Letter from Montana BLM to the White-tailed/Gunnison's Prairie Dog Working Group with regard to oil and gas development in the WTPD gross range.

The only policy we have regarding W-T prairie dogs and B-T prairie dogs is also related to potential Black-footed ferret reintroductions. "Prior to surface disturbance, prairie dog colonies and complexes of 80 acres or more in size will be examined to determine the absence or presence of black-footed ferrets." -1992, Oil and Gas RMP/ EIS Amendment.

Because we have only about 118 acres of active W-T prairie dog towns, we have had no conflict with O/G leasing. I do review lease parcels and definitely will identify any parcels involving W-T dog towns, with the intention of avoidance of any conflicts or disturbance. Because the acreage of dog towns is so small we have not encountered any conflicts to date.

The Custer National Forest did have a conflict with a potential lease offering and a W-T dog town. I have an email requesting a final resolution to that issue. I'm not sure how they resolved the issue.