FINAL REPORT

As Required by

THE ENDANGERED SPECIES PROGRAM

TEXAS

Grant No. E-27

Endangered and Threatened Species Conservation

Black-tailed Prairie Dog Management Planning and Implementation in Texas

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14 November 2006

FINAL REPORT

STATE: Texas **GRANT NUMBER:** E-27

GRANT TITLE: Black-tailed Prairie Dog Management Planning and Implementation in Texas

REPORTING PERIOD: 1 September 2001 to 31 October 2006

OBJECTIVE(S):

(1) To conduct a state-wide inventory of black-tailed prairie dog populations and habitat in Texas and (2) to implement the black-tailed prairie dog candidate conservation agreement in Texas.

Significant Deviations:

None.

Summary Of Progress:

Please see the following attachments:

(1) Attachment A;
(2) Black-tailed Prairie Dog Monitoring Packet;
(3) Establishing a Baseline for Monitoring Gene Diversity of Black-Tailed Prairie Dogs (*Cynomys ludovicianus*) in Texas Using Microsatellite Loci; and
(4) 2005 Inventory of the Black-Tailed Prairie Dog in Texas
(5) Texas Black-Tailed Prairie Dog Plant Community Alliances and Associations

Location: Statewide, Texas.

Cost: Financial reports were unavailable at time of report.

Prepared by: Craig Farquhar **Date:** 14 November 2006

Approved by: Timothy W. Birdsong, Federal Aid Coordinator **Date:** 27 November 2006

ATTACHMENT A

Segment Objectives:

1. Black-tailed prairie dog Distribution and Habitat Maps. To accurately survey black-tailed prairie dog towns and associated habitat in Texas, remote sensing tools will be used. These will include semi-automated and automated remote sensing/image processing classification methodology and ground-truthing utilizing standard Global Positioning System techniques. In order to verify the rarity of prairie dog towns in the Texas High Plains, Rolling Plains, and Trans-Pecos ecoregions, a digital baseline data set of precise locality and town size needs to be acquired. Land use/land cover will also need to be acquired to quantify shortgrass prairie, midgrass prairie, and brush community systems prairie dogs currently and historically occupied. This will be accomplished by the following three procedures.

   1.1 Eleven (11) Thematic Mapper (TM) Landsat 7 Imagery (30 meter multi-spectral and 15 meter panchromatic) for the Texas High Plains, Rolling Plains, and Trans-Pecos ecoregions were acquired from the Texas Parks and Wildlife Department Headquarters GIS Laboratory and classified for land use/land cover.

   1.2 Wildlife Diversity Program will acquire Digital Ortho-photography Quadrangles (DOQ) for 1200 images covering the area-of-interest in 1.1.

   1.3 A final classification report was compiled representing prairie dog occupation maps for each county and land use/land cover classification maps for each TM scene. A summary of vegetation types, soil substrates, and occupation of prairie dogs, and burrowing owls presence in each county will be described. Land use/land cover class descriptions for each TM Scene will also be summarized.

2. Implementation of the Texas Black-tailed Prairie Dog Management Plan. Funds were used to implement the Black-tailed Prairie Dog plan. Duties performed by the state coordinator would include:

   2.1. Overseeing coordination of the Texas Prairie Dog Working Group;
   2.2 Develop a state conservation agreement;
   2.3. Developing a wide variety of landowner incentives and stimulate funding sources;
   2.4. Working with national grassland managers to facilitate maximum occupancy on federal lands;
   2.5. Facilitating and coordinating census and monitoring work;
   2.6. Coordinating the selection of conservation priority areas in the state;
   2.7. Developing plan and implementation protocols for priority conservation regions;

2.8. Prioritizing and facilitating research projects that have high potential to promote conservation;

2.9. Formalizing state prairie dog conservation and management network;

2.10. Working with extension service and Ecological Services to develop a landowner prairie dog management manual;

2.11. Supervising the review and possible revision of prairie dog-related legislation and agency policies.

2.12. Develop and implement education and outreach programs that focus on the black-tailed prairie dog, related human health issues, and also the structure, function, and ecological and economic value of prairie ecosystems.

2.13. Identify state and federal agencies in Texas involved in the management of prairie dogs and their current and potential role in prairie dog management and conservation. Assess the effect each agency's actions have singly and in sum on prairie dog populations. Through collaboration, determine how the policies and actions of the agencies could be adjusted to fulfill their obligations to each of their constituencies while simultaneously addressing the population status of prairie dogs.

2.14 Form committees to begin working with groups particularly important to the success of the plan. Proposed committees include education, intrastate agency, and southwestern plains working groups. Also form ad hoc committees to work with particularly important federal and state agencies e.g. Rita Blanca National Grasslands.

2.15. Use data on the economic value of native prairie and prairie species developed by wildlife cooperatives and ecotourism groups to encourage management techniques and prairie restoration that favor prairie dogs.

2.16 Establish guidelines and procedures including management recommendations for determining when, where and under what circumstances prairie dog colonies could be re-established.

2.17 Develop a formal, cooperative, relationships with personnel at facilities with prairie dogs on their property, for example, Muleshoe National Wildlife Refuge, US Forest Service, Rita Blanca National Grasslands, West Texas A&M University, Texas Tech University, and the Department of Energy (DoE) – PANTEX.

2.18 Establish a long-term research site that can be used as a baseline for future research and evaluation of prairie systems and associated assemblages of species.

Summary of Progress:

Black-tailed prairie dog Distribution and Habitat Maps

Texas Parks and Wildlife Department has spent the past 2 years surveying prairie dog acreage by utilizing digital orthophoto quadrangles (DOQ's). We searched over 1400 individual DOQ's using ERDAS Imagine software and used both black and white and color images. Most of the imagery was acquired from 1995-1996. The baseline survey was completed in 2004 and the datasets were used to estimate the;

- total number of acres of prairie dog colonies currently,
- change in population from 1996 to 2004,
- current hypothetical range for the BTPD,
- the locations and sizes of complexes of prairie dog colonies greater than 5000 acres, and
- percentage of prairie dogs living in complexes greater than 1000 acres.

The results of the inventory yielded a best estimate of 115,000 acres of prairie dog colonies in Texas currently (Figure 1). The estimated change in population size from 1996 to 2004 was 12 – 24% decline. We identified 2-6 complexes greater than 5000 acres in size and estimate that 40-60% prairie dogs live in complexes of greater than 1000 acres. Based on these estimates Texas achieves 2 of the 3 goals established by the Interstate Working Group (i.e. 10% prairie dog complexes in 1,000 acre or more; and one complex of 5000 acres).

After completing the statewide assesement focal areas for monitoring were established; 12 areas representing various Ecoregions with prairie dogs were selected for periodic monitoring. The first year for monitoring was 2005 when new imagery became available. Efforts to interpret the imagery and ground truth the selected monitoring areas begin April 2005 and were completed in May 2006 (attachment titled 2005 Inventory of Black-tailed Prairie Dog in Texas).

A summary of vegetation types, soil substrates, and occupation of prairie dogs is also attached (Appendix A). A map detailing burrowing owls presence is also provided.

2. Implementation of the Texas Black-tailed Prairie Dog Management Plan

Funds were used to hire a full time coordinator to implement the Texas Black-tailed Prairie Dog management plan. Duties performed by the state coordinator included the following:

2.1. Overseeing coordination of the Texas Prairie Dog Working Group:

Texas Parks and Wildlife Department attended and organized meetings of the Texas Black-tailed Prairie Dog Working Group. Activities at these meetings included 1) presentations by researchers and graduate students on research results, and 2) discussions of prairie dog-urban interface situations, management plans in other states, USDA conservation measures, prairie dog control measures, Interstate Prairie Dog Conservation Team, Work Plan for Prairie Dog Program Coordinator, implementation strategy for *Texas Black-tailed Prairie Dog Conservation and Management Plan* (Management Plan), statewide inventory efforts, and focus and monitoring areas. In addition, a plague monitoring subgroup was established and developed a plague monitoring protocol (See Attached).

2.2. Develop a state conservation agreement.

Meetings were conducted with personnel from the U.S. Fish and Wildlife Service and a draft Umbrella Candidate Conservation Agreement with Assurances (CCAA) was created. Development of a CCAA was halted in 2003 and did not proceed. We requested that we be allowed to utilize these funds to continue implementation of the Texas Black-tailed Prairie Dog Management Plan. To that end an amendment to the original grant was approved in 2004. A 10-year state conservation agreement was drafted and signed by the USFWS and TPWD in 2005. This was done in lieu of a Candidate Conservation Agreement.

2.3. Developing a wide variety of landowner incentives and stimulate funding sources:

Landowner incentives exist through the various Farm Bill programs including WHIP, EQUIP, and others. Through the EQIP program we have 4 emphasis areas and each is associated with declining species. The lesser prairie chicken and black-tailed prairie dog emphasis area encourages cost sharing on brush control and deferred grazing. Other funding programs available to private landowners for wildlife management and enhancement projects include the Landowner Incentive Program, State Wildlife Grants, Horned Lizard License Plate Funds, and State Hunting License Revenue.

2.4. Working with national grassland managers to facilitate maximum occupancy on federal lands:

Coordination and communication with national grassland and other federal land managers (U.S. Fish and Wildlife Service National Wildlife Refuges, National Parks and Recreation Areas) continues. The National Grasslands and USFWS have representatives on the Working Group. Two of the focus areas for monitoring occur on federal lands. TPWD also prepared a position paper to the US Forest Service National Grasslands encouraging the halt of prairie dog control on national grasslands while prairie dogs were a Candidate species for listing.

2.5. Facilitating and coordinating census and monitoring work:

Census work was completed in 2004. Monitoring began in 2005 and analysis of the monitoring data will be completed by May 2006. In 2004 TPWD coordinated with the National Grasslands, Texas Department of Health, and USFWS and documented the affects of a plague outbreak in Texas. Information on this epizootic was presented to the USFWS Ecological Services office in TPWD's Annual USFWS Update on the Status of Prairie Dogs in Texas 2004-2005.

2.6. Coordinating the selection of conservation priority areas in the state:

The focal areas selected for monitoring are also the conservation priority areas. Conservation priority areas were selected based on concentrations of prairie dogs, availability of public lands, and appropriate soils, land use, and topography. (See attachment delineating priority areas.)

2.7. Developing plan and implementation protocols for priority conservation regions:

The main goals of the Management Plan are: (1) determine the current population size of black-tailed prairie dogs in Texas and establish a long term monitoring program, (2) develop and implement an effective education and outreach program, (3) develop management options and guidelines that conserve prairie dogs at long term sustainable levels, (4) review and make recommendations for regulatory changes in the status of the black-tailed prairie dog, (5) identify research needs and identify a research program that facilitates long-term viability of black-tailed prairie dogs in Texas, and (6) implementation. Implementation will focus on conservation priority areas/regions. The implementation plan is attached as part of the final prairie dog management plan.

2.8. Prioritizing and facilitating research projects that have high potential to promote conservation:

TPWD-supported research on 2 master's projects at Texas Tech University (TTU): *Playa Lakes as Habitat Reserves for Black-tailed Prairie Dogs,* and *Resource Partitioning and Overlap of a Raptor Assemblage Associated with Prairie Dog Colonies*; both of these were reported on previously. In 2005 TPWD entered into a contract agreement with the University of North Texas in a project titled "Monitoring gene diversity in black-tailed prairie dogs (Cynomys ludovicianus) using microsatellite DNA."

Over 300 samples were collected from 16 sites and analyzed in 2006. For complete details please see attached report "Establishing a baseline for monitoring gene diversity of black-tailed prairie dogs in Texas using microsatellite loci".

2.9. Formalizing state prairie dog conservation and management network:

In addition to the in-state prairie dog conservation and management network formed through the Working Group and associated interested parties, TPWD has continued to develop an interstate network of professionals interested in prairie dog conservation and management by attending meetings and conferences in different parts of prairie dog range. At these meetings, TPWD representatives to interstate groups were able to disseminate information regarding prairie dog conservation and management in Texas, in addition to receiving information from other states.

2.10. Working with extension service and Ecological Services to develop a landowner prairie dog management manual:

TPWD assisted Natural Resources Conservation Service in preparing a publication targeted at assisting landowners to manage for prairie dogs. This was an NRCS publication completed in 2004.

2.11. Supervising the review and possible revision of prairie dog-related legislation and agency policies:

In 2004 TPWD included questions regarding the harvest of prairie dogs in Texas in the Department's annual small game animal survey. TPWD estimated that 7021 hunters killed 26,428 prairie dogs; 95% confidence interval 20,957-31,898. In addition to estimating hunter harvest TPWD required reporting of prairie dogs taken under the commercial non-game permit. With the monkey pox outbreak and banning of prairie dogs in the pet trade TPWD discontinued monitoring the take of prairie dogs under the non-game permit. Additionally, efforts to monitor the harvest of prairie dogs through use of a mail survey were discontinued after one year. Low sample size and high confidence intervals indicated that the data obtained by this method were unreliable.

Texas Parks and Wildlife Department does not currently regulate harvest and does not have authority over lethal control of prairie dogs. We have however with cooperation from the Food and Drug Administration (FDA) monitored the number of permits issued by the FDA for various uses of prairie dogs since 2003. Table 1 provides a breakdown by year of the permits issued for prairie dog activities The number of permits issued by FDA for prairie dogs varies annually but has ranged from10 in 2003 as high as 34 in 2005. The majority of permits issued are for removal and relocation of nuisance prairie dogs from one site within Texas to another. The number of permits for removal and relocation has grown from 4 in 2003 to 22 in 2005, with 11 permits issued in 2006. Educational use and research are the next two most common types of permits issued for prairie dog.

2.12. Develop and implement education and outreach programs that focus on the black-tailed prairie dog, related human health issues, and also the structure, function, and ecological and economic value of prairie ecosystems.

One goal of the Management plan is Outreach and Education. TPWD has developed a citizen science monitoring program titled Prairie Dog Watch (see attached). In addition TPWD has published the Texas Black-tailed Prairie Dog Management Plan and a Black-tailed Prairie Dog brochure outlining the general ecology of prairie dogs. TPWD has also compiled education materials from other states to avoid duplication of efforts. Most of these materials are available to landowners and the public.

2.13. Identify state and federal agencies in Texas involved in the management of prairie dogs and their current and potential role in prairie dog management and conservation. Assess the effect each agency's actions have singly and in sum on prairie dog populations. Through collaboration, determine how the policies and actions of the agencies could be adjusted to fulfill their obligations to each of their constituencies while simultaneously addressing the population status of prairie dogs.

This endeavor was undertaken during the identification and formation of the Black-tailed Prairie Dog Working Group and culminated in the formation of the Black-tailed Prairie Dog Management Plan. The plan was a consensus document formed by the organizations listed within the plan.

2.14 Form committees to begin working with groups particularly important to the success of the plan. Proposed committees include education, intrastate agency, and southwestern plains working groups. Also form ad hoc committees to work with particularly important federal and state agencies e.g. Rita Blanca National Grasslands.

A variety of committees have been established over the years including subcommittees on plague monitoring and education.

2.15. Use data on the economic value of native prairie and prairie species developed by wildlife cooperatives and ecotourism groups to encourage management techniques and prairie restoration that favor prairie dogs.

Literature on the economic value of prairie and prairie species has been summarized and is contained in the prairie dog brochure published in 2005.

2.16 Establish guidelines and procedures including management recommendations for determining when, where and under what circumstances prairie dog colonies could be re-established.

Literature on the subject of prairie dog relocation is available and has been summarized for use within TPWD and for use by individuals interested in re-establishing or relocating prairie dogs to new areas.

2.17 Develop a formal, cooperative, relationships with personnel at facilities with prairie dogs on their property, for example, Muleshoe National Wildlife Refuge, US Forest Service, Rita Blanca National Grasslands, West Texas A&M University, Texas Tech University, and the Department of Energy (DoE) – PANTEX.

The Texas Black-tailed prairie dog working group involves the above named organizations as well as others. While the mission of the working group (i.e. develop a management plan) has been completed the group reorganized in 2004 to implement the management plan. A formal cooperative relationship still exists.

2.18 Establish a long-term research site that can be used as a baseline for future research and evaluation of prairie systems and associated assemblages of species.

No suitable location for a long-term research site could be established.

Table 1. Prairie dog relocation permits issued by the Food and Drug Administration Center for Veterinary Medicine Division of Compliance for Texas 2003 to 2006.

Date Issued	Issued to	City	State	Permit details
8/21/2003	Haddock, Joann D.	Lorenzo	TX	Removal from development site
9/3/2003	Turley, Windle	Dallas	TX	Removal from city park
9/12/2003	Watts, Douglas M.	Galveston	TX	Monkeypox research
9/15/2003	Wise, Kerry	Dallas	TX	Release of 162 PD from facility
10/10/2003	Czisny, Linda	Austin	TX	Adoption from pet owner to zoo
11/10/2003	Haddock, Joann D.	Lorenzo	TX	Remove from construction site
10/10/2003	Wagner, Deana	Amarillo	TX	Remove from development site
11/12/2003	Continental Airlines,	Houston	TX	Ship wild p-dogs for Dr. Moser's research project
11/12/2003	McKee, Mark	Bonham	TX	Collect wild p-dogs for Dr. Moser's research project
12/19/2003	Wayne Rothermel	Dallas	TX	DENIED permission to export p-dogs to Denmark for sale as pets
1/9/2004	Big Springs State Park	Big Springs	TX	NOT ISSUED--permit issue resolved by GC#040163 to Joann Haddock
1/9/2004	Haddock, Joann D.	Lorenzo	TX	Remove from Sun Country Estates in Lubbock, release @ Beach Ranch
1/9/2004	Haddock, Joann D.	Lorenzo	TX	Remove from Meadowbrook Golf Course Lubbock, release Beach Ranch
1/9/2004	Haddock, Joann D.	Lorenzo	TX	Remove Mackenzie Park Lubbock, release Beach Ranch
2/4/2004	Czisny, Linda	Austin	TX	Adoption from shelter to zoo
4/1/2004	McKee, Mark	Bonham	TX	Remove from Midland, TX, wastewater site, ship to Univ. of Pittsburgh for research
4/8/2004	Wagner, Deana	Amarillo	TX	Remove from development site, release at Gene Hemp Wildlife Area
4/20/2004	Continental Airlines	Houston	TX	Transport Abedin p-dogs from Houston to Philadelphia
4/20/2004	McKee, Mark	Kennard	TX	Collect wild p-dogs for Dr. Abedin's research project, transport to airport
4/21/2004	McKee, Mark	Big Springs	TX	Remove from Big Springs airport, release in Sutton County
4/29/2004	McKee, Mark	Odessa	TX	Remove from Univ. Texas Permian Basin, release in Sutton County
4/29/2004	McKee, Mark	Midland	TX	Remove from Midland Junior College, release in Sutton County
5/10/2004	Wagner, Deana	Amarillo	TX	Change release site for permit issued 2-20-04 to private land near Dudley, TX
5/13/2004	Wagner, Deana	Amarillo	TX	Remove from development site, release on private ranchland
5/13/2004	Wagner, Deana	Amarillo	TX	Remove from Midland College property, release to private ranchland
5/14/2004	San Antonio Zoo	San Antonio	TX	Transport p-dogs from Sedgwick Co Zoo in Kansas to San Antonio Zoo
6/2/2004	Byrne, Mike	Dallas	TX	Adopt 2 p-dogs from Lynda Watson
6/24/2004	McKee, Mark	Kennard	TX	Remove from development site in Yukon, OK, transport to Turley Ranch
7/19/2004	Citizens for Prairie Dogs	Lorenzo	TX	Remove from South Plains Fairgrounds, release at Beach or Werner Ranch

8/10/2004	Animal Edutainment	Aubrey	TX	Permit allows for use of p-dogs in traveling educational programs
8/10/2004	NextPet.Com	Dallas	TX	Allow euthanasia & disposal of 115 captive p-dogs
8/12/2004	Zooniversity	Dallas	TX	Permit allows for use of p-dogs in traveling educational programs
8/19/2004	Llano Estacado Audubon Soc	Lubbock	TX	Allow display of captive-raised p-dogs for educational purposes
10/7/2004	Wagner, Deana	Amarillo	TX	Remove nuisance p-dogs from neighborhood, release on private land
10/29/2004	Wagner, Deana	Amarillo	TX	Allow display of captive-raised p-dogs for educational purposes
11/3/2004	Citizens for Prairie Dogs	Lubbock	TX	Allow capture of nuisance p-dogs in Lubbock County w/out advance permission
11/10/2004	Citizens for Prairie Dogs	Lorenzo	TX	Allow display of captive-raised p-dogs for educational purposes
2/18/2005	Citizens for Prairie Dogs	Lorenzo	TX	Allow capture of nuisance p-dogs in Lubbock, Hale & Swisher Counties, Texas
2/4/2005	Citizens for Prairie Dogs	Lubbock	TX	Release nuisance p-dogs in Oldham County, TX
3/10/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs near Pampa, TX, release near Dudley, TX
3/10/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs near Midland, TX, release near Colorado City, TX
3/15/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs at 5 sites, release in Oldham County, TX
3/31/2005	NextPet.Com	Bowie	TX	Allow capture & transport of wild p-dogs to airport for shipment to zoo in Korea
4/1/2005	Watson, Lynda	Lubbock	TX	Allow donation of captive p-dogs to museum in Del Rio for exhibition/education use
4/21/2005	Wagner, Deana	Amarillo	TX	Allow transport of captive p-dog to Nature Center & TV station for exhibition
5/13/2005	McKee, Mark	Kennard	TX	Allow capture of nuisance p-dogs in Tarrant Co., release at Beach Ranch, Garza Co.
5/20/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs from private land, relocate to Werner Ranch, Oldham Co., TX
5/20/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogson private land, relocate to private land, Calahan Co., TX
5/20/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs on private land, release at Childress High School
5/20/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs on private land, release on private land, Cochran Co., TX
5/20/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs on private land, release on private land, Uvalde Co., TX
6/2/2005	Wagner, Deana	Amarillo	TX	Allow shipment of dead p-dog to taxidermist to be prepared for National Park display
6/17/2005	Citizens for Prairie Dogs	Lorenzo	TX	Allow release of nuisance p-dogs on ranch in Oldham County, TX
6/28/2005	Watson, Lynda	Lubbock	TX	Allow capture of nuisance p-dogs in several counties in Texas
6/29/2005	Citizens for Prairie Dogs	Lorenzo	TX	Allow capture of nuisance p-dogs in several counties in Texas
7/13/2005	Animal Edutainment	Aubrey	TX	Renew permit allowing educational use of p-dogs
7/14/2005	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs & relocate to private land in Oldham County
7/27/2005	Barr, Cynthia	Lubbock	TX	NO -- wanted to adopt from pet shop
8/4/2005	Zooniversity LLC	Dallas	TX	Renew permit allowing education use of p-dogs
8/9/2005	Citizens for Prairie Dogs	Lubbock	TX	Allow capture of nuisance p-dogs in Clovis, NM, release on private ranch land
8/12/2005	Univ. of North Texas	Denton	TX	Allow to collect and transport 400 tissue samples for research project
8/12/2005	Wagner, Deana	Amarillo	TX	Allow to capture 1 nuisance p-dog and release on private land

8/17/2005	Citizens for Prairie Dogs	Lubbock	TX	Allow transport & use of 2 captive p-dogs for educational program
8/17/2005	Go3 Pets	Houston	TX	Allow him to adopt p-dogs from his own store when it closes at end of month
9/16/2005	Citizens for Prairie Dogs	Lubbock	TX	CLOSED by memo to file -- this request was no longer necessary
9/23/2005	Citizens for Prairie Dogs	Lubbock	TX	Allow capture of nuisance p-dogs in Clovis, NM, release on private ranch land
10/13/2005	McKee, Mark	Haslet	TX	Allow transport of 35 wild p-dogs to Dr. Moser at Univ. of Pittsburgh Med School
10/13/2005	McKee, Mark	Haslet	TX	Allow capture of nuisance p-dogs from colleges in Midland & Permian, release on private ranchland
10/26/2005	Citizens for Prairie Dogs	Lorenzo	TX	Allow to transport & release 50 nuisance p-dogs on Beach Ranch
10/26/2005	Watson, Lynda	Lubbock	TX	Allow the release of 89 wild p-dogs captured for Cindy Biggs Ph.D. research
11/16/2005	Citizens for Prairie Dogs	Lorenzo	TX	Allow her to take 1 p-dog to a school for educational program
1/10/2006	Citizens for Prairie Dogs	Lorenzo	TX	Allow to transport & release 123 nuisance p-dogs on Beach Ranch
1/24/2006	Wagner, Deana	Amarillo	TX	Allow transport to nature center for photographs, and to TV station
3/10/2006	Citizens for Prairie Dogs	Lorenzo	TX	Allow release of nuisance p-dogs on ranch in Oldham County, TX
4/19/2006	Univ. of Texas Permian Basin	Odessa	TX	Allow capture of wild p-dogs for research project
5/5/2006	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs at construction site, release on private land
5/5/2006	Wagner, Deana	Amarillo	TX	Allow capture of nuisance p-dogs on agricultural land, release on private land
5/5/2006	Wagner, Deana	Amarillo	TX	Allow transport & use of 2 captive p-dogs for educational program
5/17/2006	Citizens for Prairie Dogs	Lorenzo	TX	Allow capture of 150 nuisance p-dogs from US Post Office property, release on private land
6/29/2006	Watson, Lynda	Lubbock	TX	Allow relocation of captured nuisance p-dogs in two additional locations
7/12/2006	Animal Edutainment	Aubrey	TX	Allow use of 3 captive p-dogs in educational shows
7/12/2006	Watson, Lynda	Lubbock	TX	Allow capture and shipment of 100 wild p-dogs to Drexel Univ. for research
7/25/2006	Citizens for Prairie Dogs	Lorenzo	TX	Allow capture of 100 nuisance p-dogs from location in Big Spring, TX, release at Beach Ranch
8/3/2006	Zooniversity LLC	Dallas	TX	Allow use of 3 captive p-dogs in educational show
8/28/2006	Watson, Lynda	Lubbock	TX	Allow capture of nuisance p-dogs from city-owned property in Lubbock
8/28/2006	Watson, Lynda	Lubbock	TX	Allow capture of nuisance p-dogs in several counties in Texas
9/7/2006	El Paso Zoo	El Paso	TX	Allow them to transport & receive 9 p-dogs from San Francisco Zoo
10/2/2006	Citizens for Prairie Dogs	Lorenzo	TX	Allow transport of up to 5 p-dogs to Snyder, TX for educational use
10/11/2006	Watson, Lynda	Lubbock	TX	Allow capture of nuisance p-dogs in several counties in Texas
10/30/2006	Watson, Lynda	Lubbock	TX	Allow capture of 100 p-dogs from Northern Natural Gas, release on Harold Werner Ranch
10/30/2006	Citizens for Prairie Dogs	Lorenzo	TX	Renew permit to capture nuisance p-dogs in Lubbock County, TX
Unknown date	Watson, Lynda	Lubbock	TX	City of Lubbock sewer treatment

Establishing A Baseline For Monitoring Gene Diversity Of Black-tailed Prairie Dogs (*Cynomys ludovicianus*) In Texas Using Microsatellite Loci

By

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CHAPTER I

INTRODUCTION

Objectives

This preliminary study was conducted as part of the Texas Black-Tailed Prairie Dog Conservation and Management Plan (TPW, 2004). The principal mission of this project is to "develop and initiate a statewide plan that will conserve the black-tailed prairie dog, while simultaneously protecting personal and property rights" (TPW, 2004).

The primary objective of this study was to obtain genetic profiles of black-tailed prairie dogs (*Cynomys ludovicianus*) collected from colonies throughout the state of Texas and to use this information to establish the genetic diversity baseline necessary for continued monitoring of the genetic health of these populations. Additional benefits can be derived from these data if they are combined with data from the TPW mapping and size analysis of prairie dog colonies throughout the state. Questions that may be addressed include whether increased colony size, proximity to other prairie dog colonies, and/or increased numbers of adjacent prairie dog colonies from which prairie dogs can emigrate can substantially increase genetic diversity.

Background

The black-tailed prairie dog (*Cynomys ludovicianus*; hereafter references to "prairie dog" in this report will refer to this species alone unless otherwise specified) is one of five species of prairie dogs found in North America. They inhabit mixed-grass and short-grass prairies of the Great Plains region, currently ranging from southern Saskatchewan, Canada, to northern Mexico, and from eastern Nebraska to the foothills of the Rocky Mountains (Miller and Cully, 2001). These reddish-brown ground-dwelling squirrels average 30 cm in length and 700 g in weight (Hoogland, 1996). They are diurnal, burrowing rodents whose key characteristic includes high sociality organized into family groups termed coteries.

In 1902, C. H. Merriam, director of the U.S. Biological Survey (now the U.S. Fish and Wildlife Service), reported unsubstantiated statistics in the U.S. Department of Agriculture's *Yearbook of Agriculture* that 256 prairie dogs consume as much grass as a 1,000 pound steer, that 32 prairie dogs consume as much as 1 sheep, and that these rodents contribute to a 75% decline in rangeland productivity. These fabricated numbers influenced farmers, ranchers and government agencies to nearly decimate prairie dog populations via federally-funded mass poisonings, fumigations, drownings, shootings, and other anthropogenic activities (Hoogland, 1995; Graves, 2001).

Although the exact number has recently become a topic of controversy (Vermeire et al, 2004; Forrest, 2005), it has been estimated that as many as five **billion** prairie dogs (all prairie dog species were included in this number) were alive at one given time in the late 1800's (Merriam, 1902). Today, prairie dog abundance is commonly expressed in terms of surface area occupied by their colonies (Miller and Cully, 2001). It is currently estimated that black-tailed prairie dogs occupy less than 1% of their historical habitat (Miller and Cully, 2001) with an estimated habitat decline of 99.5% between 1870 (116,000,000 acres) to 1998 (635,000 acres) (Graves, 2001; National Wildlife Federation, 1998). The National Wildlife Federation (NWF, 1998) states that presently about 72 percent of the U.S. black-tailed prairie dog habitat, and all the remaining large complexes of black-tailed prairie dog towns, occur in three states: Montana, South Dakota and Wyoming.

Along with prairie dogs, numerous other prairie-dwelling animals [black-footed ferret (*Mustela nigripes*), bison (*Bison bison*), swift fox (*Vulpes velox*), burrowing owl (*Athene cunicularia*), ferruginous hawk (*Buteo regalis*), and mountain plovers (*Charadrius montanus*)] have also experienced tremendous reductions in numbers. The survival of these and many other species is intertwined with that of the prairie dog. These species prey on prairie dogs, find critical shelter in their burrows and/or benefit from other prairie dog activities that collectively maintain open, herbaceous habitats (Lomolino and Smith, 2001). Miller, et al.(1999) estimated that nine species of animals *depend* on prairie dogs, 20 species have opportunistic use of prairie dog colonies and 117 other species have life histories that likely benefit from prairie dog activities. A general consensus exists, although not without controversy (Stapp, 1998), that the prairie dog is a keystone species of the Great Plains prairie ecosystem (Kotliar, 2000; Kotliar et al. 1999; Miller et al., 1994, 1999).

Prairie dog populations face a wide range of challenges to their continued survival. Bubonic plague ("Black Death") is caused by the bacterial species *Yersinia pestis*, which is generally believed to utilize fleas as its vector. It is known as sylvatic plague when present in ground squirrels and other wild animals. Most likely originating from Asia, sylvatic plague is speculated to have entered United States ports approximately 100 years ago and has currently become established in wild rodent populations of the western U.S. (Cully and Williams, 2001). This disease has been documented in all four U.S. prairie dog species for the past 60 years, frequently killing >99% of prairie dogs in infected colonies (Cully and Williams, 2001). Barnes, 1993, has reported that plague is the only infectious disease known to cause extensive die-offs in prairie dogs. The major impacts of plague include local extirpation of colonies, increase in the probability of extinction of entire complexes, reduction of colony size, increase of intercolony distances within colony complexes, increase in distances between colony complexes, increase variance in local population sizes, and reduction in the effectiveness of dispersal in demographic rescue among colonies (Cully and Williams, 2001). Cully and Williams, 2001, have concluded that no evidence exists to suggest that prairie dogs have yet to evolve/develop any resistance to plague.

Prevailing myths and century-old attitudes towards the prairie dog have lead to extensive government-sponsored as well as private rodent warfare programs that have contributed to the marked decrease in prairie dog populations. Although the government-sponsored rodent warfare programs have decreased since the 1970's, negative perceptions of the prairie dog still persist and such unfounded efforts to eradicate the animals continue. The wholesale loss of available prairie dog habitat has further compounded the lethal effects of plague and rodent warfare activities to provide an additional impetus to the decline of this species.

The dramatic reduction in prairie dogs over their former range has not gone unnoticed by various governmental agencies and conservation organizations. However, the NWF's proposal in 1998 to list the black-tailed prairie dog as a threatened species was denied even though at least 4 of the 5 requirements for listing were met (only 1 is required for listing under the Endangered Species Act) (Miller and Cully, 2001). Still, prairie dogs remain as "species of concern" in most states in which they range. For this reason, various state wildlife agencies have established management plans to determine the status of prairie dogs in their respective states and to initiate conservation efforts necessary for survival of the species. The management plan for Texas was drafted in early 2004 and includes various goals with objectives and strategies. A study of population genetics of extant colonies will be beneficial to help meet the goals set forth by the state of Texas (TPW, 2004).

Social Structure of the Black-tailed Prairie Dog

A characteristic feature of all prairie dog species is coloniality. Black-tailed prairie dog colonies (*Cynomys ludovicianus*) are organized into family groups, called coteries, which are harem-polygynous units. Coteries typically include a breeding male, two or three adult females, and one or two juveniles and /or yearlings of each sex with a mean coterie size of 6.13 ± 3.53 individuals (Hoogland, 1995). However, coterie size and makeup can vary over a wide range, being particularly dependent upon the previous year's weather and the size of the coterie home territory (Hoogland, 1995). Females tend to remain in their natal coterie territories for their entire lifetimes, while males usually disperse from the coterie after two years. Hence, females of a coterie are likely to be closely related while sexually mature males can be expected to have come from other coterie units of the colony or immigrants from nearby colonies (Hoogland, 1995).

Why The Study of Population Genetics Is Important

Understanding the population genetics of prairie dog colonies is essential for long-term monitoring of their population dynamics. Prairie dogs seldom migrate, and when they do, it is only over short distances (Hoogland, 1995). Massive habitat destruction, the effects of plague and animal eradication programs have combined to convert most historical prairie dog populations into isolated groups with few hospitable migration corridors to allow adequate gene flow between them (Roach et al, 2001). This forces prairie dogs throughout the Great Plains to rely on the existing genetics within these isolated metapopulations. One of the properties of metapopulations is a recurrent pattern of localized extinction and recolonization of individual populations within the extended network (Lidicker and Koenig, 1996), with the dynamics of the population genetics of the entire unit depending upon dispersal between the metapopulation subunits. Therefore, given the increased isolation of prairie dog colonies, their current and future genetic diversity, genetic drift, founder effect and bottlenecking are major concerns.

These concerns have lead to the present study, where a molecular-based approach involving microsatellite analysis was used to measure and compare the amount of genetic diversity in selected extant black-tailed prairie dog colonies throughout their current range in Texas. The results from this study will aid future preservation, conservation and restoration projects involving this and associated animal species.

Population Genetics of Black-tailed Prairie Dog Populations

The earliest studies black-tailed prairie dog population genetics were performed by Chesser (1983) using allozyme variation at seven variable protein loci. A total of 21 sites within four regions of eastern New Mexico were studied. Data collected were used to estimate heterozygosity (H) as a measure of overall genetic variation, as well as to determine genetic differentiation using Wright's (1965) *F*-statistics as modified by Nei (1977). Pair-wise genetic similarities between populations were also calculated using the genetic identity measure (I) of Nei (1972). Based on the analysis of F_{ST}, he found significant but moderate differentiation between individual study regions and also populations from within each region. He further detected an excess of homozygous individuals within populations, as measured by Wright's F_{IS}, indicating elevated levels of inbreeding within populations. Surprisingly, Chesser (1983) found greater genetic differentiation between some colonies in the same region than between regions. Collectively, the data indicated that the populations of black-tailed prairie dogs fit a model of differentiation by founder effect, mutation and genetic drift. Finally, Chesser's (1983) data indicated that the genetic differentiation among coteries could be explained by the migration of one male per generation with five being the number of dispersers required to maintain the observed genetic differentiation between populations.

In another study, Dobson et al. (1998) examined genetic variation over ten years in a single South Dakota black-tailed prairie dog population. Mating within the population approached random with mates tending to originate from different coteries. Dobson, et al. determined allozyme variation at four variable loci and analyzed data using Wright's (1965) *F*-statistics. They found substantial genetic differentiation between coteries of the population, with 15 to 20% of the genetic variation occurring among the coteries. Measure of inbreeding (F_{IS}) was negative and low, indicating that inbreeding is not prevalent within this population.

Similarly, Travis et al. (1997) analyzed genetic variation in two populations of Gunnison's prairie dog (*Cynomys gunnisoni*) using minisatellite DNA profiles. They determined that overall genetic diversity within populations was low, with 55 to 71% similarity between individuals. Using an *F*-statistic analog, heterogeneity of the two populations was determined to be similar to black-tailed prairie dog allozyme-based F_{ST} values reported by Chesser (1983).

More recently, molecular-based analyses of highly polymorphic microsatellite or short tandem repeat (STR) loci have been used for detailed studies of population genetics in a variety of organisms. Microsatellite loci consist of tandemly repeated sequences of two to six nucleotides. Individual alleles vary by the number of repeats encoded, with individual alleles varying from several to more than 40 copies of the repeat unit. Allele designations are written as, for example, CA_n, where *n* is the number of repeats. Thus, CA_{20} indicates an allele of 20 repeat units of the dinucleotide repeat CA (C,G,A, and T are the designations for the bases of the DNA alphabet). Microsatellites are scattered throughout the genome of higher eukaryotes and are commonly found in non-coding regions of the DNA. Once the sequences of the region flanking a particular microsatellite locus are determined, one can readily analyze the allelic makeup of individuals (and thus populations) at that locus by polymerase chain reaction (PCR). The hyperpolymorphic nature of many microsatellite loci is the result of mutations believed to result from the process of slippage replication. The repetitive nature of these loci stabilizes mispairings between the newly synthesized DNA and the template strand, increasing the likelihood of replication errors that increase or decrease the size of the STR, with integeric unit changes much more likely to occur. Thus, over time, a given population will experience a general increase in the number of length variants (alleles) at these loci.

In practice, PCR amplified fragments of the different alleles, e.g., CA_{24} and $CA_{26,}$ can be separated as bands based upon their migratory properties on a test electrophoretic gel that can be visualized by in of a variety of detection techniques. The size variants represent allele variation and are indicative of sequence diversity in the genetic material. At any particular locus, a homozygous individual will exhibit a single band/allele while the heterozygous individual will yield two bands following electrophoretic analysis. Typical vertebrate populations may have as many as 5 to 15 alleles at polymorphic microsatellite loci. Determination of allelic variation at STR loci allows one to perform the same types of genetic analyses that formerly utilized allozymic data, with the STR data generally providing a more detailed data set than was possible with allozyme studies. Potential applications of microsatellite DNA analyses include individual identification, parentage analyses, relatedness calculations, genetic differentiation between populations or species, and the identification of demographic bottlenecks in species of concern to conservationists.

Demographic bottlenecks (Mayr, 1963) occur when populations experience temporary but severe reductions in population size, where the small number of individuals does not represent a random sample or a complete sampling of the genes in the parental population. For this reason bottlenecks can produce dramatic reductions in a populations' gene pool (genetic diversity). This loss of genetic diversity can reduce the potential of these populations to respond to disease, both short and long-term environmental variation (Allendorf and Leary, 1986; O'Brien, 1994; Taylor et al., 1994), or other challenges. As a result, reduced genetic diversity is clearly non-adaptive as environments change. Low levels of gene diversity in populations due to bottlenecks, or populations that result from the reintroduction of small, nonrandom samples of the gene pool, e.g. metapopulations, have become a common and important theme in conservation biology. Indeed, low levels of genetic variation have been identified in several threatened or endangered species, including Greater Prairie Chickens (Bouzat et al., 1998), loggerhead shrikes (Mundy et al., 1997) and Ethiopian wolves (Gottelli et al., 1994). Thus, the measurement of gene diversity in sample populations designated for recolonization is of extreme importance in conservation biology.

Microsatellite DNA has already proven useful in monitoring gene diversity in a variety of mammalian species designated for conservation and management. This technology has been essential in determining genetic parameters for black bears (*Ursus americanus luteolus*), which are federally listed as threatened in Louisiana and adjacent regions (Boersen et al., 2003; Csiki et al., 2003; Warrilow et al., 2001). Similarly, microsatellite analysis of the Yellowstone grizzly bear population (*Ursus arctos*) identified a slight reduction in genetic diversity due to inbreeding (Miller and Waits, 2003). The impact of bottlenecks on sea otter populations (*Enhydra lutris*) was examined by Larson et al. (2002), who found lower than expected genetic diversity in those populations impacted by fur trade exploitation. Comparable data were collected for fragmented river otter (*Lontra Canadensis*) populations with limited dispersal (Blundell et al., 2002), indicating the importance of preserving genetic diversity in this species. Microsatellite DNA variation has also been used successfully for determining genetic variation and diversity in native, reintroduced and colonizing populations of Rocky Mountain wolves in both Canada and the northern United States (Boyd, et al., 2001; Forbes and Boyd, 1996, 1997). Finally, applications of microsatellite DNA have proven effective in demonstrating that low levels of genetic diversity exist in relic populations of a diverse array of mammals (Castleberry et al., 2002; Reese et al., 2001; Uphyrkina et al., 2002), including red-backed voles (*Clethrionomys gapperi*) in the southern Appalachians, Allegheny woodrats (*Neotoma magister*) and Asian leopards (*Panthera pardus orientalis*).

Applications of microsatellite profiling to prairie dog populations have already verified its usefulness for characterizing the genetic structure and population dynamics of this species. Roach et al. (2001) examined the genetic structure of 13 colonies of black-tailed prairie dogs in northern Colorado using microsatellite loci. Here, moderate levels of differentiation were observed and levels of inbreeding were low. Of the individuals sampled, 39% were not assignable to the colony from which they were caught, indicating they were immigrants or offspring of immigrants. Furthermore, age of colony was related to genetic similarity, with older colonies being more similar than were younger colonies. These findings emphasize the importance of retaining corridors for dispersal between colonies, allowing not only for genetic exchange between colonies but also more rapid recolonization or supplementing of colonies decimated by plague or other factors. Recently, Haynie et al. (2003) utilized variation at seven microsatellite DNA loci to determine levels of multiple paternity and breeding success in Gunnison's (*Cynomys gunnisoni*) and Utah (*Cynomys parvidens*) prairie dogs. The application of microsatellite analyses for the determination genetic properties of populations of prairie dogs has thus repeatedly demonstrated its utility for monitoring genetic diversity of black-tailed prairie dog populations is clear.

CHAPTER II

MATERIALS AND METHODS

Ethical Use of Animals

The capture of live prairie dogs and collection of fresh blood samples was necessary for the completion of this project. **No animals were sacrificed.** All procedures, including trapping, blood collection, and monitoring of condition were in accordance with animal use protocols approved by the Animal Use and Care Committee at the University of North Texas.

Collection of Prairie Dog Whole Blood

A total of 319 whole blood samples were collected from prairie dogs from 16 sites/colonies located throughout the remaining range of the black-tailed prairie dog in Texas (Figure 1 and Table 1). Due to landowner privacy considerations, the precise locations of collection sites within each county are not provided. However, Dallam County is home to a portion of the Rita Blanca National Grasslands, and this site was included in this study. Collections were carried out between April and October of 2005. Sites were chosen to provide samples from isolated colonies at the extremes of the present range, as well as from much larger metapopulation clusters (five sites were located in Lubbock County and two in Hemphill County). This allows for the assessment of both total allelic diversity (gene pool) and heterozygosity levels in the entire Texas population.

Table 1: Number and gender of black- tailed prairie dogs collected at 16 sites in Texas.

County	Site Name	Sample Number	Males	Females	Unknown Gender
Cochran	COC	16	10	6	0
Cottle	COT	22	12	8	2
Dallam	DAL	23	13	10	0
Hartley	HAR	20	11	9	0
Hemphill	HEMA	21	11	9	2
Hemphill	HEMB	13	11	2	0
Howard	HOW	22	13	9	0
Hudspeth	HUD	17	8	9	0
Lubbock	LUBA	21	11	9	1
Lubbock	LUBB	23	10	12	1
Lubbock	LUBC	25	10	14	1
Lubbock	LUBD	19	5	14	0
Lubbock	LUBE	22	9	13	0
Pecos	PEC	22	10	11	1
Schleicher	SCH	14	8	6	0
Tarrant	TAR	19	5	14	0
Total		**319**	**157**	**155**	**8**

Samples were collected from an average of 20 prairie dogs at each site by one of two methods. One technique included an FDA-approved capture involved pumping water and soap into a prairie dog burrow until the prairie dog emerges into the control of an FDA-licensed prairie dog handler. An alternative method involved the use of 24 x 6 x 6 inch Tomahawk Live Traps® baited with whole oats. Traps were monitored continuously, using binoculars to determine when animals were captured. Animals were sexed by visual examination and whole blood for microsatellite analyses was collected into Microtainer® Brand tubes with EDTA (K_2) by clipping a claw on one foot immediately proximal to the distal end of the subunguis. Following blood collection, the clipped claw was dabbed with a liquid-filled Veterinarian's Best® Pet Swab™ to reduce pain and bleeding. The captured prairie dogs were maintained in 3- x 1-foot cages for a time to ensure bleeding had stopped. Then, prairie dogs were released at their point of capture. A portion of this study was also conducted in conjunction with state- and FDA-approved relocation projects. Individuals from colonies undergoing relocation were first quarantined for two weeks in an FDA-approved facility before blood samples were drawn. These prairie dogs were later released at their new relocation sites.

Long Term Storage of Prairie Dog Whole Blood Samples

The movement of prairie dogs or blood samples is subject to the interim final rule entitled "African Rodents and Other Animals that May Carry the Monkeypox Virus" (Title 21, Code of Federal Regulations, Section 1240.63). Therefore, following blood collection the sealed Microtainer® Brand tubes were quickly centrifuged and transported in a secured cooler to the Molecular Biology Laboratory at the University of North Texas. Samples were then stored at -20°C in sealed racks in a secure freezer. At the conclusion of this research project, the samples will be autoclaved prior to disposal in accordance with the Department of Health and Human Services regulations.

DNA Isolation from Prairie Dog Whole Blood Samples

A modified version of the guanidinium (iso)thiocyanate DNA extraction method (GITC) of Hammond et al. (1996) was used for DNA isolation from prairie dog blood. This approach was utilized due to its comparative simplicity and its ability to provide good yields of genomic DNA from relatively small blood samples. Twenty microliters (µl) of whole prairie dog blood was added to 500 µl of the extraction solution (0.5 M guanidinium thiocyanate and 0.1 M EDTA) in a sterile 1.7 ml microcentrifuge tube. A 250 µl aliquot of ice-cold 7.5 M ammonium acetate was then added, the contents of the tube vortexed well, and and the solution incubated on ice for 10 min. After a brief centrifugation to precipitate the contents to the bottom of the tube, 500 µl of a 24:1

chloroform: isoamyl alcohol was added and the mixture again vortexed well. After centrifugation at 10,000 rpm for 10 min at room temperature, the upper aqueous phase was transferred to a new, sterile 1.7 ml microfuge tube and the remaining chloroform mixture properly discarded. A second extraction with 500 µl of 24:1 chloroform: isoamyl alcohol as before and the final aqueous phase following centrifugation was again transferred to a new, sterile 1.7 ml microfuge tube. The DNA was then precipitated by adding 600 µl cold isopropanol, vortexing well, and storage overnight at -20˚C. The precipitated DNA was collected by centrifugation at 13,000 rpm for 20 min at 4˚C in a Heraeus microcentrifuge. The supernatant was removed using a pulled-out Pasteur pipette, leaving a small pellet of DNA. One milliliter of cold 70% ethanol was added to the microfuge tube containing the DNA pellet, which was then gently inverted 3 times. The washed pellet was again collected by centrifugation at 13,000 rpm for 5 minutes at 4˚C. The 70% ethanol supernatant was carefully removed using a pulled-out Pasteur pipette, taking care not to disturb the small DNA pellet. Residual ethanol was removed using a Speed Vac™ (Savant Instruments) vacuum concentrator for 7 min. This final dry pellet was then resuspended in 20 µl of TE Buffer (10 mM Tris/HCl, pH 8.0; 1 mM EDTA) and stored at -20˚C.

PCR Amplification

Three loci with tetrameric repeat units were chosen from 14 microsatellite loci characterized and known to be polymorphic markers in the black-tailed prairie dog (Jones et al., 2005). Oligonucleotide primers for these loci were obtained from Bio-Synthesis, Inc. and dissolved/diluted to make 100 µmolar stock solutions.

PCR was carried out using 20 µl reaction volumes containing 0.1 – 2.5 ng of template prairie dog DNA, 0.2 mM dNTPs, 0.04 µM of ^{32}P-labeled forward primer, 0.1 µM of both non-labeled forward and reverse primers, 0.5 units per reaction *Taq* DNA polymerase (New England BioLabs), and 1X final concentration of Thermopol Buffer (New England Biolabs). PCR cycle conditions were 3 minutes at 94°C; followed by 30 cycles of 30 seconds at 94°C, 1 minute at T_a°C [annealing temperature, specific for each primer set, see table 2], 1 minute at 72°C; followed by 4 minutes at 72°C, and held at 4°C. Forward primers were labeled in a 20 µl reaction containing 2 µM forward primer, 0.3 µCi per reaction γ-^{32}P-dATP, 10 units/µl T4 Polynucleotide Kinase (New England BioLabs), and 1 X final PNK Buffer (New England BioLabs). This mixture was incubated at 37°C for 1 hour, yielding forward primers carrying ^{32}P at their 5' ends. The polynucleotide kinase was then irreversibly denatured by a 10 min incubation at 75°C.

Table 2: Primer sets, annealing temperatures (Ta), allele size ranges, and number of alleles (A) for microsatellite loci used in the genetic analysis of populations of black tailed prairie dogs (*Cynomys ludovicianus*).

Locus*	Primer sequence (5'-3')*	Repeat*	Ta	Size range* (base pairs)	A
D1	ACCTTTTGTTTCATTCTCAGC TGCCATAGTTTGCTTTCTTACT	$(TATC)_9$	60	178-202	6
D12	TTACCTCCCCACACACAAA TGCCTCACTATTGGACAGC	$(TAGA)_8$	55	192-208	6
D115	CAGGCATCTATGGAAGACAG CTTTGATTGGTGAGTTTTGTG	$(TAGA)_{11}$	57	188-208	8

*Source = Jones et al, 2005

PCR products were electrophoresed until the bromophenol blue loading dye had migrated 33 cm of a 50 cm x 0.25 mm 5.75% Long Ranger® (Cambrex, Inc) denaturing gel [7 M urea, 1 X TBE] using reference allele sizing ladders constructed from reference profiles of known genotypes. Gels were dried and exposed to x-ray film for approximately 20 hours.

Statistical Analyses

Gene diversity assessments within and among populations and subpopulations were measured. Observed genotypic frequencies were calculated and tested for conformation to Hardy-Weinberg expectations and linkage disequilibrium using GENEPOP (Raymond and Rousset, 1995). Comparisons of observed (H_O) and expected (H_E) heterozygosity frequencies were also made. Linkage equilibrium tests employed the randomization method of Raymond and Rousset (1995) for all locus pairs. GENEPOP was also used to perform pairwise tests of allele frequency and to estimate F_{ST} values using the methods of Weir and Cockerham (1984).

CHAPTER III

RESULTS AND DISCUSSION

Colony characterization

The sample group for this study consisted of 319 prairie dogs captured from 16 sites/colonies in 11 north and west Texas counties (Figure 1). An attempt was made to collect no more than one each adult male and female from individual widely spaced burrows throughout the colony to minimize the collection of closely related animals. The gender of 311 of the 319 individuals captured was determined and yielded a final makeup of 154 females and 157 males (Table 1).

Based upon Geographical Positioning System (GPS) coordinates, the minimum and the maximum pairwise colony distances were 6.6 and 780.5 km, respectively. Five study colonies have now been completely relocated/eradicated and thus no longer exist (COC, LUBA, LUBC, LUBE, and TAR). Currently, one additional study colony (LUBD) is in the process of being relocated/eradicated.

Population genetic structure

The number of identified alleles per locus for the three microsatellite loci characterized ranged from 6 for D1 and D12 to 8 for D115 in the study populations. The mean observed heterozygosity for the 319 individuals at these three loci equaled 0.53 and values for individual colonies ranged from 0.25 -0.70 depending upon the specific locus and colony (Table 3). Although the H_E and H_O values for the total study group are in agreement (0.58 and 0.53), it should be noted that the values from several of the

Figure 1

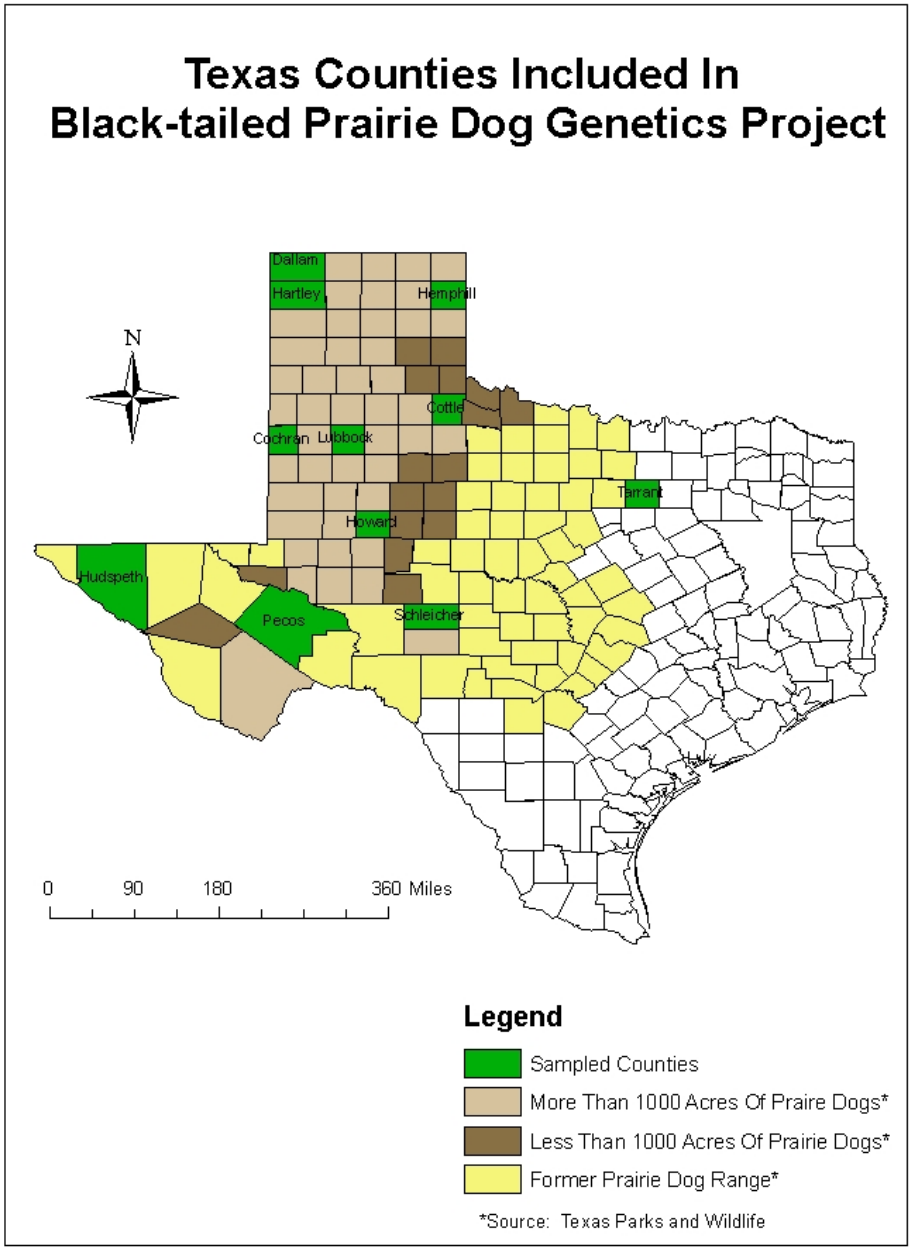

Figure 1: Texas counties where prairie dogs were collected for microsatellite variation analysis. Details of past and existing prairie dog ranges are also given.

sampled colonies show H_O values substantially lower than expected and are thus consistent with small genetically isolated colonies that have been reduced in size to levels where genetic drift might impact allele frequencies, e.g. DAL, LUBD, HEMA.

Table 3: Combined D1, D12, and D115 population statistics for 16 black-tailed prairie dog populations (*Cynomys ludovicianus*).

Population/site	Sample size	Expected Heterozygosity	Observed Heterozygosity	Average alleles / locus
COC	16	0.61	0.60	4.33
COT	22	0.54	0.55	2.67
DAL	23	0.71	0.54	5.67
HAR	20	0.70	0.62	4.67
HEMA	21	0.67	0.52	5.00
HEMB	13	0.64	0.66	4.00
HOW	22	0.61	0.46	4.33
HUD	17	0.34	0.25	4.00
LUBA	21	0.66	0.70	4.67
LUBB	23	0.51	0.49	4.33
LUBC	25	0.59	0.52	5.00
LUBD	19	0.54	0.37	4.00
LUBE	22	0.61	0.64	4.33
PEC	22	0.54	0.58	3.67
SCH	14	0.62	0.50	4.33
TAR	19	0.42	0.44	3.00
Mean	19.9	0.58	0.53	4.25

Evaluations of the combined data from the three loci revealed that 43% (7 out 16) of the colonies were not in Hardy-Weinberg equilibrium (Table 4). Two additional colonies were specifically identified as exhibiting heterozygote deficiency at D12 and thus deviate from Hardy-Weinberg equilibrium at this locus (TAR, LUBC). Failure to meet Hardy-Weinberg expectations can result from a range of factors for which there may be no conclusive evidence, e.g. sampling error or null alleles. Although every possible effort was made to obtain a representative random sample from each colony, sampling error is always a possibility, especially when dealing with alleles that have low frequencies. Null alleles are alleles that go undetected by the protocol, and are commonly due to mutations at one or more PCR primer binding sites in microsatellite loci. Although we cannot rule out the occurrence of such alleles, the fact that all of the animals were successfully genotyped indicates that any null alleles (if present), occurred at a frequency too low to ever be homozygous (matched with a second null allele). Finally, given the potential for unstable populations of prairie dogs that have been impacted by human perturbations or plague, it would not be surprising for some colonies to be in varying states of recovery or decline and thus fail to meet one or more prerequisites for maintaining Hardy-Weinberg equilibrium.

Table 4: Hardy-Weinberg probabilities test for 16 black-tailed prairie dog populations (*Cynomys ludovicianus*).

Population / Site	Locus D1	Locus D12	Locus D115	Combined
COC	0.651	1	0.289	0.765
COT	0.497	0.043	0.647	0.200
DAL	0.276	0.111	0.661	0.253
HAR	0.000	0.318	0.423	0.001
HEMA	0.003	0.284	0.028	0.001
HEMB	0.819	0.642	0.925	0.963
HOW	0.093	0.044	0.281	0.035
HUD	0.117	0.123	0.091	0.039
LUBA	0.098	0.464	0.036	0.046
LUBB	0.569	0.134	0.256	0.247
LUBC	0.324	0.17	0.453	0.286
LUBD	0.009	0.147	0.02	0.002
LUBE	0.555	0.749	0.406	0.736
PEC	0.782	0.183	0.503	0.510
SCH	0.048	0.007	0.695	0.010
TAR	0.885	0.042	1	0.360
Total	0.091	0.002	0.091	0.000

The allelic frequencies for the three microsatellite loci in each population are recorded in Tables 5 through 7. The loci may be collectively characterized as having 3-4 common alleles each and up to 4 alleles occurring at frequencies below 0.10. As noted previously, the total alleles at each locus ranged from six at D1 and D12 to eight at the more polymorphic D115 locus. Some alleles showed suggestive evidence of regional-dependent frequency patterns and/or founder/bottleneck effects. For example, from these data it can be seen that, compared to the sample population as a whole, elevated D1 allele frequencies were found in 3 of the study colonies. The sampled group from COT exhibited an allele #3 frequency of 0.66, while those at HUD and SCH had frequencies of 0.79 and 0.57, respectively. The remaining 13 sites averaged an allele #3 frequency of only 0.17. Individuals collected from TAR showed this population to have a frequency of the #1 allele of 0.90 at locus D115. This allele had a frequency of no more than 0.14 at any other location, making the results from this locus consistent with this colony having undergone a severe genetic bottleneck in its past. Additional evidence of a possible bottleneck in this colony's past is observed at the remaining two loci, as well. Collectively, the allelic frequency data show that in the TAR population, a maximum of two alleles account for more than 92% of the total for each of the 3 study loci. In contrast, the much larger colony at DAL has no allele at D1 that exceeds a frequency of 0.26, and four that all exceed 0.2 at this locus.

Table 5: Allele frequencies of D1 locus with (n)=number of alleles.

County / site	Sample Number	D1 alleles 1	2	3	4	5	6
Cochran / COC	16	(1) .03	(0) .00	(4) .13	(17) .53	(10) .31	(0) .00
Cottle / COT	22	(0) .00	(0) .00	(29) .66	(8) .18	(7) .16	(0) .00
Dallam / DAL	23	(1) .02	(12) .26	(10) .22	(10) .22	(10) .22	(3) .07
Hartley / HAR	20	(2) .05	(4) .10	(8) .20	(18) .45	(8) .20	(0) .00
Hemphill / HEMA	21	(0) .00	(7) .17	(2) .05	(20) .48	(10) .24	(3) .07
Hemphill / HEMB	13	(0) .00	(6) .23	(9) .35	(11) .42	(0) .00	(0) .00
Howard / HOW	22	(0) .00	(0) .00	(16) .36	(21) .48	(6) .14	(1) .02
Hudspeth / HUD	17	(0) .00	(0) .00	(27) .79	(5) .15	(1) .03	(1) .03
Lubbock / LUBA	21	(2) .05	(1) .02	(10) .24	(22) .52	(5) .12	(2) .05
Lubbock / LUBB	23	(0) .00	(0) .00	(10) .22	(34) .74	(2) .04	(0) .00
Lubbock / LUBC	25	(3) .06	(0) .00	(7) .14	(32) .64	(0) .00	(8) .16
Lubbock / LUBD	19	(0) .00	(5) .13	(2) .05	(20) .53	(11) .29	(0) .00
Lubbock / LUBE	22	(1) .02	(2) .05	(3) .07	(24) .55	(14) .32	(0) .00
Pecos / PEC	22	(0) .00	(0) .00	(1) .02	(28) .64	(15) .34	(0) .00
Schleicher / SCH	14	(0) .00	(1) .037	(16) .57	(6) .21	(4) .14	(1) .04
Tarrant / TAR	19	(0) .00	(1) .03	(13) .34	(22) .58	(2) .05	(0) .00
Total	**(638) 219**	**(10) .02**	**(39) .06**	**(167) .26**	**(298) .47**	**(105) .17**	**(19) .03**

Table 6: Allele frequencies of D12 locus with (n)=number of alleles.

County / site	Sample Number	D12 alleles 1	2	3	4	5	6
Cochran / COC	16	(0) .00	(8) .25	(3) .09	(16) .50	(4) .13	(1) .03
Cottle / COT	22	(0) .00	(0) .00	(0) .00	(17) .39	(7) .16	(20) .46
Dallam / DAL	23	(2) .04	(14) .30	(4) .09	(18) .39	(3) .07	(5) .11
Hartley / HAR	20	(0) .00	(8) .20	(6) .15	(20) .50	(4) .10	(2) .05
Hemphill / HEMA	21	(0) .00	(20) .48	(0) .00	(19) .45	(3) .07	(0) .00
Hemphill / HEMB	13	(0) .00	(19) .73	(0) .00	(6) .23	(1) .04	(0) .00
Howard / HOW	22	(0) .00	(8) .18	(4) .09	(27) .61	(2) .05	(3) .07
Hudspeth / HUD	17	(0) .00	(2) .06	(2) .06	(24) .71	(5) .15	(1) .03
Lubbock / LUBA	21	(0) .00	(9) .21	(0) .00	(15) .36	(1) .02	(17) .41
Lubbock / LUBB	23	(0) .00	(4) .09	(1) .02	(37) .80	(2) .04	(2) .04
Lubbock / LUBC	25	(0) .00	(14) .28	(2) .04	(28) .56	(4) .08	(2) .04
Lubbock / LUBD	19	(0) .00	(10) .26	(0) .00	(23) .61	(0) .00	(5) .13
Lubbock / LUBE	22	(0) .00	(20) .46	(0) .00	(15) .34	(7) .16	(2) .05
Pecos / PEC	22	(0) .00	(6) .14	(4) .09	(19) .43	(15) .34	(0) .00
Schleicher / SCH	14	(0) .00	(9) .32	(10) .36	(1) .04	(8) .29	(0) .00
Tarrant / TAR	19	(0) .00	(0) .00	(0) .00	(2) .05	(25) .66	(11) .29
Total	**319 (638)**	**(2) .01**	**(151) .24**	**(36) .06**	**(287) .45**	**(91) .14**	**(71) .11**

*Minimum allele frequency is arbitrarily reported as 0.01, since only 2 significant figures are carried in this table.

Table 7: Allele frequencies of D115 locus with (n)=number of alleles.

	Sample	D115 alleles							
County / site	**Number**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Cochran / COC	16	(4) .13	(0) .00	(1) .03	(6) .19	(21) .66	(0) .00	(0) .00	(0) .00
Cottle / COT	20	(0) .00	(0) .00	(0) .00	(25) .63	(15) .38	(0) .00	(0) .00	(0) .00
Dallam / DAL	22	(1) .02	(0) .00	(3) .07	(25) .57	(14) .32	(0) .00	(1) .02	(0) .00
Hartley / HAR	20	(0) .00	(0) .00	(4) .10	(17) .43	(14) .35	(5) .13	(0) .00	(0) .00
Hemphill / HEMA	20	(1) .03	(1) .03	(1) .03	(12) .30	(16) .40	(3) .08	(6) .15	(0) .00
Hemphill / HEMB	12	(0) .00	(1) .04	(2) .08	(7) .29	(6) .25	(6) .25	(2) .08	(0) .00
Howard / HOW	21	(2) .05	(0) .00	(0) .00	(2) .05	(20) .48	(18) .43	(0) .00	(0) .00
Hudspeth / HUD	17	(0) .00	(0) .00	(0) .00	(0) .00	(31) .91	(2) .06	(1) .03	(0) .00
Lubbock / LUBA	21	(6) .14	(0) .00	(2) .05	(0) .00	(23) .55	(11) .26	(0) .00	(0) .00
Lubbock / LUBB	20	(10) .25	(0) .00	(10) .25	(11) .28	(8) .20	(0) .00	(0) .00	(1) .03
Lubbock / LUBC	24	(0) .00	(0) .00	(1) .02	(11) .23	(28) .58	(3) .06	(4) .08	(1) .02
Lubbock / LUBD	19	(2) .05	(2) .05	(0) .00	(2) .05	(29) .76	(0) .00	(3) .08	(0) .00
Lubbock / LUBE	22	(0) .00	(0) .00	(0) .00	(2) .05	(26) .59	(3) .07	(13) .30	(0) .00
Pecos / PEC	22	(2) .05	(5) .11	(0) .00	(0) .00	(32) .73	(5) .11	(0) .00	(0) .00
Schleicher / SCH	14	(2) .07	(0) .00	(0) .00	(2) .07	(18) .64	(6) .21	(0) .00	(0) .00
Tarrant / TAR	19	(34) .90	(0) .00	(0) .00	(0) .00	(4) .11	(0) .00	(0) .00	(0) .00
Total	**309 (618)**	**(64) .10**	**(9) .02**	**(24) .04**	**(122) .20**	**(305) .49**	**(62) .10**	**(30) .05**	**(2) .01**

Two years prior to sampling, the colony from Schleicher County (SCH) had been large and seemingly healthy, and was used for collection of juvenile prairie dogs for sale in the pet industry. At the time of sample collection for this study, the colony was greatly reduced in overall numbers and the remaining prairie dogs were scattered in small groups (8 was the maximum number observed in a single area). It is suspected that this colony was infected with plague within the intervening 2 years. As a result of this major population decline, the number of animals sampled was small (14).

Genotypic disequilibrium analyses showed that D12 and D115 genotypes do not vary completely independent of each other ($p = 0.026$) (Table 8). This suggests that these loci may be linked. Although no evidence of linkage was reported in the original paper describing the isolation of the loci (Jones, et al., 2005), the data reported here represents a much more in depth study and thus makes such analyses/determinations possible.

Table 8: Geontypic disequilibrium test. Probabilities given for each locus pair across 16 black-tailed prairie dog populations (*Cynomys ludovicianus*).

Locus Pair	Chi2	df	P-value
D12 & D115	49.36	32	0.026
D12 & D1	24.76	32	0.816
D115 & D1	36.02	32	0.286

Pairwise comparisons of genic differentiation for each population pair ranged from significantly different ($P < 0.01$) to highly significantly different ($P < 0.0001$) for all pairs except the comparison between HAR and DAL, located 77.3 kilometers apart in adjacent counties. This indicates that the large majority of the study colonies are becoming isolated to the point where there is insufficient intercolony migration to prevent them from becoming independent genetic units.

CHAPTER IV

Summary

The concern for the long term “genetic health” of natural populations that have undergone demographic bottlenecks due to loss of habitat and habitat fragmentation has increased in recent years. In Texas, the black-tailed prairie dog has experienced dramatic declines over much of its historical range, and many populations occur as relicts. Attempts are underway to establish preserves and to reintroduce populations into suitable habitats once occupied by prairie dogs, and these efforts can be expected to experience varying degrees of success. To meet the goals of the Texas Black-Tailed Prairie Dog Conservation and Management Plan (TPW, 2004), monitoring genetic diversity and determining the role it might play in the viability of black-tailed prairie dog populations and their stability is vital to the success of any management plan. It is imperative that genetic studies be continued to establish parameters of overall gene diversity in long-established colonies and to compare these parameters with those of newly colonized and reintroduced prairie dog towns and to determine the effects of localized extinctions on metapopulation structure.

The primary objective of this study was to produce multiple locus genetic profiles of black-tailed prairie dogs (*Cynomys ludovicianus*) collected from colonies throughout the existing range of prairie dogs in the state of Texas and to use this information to establish a genetic diversity baseline necessary for continued monitoring of the genetic health of these populations. Our initial assessment of these prairie dogs has revealed that the presently existing populations have sufficient variation at the first three microsatellite loci characterized to verify the long term usefulness of this approach as a primary genetic tool in conservation and preservation of this species.

An evaluation of the data from the 319 member Texas study population reveals that the allelic diversity at the 3 microsatellite loci was comparable to that found by Jones, et al. (2005) in their study of 47 individuals collected from a total of 4 sites in 3 states. However, a more detailed analysis of the genetic data from this study of Texas black-tailed prairie dogs suggests that although the state population as a whole may appear genetically diverse, an observable genic divergence has already occurred between many of the smaller colonies/populations that collectively make up the statewide population. The average differentiation among Texas populations is approximately 16.7% (Table 9), and this compares to 11.8% from a study of Colorado prairie dogs (Roach et al., 2001) and 10.3% for a study of New Mexico colonies (Chesser, 1983).

Table 9: F_{ST} for each microsatellite locus for 16 black-tailed prairie dog populations (*Cynomys ludovicianus*).

Locus	F_{ST}
D1	0.127
D12	0.155
D115	0.219
Combined	0.167

As noted earlier, the findings described in this document represent the preliminary report for an ongoing study of black-tailed prairie dog genetics. At this time, the sample population is being further characterized with additional microsatellite loci to expand and better define our initial findings. The additional data from an increased number of microsatellite loci will allow us to better determine which populations of black-tailed prairie dogs in Texas are of sufficient size and possess ample genetic diversity to be characterized as candidate foundation populations for future preservation efforts. Colonies with low genetic diversity would be ideal candidates for supplementation with properly chosen individuals. Alternatively, these colonies could be relocated and/or blended with other similar but genetically distinct colonies that would also benefit from the resulting influx of genetic diversity. Prairie dog colony size and available genetic diversity will also be two of many issues that will need to be assessed as part of conservation efforts related to other ecologically-dependent species, e.g. a black-footed ferret reintroduction program.

CHAPTER V

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TEXAS PARKS & WILDLIFE

Texas

Black-tailed Prairie Dog Monitoring Packet

Offering Texans a way to get involved in conservation research

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PWD BK W7000-1123 (08/05)

Black-tailed prairie dogs *(Cynomys ludovicianus)* are an icon of the grasslands. These animals were once common in short and mixed grass prairies throughout the western mid-west, including Texas, Oklahoma, Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, South Dakota, North Dakota and Wyoming, as well as Canada and Mexico. Field notes from early explorers, museum specimens, and turn-of-the-century accounts in the literature contain information upon which the historical range of the black-tailed prairie dog in Texas is based *(Bailey 1905).* Although these accounts provide useful information, they are not scientifically accurate estimates of the total number of acres that were inhabited. Bailey *(1905)* described the range of the prairie dog in Texas as extending from Henrietta, Fort Belknap, Baird, and Mason west to near the Rio Grande River, north through the Panhandle, and south to Devil's River, to 10 mi (16.2 km) south of Marathon and 25 mi (40.2 km) south of Marfa. This equates roughly the northwest 1/2 of the state and includes all or portions of the High Plains, Rolling Plains, Edwards Plateau, and the Trans-Pecos Ecological Regions. Bailey *(1905)* estimated there were 800,000,000 prairie dogs covering an area of 90,000 mi^2 or 57,600,000 acres (233,100 km^2, or 23,310,000 ha). Although these historical numbers are the most reliable early estimates for prairie dogs in Texas, they were based only on rough estimations.

Unfortunately throughout their range there has been a drastic decline in the population. Black-tailed prairie dog colonies currently occupy less than 1% of their historic range *(See Map on pg 2).* Historically, millions of acres of Texas grassland were covered by prairie dog towns, today they cover less than 150,000 acres. The major factor affecting population decline is loss of habitat due to conversion of native prairies to cropland. Other factors include poisoning, recreational shooting, the pet trade and Sylvatic Plague.

Prairie dogs are an important part of the ecosystem, their digging aerates and promotes soil formation, they clip back brush maintaining the short grass prairie and they are a keystone species providing food and shelter for as many as 170 different animals. A keystone species is a species that other species depend upon for survival. The Burrowing Owl, Mountain Plover, Ferruginous Hawk, Golden Eagle, Horned Lark, swift fox, and pronghorn as well as many others all benefit from prairie dogs.

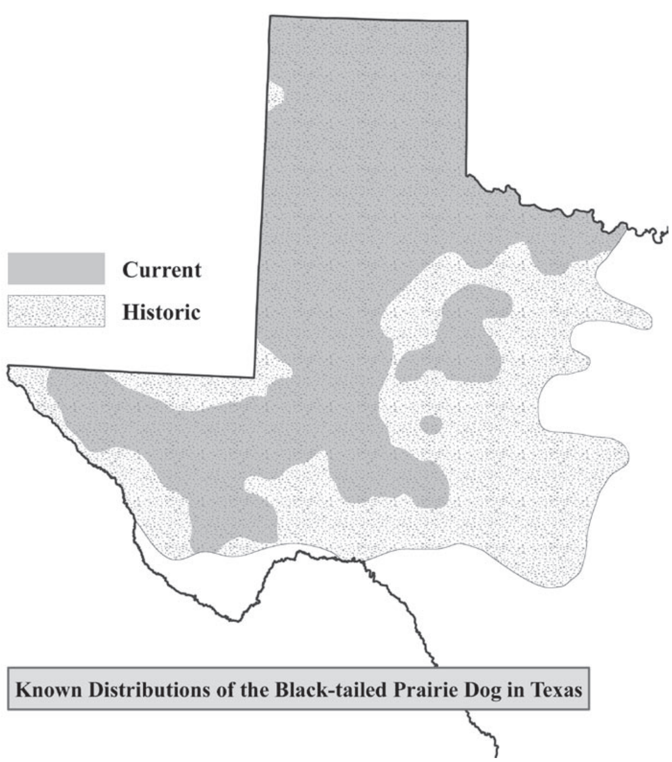
Now, through participation in the Texas Black-tailed Prairie Dog Watch you can help widen our understanding of black-tailed prairies dogs and what is contributing to their decline. The Texas Parks and Wildlife Department (TPWD) needs your help to monitor prairie dog colonies in your area by observing and collecting data. The data that is collected will help TPWD to monitor population trends and develop more effective conservation and management methods.

The Texas Black-tailed Prairie Dog Conservation and Management Plan

The Texas Black-tailed Prairie Dog Conservation and Management Plan

In February 2000 the U.S. Fish and Wildlife Service determined that the black-tailed prairie dog warranted listing under the Endangered Species Act, but declined to list the species at that time because there were other species also waiting to be listed that were in greater need of protection. The Black-tailed prairie dog was then placed on the candidate list of species. On August 12, 2004, the U.S. Fish and Wildlife Service removed the Black-tailed prairie dog from the candidate species list because of new information regarding the range-wide impact of disease, chemical control and other lesser factors, and recent state estimates of occupied habitat. The U.S. Fish and Wildlife Service reviews the prairie dogs status annually. For more information go to: http://mountain-prairie.fws.gov/species/mammals/btprairiedog/

In 1999 representatives from the eleven states that encompass the range of the Black-tailed prairie dog formed the Interstate Prairie Dog Conservation Team. One of the actions of this team was to develop a state conservation and management plan. A Texas Black-tailed Prairie Dog Working Group was formed and they drafted The Texas Black-tailed Prairie Dog Conservation and Management Plan on March 24, 2004. The working group was composed of 3 private landowners, and representatives from commodity, ranching, farming, conservation groups, and state and federal agencies. Goal 2 of the plan is to develop and implement an effective education and outreach program. That is where the Black-tailed Prairie Dog Watch program comes in. For a copy of the Texas Black-tailed Prairie Dog Conservation and Management Plan go to: http://www.texasprairiedog.org



Known Distributions of the Black-tailed Prairie Dog in Texas

Current Conservation Guidelines in Texas

Financial incentives exist to help defer the costs of black-tailed prairie dog conservation on private lands. Some of these incentives exist through the following organizations and programs:

- Land Incentive Program (TPWD) http://www.tpwd.state.tx.us/landwater/land/private/lip/
- Private Lands Initiative (TPWD) http://www.tpwd.state.tx.us/conserve/private_lands/
- Conservation Reserve Program (FSA) http://www.fsa.usda.gov/dafp/cepd/crp.htm
- Grassland Reserve Program (NRCS) http://www.nrcs.usda.gov/programs/GRP/
- Environmental Quality Incentives Program (NRCS) http://www.nrcs.usda.gov/programs/eqip/
- Wildlife Habitat Incentives Program (NRCS) http://www.nrcs.usda.gov/programs/whip/
- Partners for Fish and Wildlife (USFWS) http://www.fws.gov/partners/
- Cooperative Endangered Species Conservation Fund (Section 6) Grants to States & Territories (USFWS) http://endangered.fws.gov/grants/section6/ 2
- Habitat Conservation Plan (USFWS) http://endangered.fws.gov/hcp/#about
- National Fish and Wildlife Foundation http://www.nfwf.org/
- Playa Lakes Joint Venture http://www.pljv.org/

Ways in which to conserve or enhance prairie dog populations include: manipulating livestock grazing pressure through placement of salt and water, controlled burning used to increase potential habitat for prairie dog expansion, allow prairie dogs to expand naturally, or restriction on shooting seasons to prevent over-reduction in the density of prairie dogs.

Myths About Prairie Dogs

Pioneers settling in the Panhandle and Rolling Plains of Texas recognized the value of abundant grasslands, a plentiful water supply as well as other available resources in a time when the region was considered by many to be a vast desert wasteland. Today, the myth of wasteland persists in spite of an abundance of wildlife and dramatic topography. The Land and Water Conservation and Recreation Plan, the strategic plan guiding Texas Parks and Wildlife Department (TPWD) for the next 10 years, designates the High Plains/Short grass Prairie as a priority area for conservation. Prairie lands are one of the least appreciated and most quickly disappearing ecosystems in the Western Hemisphere. Presently, most populations of prairie wildlife exist in scattered, isolated remnants of prairie landscape. The broad scale loss of grasslands has produced dramatic declines in the diversity of plant and animal species. As many as 55 species of prairie wildlife are currently listed under the Endangered Species Act as endangered or threatened.

Myths

Myth #1: Prairie dogs compete with domestic animals for forage.
Truth: About 300 prairie dogs will eat as much as a cow and a calf.

Myth #2: Prairie dog activity causes erosion.
Truth: Digging activities of prairie dogs aerate the soil which increases soil absorption of water and promotes the formation of soil. This activity increases plant diversity by improving soil conditions and therefore decreases erosion.

Myth #3: Prairie dogs carry many diseases harmful to humans and livestock.
Truth: Prairie dogs, like many other rodent species can be infected with diseases that are transmitted by fleas such as plague. The likelihood of human infection from prairie dogs is no greater than infection from other common urban rodents such as tree squirrels.

Myth #4: Prairie dogs are everywhere.
Truth: It is often thought that prairie dogs are very abundant. Local abundances can give the impression that they are everywhere. However, they actually occupy less than 1% of the Great Plains.

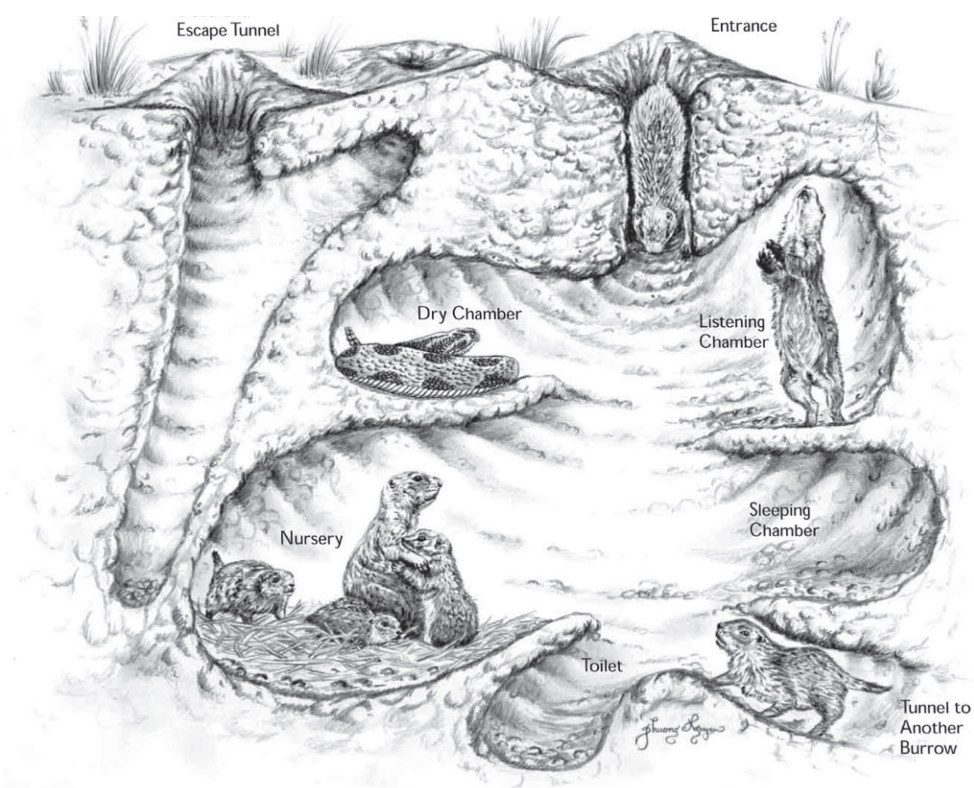
About Black-tailed Prairie Dogs

"Just above the entrance of Teapot creek on the star'd sid there is a large assemblage of the burrows of the Barking Squirrel."— Meriwether Lewis, 1804

In the exploration of the newly acquired Louisiana Purchase, Lewis and Clark crossed vast prairies spanning the Mississippi River valley west to the Pacific coast during 1804 to 1806. Meriwether Lewis described huge colonies of large, ground-dwelling rodents and named them "prairie dogs" for their barking vocalizations.

Prairie dogs are members of the squirrel family Sciuridae which includes flying, tree, and ground squirrels, chipmunks, marmots, and woodchucks. Five species of prairie dogs occur in North America. The Utah prairie dog *(Cynomys parvidens)* is listed as threatened and the Mexican prairie dog *(C. mexicanus)* is listed as endangered. Others include the white-tailed prairie dog *(C. leucurus),* Gunnison's prairie dog *(C. gunnisoni),* and Black-tailed prairie dog *(C. ludovicianus).* The Black-tailed prairie dog is the only prairie dog found in Texas.

The black-tailed prairie dog is named for its black tipped tail. It weighs one to three pounds and is generally 10-16 inches long. These rodents inhabit short to mid-grass prairies in the Panhandle and West Texas avoiding areas of dense brush and tall grasses. The social structure is divided into coteries of one male and two to eight females and their young. These coteries are then organized into colonies or towns ranging in size from a few acres to several thousand. Prairie dogs are very sociable animals.



Prairie dogs live in deep burrows 3-4 in (7-10 cm) in diameter with funnel-shaped entrances. Burrows typically descend at a steep angle for 7-16 ft (2-5 m) before leveling off. From the lower portion of the burrow, which itself may be 13 ft (4 m) long, extends blind side tunnels and nest chambers. The main burrow entrances are marked by mounds with parapets constructed around them. These mounds are often 12 in (30 cm) high and serve as dikes to keep flash floods from inundating the burrows. They also serve as lookout points *(Davis and Schmidly 1994).*

Prairie dogs are diurnal, which means that they are active outside their burrows during the day. In Texas they are most active during the morning and evening, when they are socializing with each other and foraging on grasses, roots, weeds, forbs, and blossoms with the occasional insect. Prairie dogs are famous for their "bark-like" call, which is sounded at the sighting of predators. When a predator approaches, the sentinel or first alert prairie dog gives a sharp warning call, bobs up and down in excitement, calls again, then plunges into a burrow. Other sentinels farther from danger take up the watch, monitoring the course of the predator. Predators of black-tailed prairie dogs include: coyotes *(Canis latrans),* bobcats *(Lynx rufus),* North American badgers *(Taxidea taxus),* Golden Eagles *(Aquila chrysaetos),* Prairie Falcons *(Falco mexicanus),* accipiter hawks *(Accipiter* spp.), buteo hawks *(Buteo* spp.), bullsnakes *(Pituophis melanoleucus)* and rattlesnakes *(Crotalus* spp.).

Reproduction occurs in the spring. Females breed in their second year producing litters averaging in four or five hairless, blind young in March or April and then breed once a year after that. The young will appear above ground in May or early June, generally at the age of six weeks. This is also the time at which yearlings and some adults relocate. By August or September, the young will be about ⅔ the size of an adult.

Plague in Black-tailed Prairie Dogs & How to Monitor Black-tailed Prairie Dogs

Plague in Black-tailed Prairie Dogs

Plague is a flu-like disease caused by a gram-negative bacteria *(Yersinia pestis),* transmitted through flea bites and contact with infected animals. The disease affects rodents such as rats, squirrels, and prairie dogs; and also cats and people. Plague is periodically found in rodents in the western two-thirds of Texas. Plague kills prairie dogs. Once plague is present in a prairie dog colony it can become persistent, periodically erupt and potentially extirpate the local prairie dog population. Fleas can carry the plague bacterium for more than a year. Cases in humans are rare, but do occur. Plague is easily treatable in animals and humans if caught early. To protect yourself, while monitoring prairie dogs, avoid all direct contact. Fleas can jump 7″-8″ vertically and 14″-16″ horizontally, so it is recommended that you stand at least 5 to 10 feet from the perimeter of the prairie dog colony when monitoring. If within a week after contact you feel sick, consult your doctor. Do not feed prairie dogs or touch sick or dead prairie dogs.

How to Monitor Black-tailed Prairie Dogs

There are three ways you can participate in Texas Black-tailed Prairie-Dog Watch. You may wish to participate in more than one survey type. Please note that each survey type has its own unique data form.

Black-tailed Prairie Dog Spotter

This first method is designed for monitoring black-tailed prairie dog colonies observed only on public property and outside your adopted site. If possible, obtain a map of the town or county and mark the location and number of each sighting. Record the data for each sighting on the enclosed data sheet. Include an estimate the number of black-tailed prairie dogs observed within the colony and the acres or description of the physical boundaries. For information on how to record the data, simply follow the directions on the enclosed data sheet and also see the enclosed example.

Black-tailed Prairie Dog Adopt-a-Colony

This second method is designed for monitoring black-tailed prairie dog colonies on an adopted site. A colony site can range from your backyard to your ranch. We simply ask that you visit your site at least 2 times a year, once before and once after the birth of prairie dog pups in the colony. Pups are born in March or April, so your first visit should occur before March. The young appear above ground in May or early June. By August or September, the young will be about ⅔ the size of an adult, so your second visit should occur sometime between June and August. An additional visit in the fall is recommended. You will be recording the distribution of prairie dogs within the colony as well as environmental conditions. For information on how to record the data at your adopted site, simply follow the directions on the enclosed data sheet and also see the enclosed example. Record the data on the data sheet during each visit *(record data even when you do not see black-tailed prairie dogs).* If you adopt more than one colony, then simply make copies of the data sheet. If possible, please record your sites on a map. We hope that you will record data at your site for many years so that we may understand trends in Black-tailed prairie dog colonies.

Black-tailed Prairie Dog Density Study

This third method also involves monitoring black-tailed prairie dog colonies on an adopted site. A colony site can range from your backyard to your ranch. To go a step further, this third method uses a Texas Tech University model *(Boal and Pruett, 2004)* that provides an efficient way to obtain estimates of black-tailed prairie dog population sizes in colonies. Wait for 5 minutes before beginning the count. This is an acclimation period that gives the prairie dogs a chance to get used to your presence. Counts consist of scanning the entire colony and counting every visible prairie dog. Each count should take approximately 10 minutes to conduct. Boal and Pruett *(2004)* found that May through September counts are statistically more accurate than counts conducted November through March. Therefore, we recommend that these counts be conducted between May through September. Counts should be conducted during the mornings and evenings when prairie dogs are most active. A total of 4 counts should be conducted and the data should be recorded on the enclosed data sheet. Each count should be at least 2 hours apart. They can be conducted on consecutive days but the hours should still be at least two hours apart. Example: Monday's data is collected at 4:00p.m., Tuesday's data is collected at 6:00p.m., Wednesday's data is collected at 8:00a.m and Thursday's data is collected at 10:00a.m.

You will be recording the density and distribution of prairie dogs in the colony as well as environmental conditions. For information on how to record the data at your adopted site, simply follow the directions on the enclosed data sheet and also see the enclosed example. If you adopt more than one colony, then simply make copies of the data sheet. If possible, please record your sites on a map. The data collected from this study will be put into a formula by TPWD biologists to determine the population of black-tailed prairie dogs at you site. The formula for this study can be found in Boal and Pruett *(2004)* on page 10.

Information from this study will help TPWD biologists answer questions like the following:

Do black-tailed prairie dog densities vary in different regions in Texas?

Are currently used estimates accurate?

Additional Monitoring Notes…

- Please stand at least 10 feet from the perimeter of the prairie dog colony when monitoring. Monitoring can also be done from a vehicle using binoculars or spotting scope.
- From November through March, black-tailed prairie dogs have a unimodel pattern and are active outside of their burrows during the afternoon. From May through September, they have a bimodal pattern and are active in the morning and in the evening.
- There is little above ground activity during any precipitation regardless of temperature, time of day, or season, therefore counts should not be conducted when it is raining or snowing.
- The habitat types are defined on page 13.
- Also include any sightings and the numbers of other species that may be directly or indirectly associated with prairie dog colonies. If you observe species that are not included on the list, please add them to the space provided. If there is not enough space, please use the back of this form for additional species.
- Please note on your data form if there is any evidence of disease in the prairie dog colony. Examples may include lethargy or signs of starvation. If there are dead prairie dogs observed within the boundary of the colony, please note this on the data form and contact the Texas Department of Health, Zoonosis Control Division at (800) 252-8239 and select option #3. For more information please visit: www.tdh.state.tx.us/zoonosis/diseases/plague
- TPWD cannot accept sightings from private property without the landowner's written permission. A Private Lands Access Request Form has been provided for you in this booklet.

Prairie Dog Tracks

The black-footed ferret is an endangered species that is believed to be extinct in Texas. The last recorded observations of black-footed ferrets in Texas were in 1953 in Dallam County and in 1963 in Bailey County. Black-footed ferrets depend upon prairie dogs for food and use their burrows as dens for shelter. Once thought to be extinct, reintroductions of black-footed ferrets are currently taking place in other states. No reintroductions have taken place in Texas.

Spotter Form

Name:________________________ County:________________________
Address:______________________ Phone:________________________
______________________________ Email:________________________

INSTRUCTIONS: Please use this sheet to submit records of black-tailed prairie dogs in Texas. Use a separate line for each visit to a particular site. Mark location and number of each sighting on a county map if possible.

Habitat Types (described on page 13):

A. Short Grass Prairie
B. Mid Grass Prairie
C. Mesquite Savanna Openings
D. Playas (dry)
E. Old Fields/Cropland (No-Till)
F. Sand Sage Depression
G. Creosote-Tarbush Openings

Sighting Number	Date	# of Prairie Dogs	Habitat Type	Estimated size of colony (acres or description of physical boundaries)	Location (distance & direction from nearest town)	Burrowing Owl (record # present):	Ferruginous Hawk (record # present):	Swainson's Hawk (record # present):	Mountain Plover (record # present):	Swift Fox (record # present):	Other species (list and record # present):
ex.	8/1/2005	352	A	25 acres	2 miles NE of Lubbock	2	3	0	1	2	2 Jackrabbits

Is there evidence of disease in colony? **Yes** **No**

If **Yes**, please describe:________________________________

Are dead prairie dogs observed? **Yes** **No**

If **Yes**, contact the **Texas Department of Health, Zoonosis Control Division at (800) 252-8239 (select option #3)**

Send Completed form(s) to: "Prairie Dog Watch", Texas Parks and Wildlife Department, 3000 IH-35 South, Suite 100, Austin, Texas 78704

Texas Parks and Wildlife Department maintains the information collected through this form. With few exceptions, you are entitled to be informed about the information we collect. Under Sections 552.021 and 552.023 of the Texas Government Code, you are also entitled to receive and review the information. Under Section 559.004, you are also entitled to have this information corrected. www.tpwd.state.tx.us <http://www.tpwd.state.tx.us/> (800) 792-1112 4200 Smith School Road, Austin, TX 78744

Adopt-A-Colony Form 1

Site #:_____________(To be assigned by TPWD)
Name:_____________________________________ County:___________________________________
Address:___________________________________ Phone:___________________________________
___________________________________ Email:___________________________________

Location of site (Lat-Long or distance & directions from nearest town):_________________________________
____

INSTRUCTIONS: Please use this sheet to record data each time you visit your adopted site. There is no limit to the number of times you may record data at each site; however we encourage you to visit the site at least 2 times (before March and after May). Please use a separate data sheet for each site. Mark site location on a map if possible.

Date:___________________ **Time of Day:**___________________ **Temperature:** ______ºF or _____ºC

Sky:

Few clouds
Partly cloudy or variable sky
Fog or smoke
Cloudy or overcast

Estimated size of colony (acres or description of physical boundaries):________________

Habitat Type (described on page 13):

Short Grass Prairie
Mid Grass Prairie
Mesquite Savanna Openings
Playas (dry)
Old Fields/Cropland (No-Till)
Sand Sage Depression
Creosote-Tarbush Openings

Estimated # of Prairie Dogs in colony:_________________

Species directly or indirectly associated with prairie dog colonies:

Burrowing Owl	**Yes**	**No**	# Present __________
Ferruginous Hawk	**Yes**	**No**	# Present __________
Swainson's Hawk	**Yes**	**No**	# Present __________
Mountain Plover	**Yes**	**No**	# Present __________
Swift Fox	**Yes**	**No**	# Present __________

Other species (record # present):____

Is there evidence of disease in colony? **Yes** **No**

If **Yes**, please describe:____

Are dead prairie dogs observed? **Yes** **No**

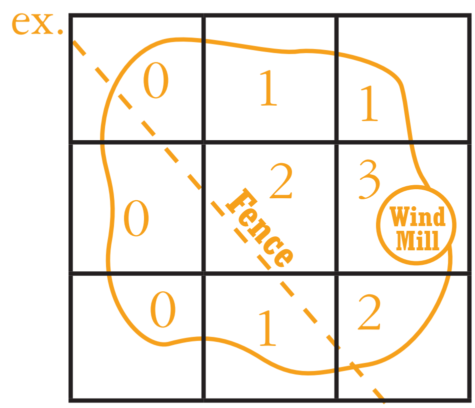
If **Yes**, contact the **Texas Department of Health, Zoonosis Control Division at (800) 252-8239 (select option #3)**

How long has the colony been at this site?________________________________

Has the colony: **expanded** **declined** **remained stable**

Has the colony been managed? **Yes** **No**
If **Yes**, please describe:____

Adopt-A-Colony Form 2



Please draw the border of the prairie dog colony on the following grid. Within each square, please include a value, 0 to 4 (see description below), that describes the percentage of the colony occupied by prairie dogs within the border of the colony.

Value for area occupied by prairie dogs:

- 0 = unoccupied
- 1 = 25% occupied
- 2 = 50% occupied
- 3 = 75% occupied
- 4 = 100% occupied

Send Completed form(s) to: "Prairie Dog Watch", Texas Parks and Wildlife Department, 3000 IH-35 South, Suite 100, Austin, Texas 78704

Density Form 1

Site #:_____________(To be assigned by TPWD)

Name:_______________________________________

County:_______________________________________

Address:_____________________________________

____

Phone:_______________________________________

Email:_______________________________________

Location of site (Lat-Long or distance & directions from nearest town):__________________________________

____

INSTRUCTIONS: Please use this sheet to record data each time you visit your site. Wait 5 minutes before beginning count. Counts consist of scanning the entire colony and counting every visible black-tailed prairie dog. Please conduct counts between May and September. Also conduct counts during mornings and evenings when prairie dogs are most active. Each count should be at least 2 hours apart. There is no limit to the number of times you may record data at each site. Please use a separate data sheet for each site. Mark site location on a map if possible.

Estimated size of colony (acres or description of physical boundaries):________________

<u>Habitat Type (described on page 13):</u>

Short Grass Prairie	Mid Grass Prairie	Mesquite Savanna Openings
Playas (dry)	Old Fields/Cropland (No-Till)	Sand Sage Depression
Creosote-Tarbush Openings		

Is there evidence of disease in colony? **Yes** **No**

If **Yes**, please describe:____

Are dead prairie dogs observed? **Yes** **No**

If **Yes**, contact the **Texas Department of Health, Zoonosis Control Division at (800) 252-8239 (select option #3)**

How long has the colony been at this site?__________________________________

Has the colony: **expanded** **declined** **remained stable**

Has the colony been managed? **Yes** **No**

If **Yes**, please describe:____

Density Form 2

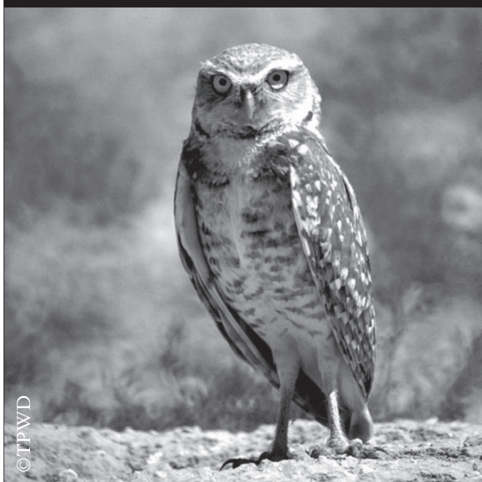
	Example	Count #1	Count #2	Count #3	Count #4
Date:	August 1, 2005				
Time:	4:00 P.M.				
Temperature (ºC):	35				
Sky Ratings: 1. Few clouds 2. Fog or smoke 3. Partly cloudy or variable sky 4. Cloudy or overcast **Sky:**	1				
# of Black-tailed Prairie Dogs:	352				
# of Burrowing Owls:	15				
# of Ferruginous Hawks:	0				
# of Swainson's Hawks:	2				
# of Mountain Plover:	0				
# of Swift Foxes:	0				
# of other species: ______					
# of other species: ______					
# of other species: ______					
# of other species: ______					

Diagram of the percentage of the colony that has prairie dogs

Please use the grid located on the form for the Black-tailed Prairie Dog Adopt-a-Colony on page 9.
Draw the border of the prairie dog colony on the grid.
Within each square, please include a value, 0 to 4, that describes the percentage of the colony occupied by prairie dogs within the border of the colony.

Send Completed form(s) to: "Prairie Dog Watch", Texas Parks and Wildlife Department, 3000 IH-35 South, Suite 100, Austin, Texas 78704

Species Associated with Prairie Dog Colonies



©TPWD

Burrowing Owl *(Athene cunicularia)*–Prairie dog towns furnish the ideal habitat for these birds. This owl is active both during the day and at night. The burrowing owl is a small, ground-dwelling owl with long legs. The owl's head is round and lacks eartufts. Burrowing owls can be found in West Texas and the Panhandle throughout the year, but will vacate the northern Panhandle during the winter months. For more information, go to: http://www.tpwd.state.tx.us/huntwild/wild/species/burowl/ *and* http://www.birds.cornell.edu/programs/AllAboutBirds/BirdGuide/Burrowing_Owl.html

C. Brunner

Ferruginous Hawk *(Buteo regalis)*–Prairie dogs are one of the primary prey of Ferruginous Hawks. They often can be found in numbers of 5 to 10 perching near a prairie dog town waiting to attack their prey. The Ferruginous Hawk is a large, buteo, with broad wings and a large head. It has a white or light gray tail. Legs are feathered to the toes. In the light morph, in flight, the head is whiter then that of most hawks and the back and shoulders are rufous. The dark morph has a dark head and the upper wings and back feathers are fringed with rufous. Ferruginous Hawks can be found in West Texas and the Panhandle during the winter months and year-round in the northwest portion of the Texas Panhandle. For more information, go to: http://www.tpwd.state.tx.us/huntwild/wild/species/forhawk/ *and* http://www.birds.cornell.edu/programs/AllAboutBirds/BirdGuide/Ferruginous_Hawk.html

©USFWS/ Paul Kerris

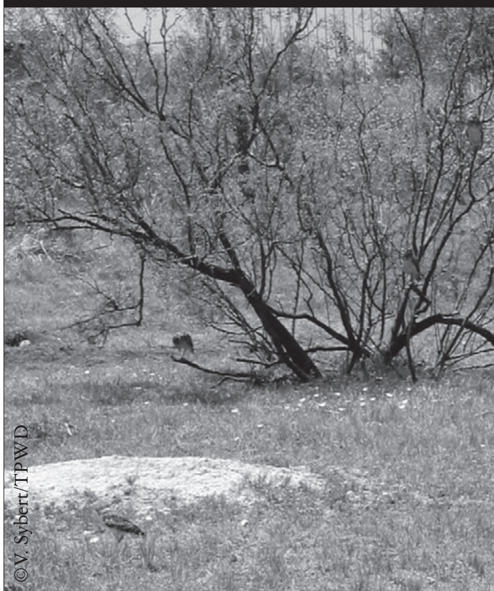
Swainson's Hawk *(Buteo swainsoni)*–The Swainson's Hawks diet during the breeding season consists of mainly mammals, birds and reptiles. This hawk has a stout body and broad wings, but compared to other North American hawks, it has a slimmer appearance and narrower wings. In flight, the dark flight feathers contrast sharply with the lighter feathers on the leading edge of the wing. Dark adult Swainson's Hawks lack this sharp contrast. The light morph adult has dark brown plumage with a brown breast and a pale belly. It also has a white chin. The dark morph has a similar pattern but is overall darker. The Swainson's Hawk depends on open grasslands for foraging. The Swainson's Hawk can be found in the western portions of Texas and the Panhandle during the summer months. For more information, go to: http://www.tpwd.state.tx.us/huntwild/wild/species/swainson/ *and* http://www.birds.cornell.edu/programs/AllAboutBirds/BirdGuide/Swainsons_Hawk_dtl.html

©USFWS

Mountain Plover *(Charadrius montanus)* –The Mountain Plover is a native to the short grass prairies, not mountains. It nests in sites used historically by prairie dogs, bison and pronghorns. The Mountain Plover is a fairly large plover, about the same size as a Killdeer *(Charadrius vociferous)* but has longer legs. It can closely resemble the American Golden-Plover *(Pluvialis dominica),* migrates through Texas. The Mountain Plover is drably colored and lacks a black breast band. The upperparts of this bird are sandy brown that extends along the side of the neck and onto the chest. The forehead, throat, breast and underwings are white. Breeding birds have a distinctive black stripe extending from the bill to the eye. It is the only North American plover with a black bar on the front of the crown and a clear white breast. Mountain Plovers can be found in the northern regions of the Texas Panhandle during the summer months and the southern regions of Texas during the winter. For more information, go to: http://www.birds.cornell.edu/programs/AllAboutBirds/BirdGuide/Mountain_Plover.html

Swift Fox *(Vulpes velox)*–The swift or kit fox is the smallest of the American Foxes. This fox lives in open desert or grasslands. It has a pale buffy yellow coat with a buffy gray tail that has a black tip. The swift fox can be found in West Texas and the Panhandle. For more information, go to: http://www.tpwd.state.tx.us/huntwild/wild/species/kitfox/

Description of Habitat Types



Prairie Dog Town in Mesquite Savanna

A.Short Grass Prairie–Rangeland in the High Plains, Rolling Plains and Edward's Plateau Ecoregions and is dominated by buffalo grass *(Buchloe dactyloides)* on clay (and other compacted) soils. Grass species may include blue grama *(Bouteloua gracilis),* three awn *(Aristida* spp.), and dropseed *(Sporobolus* spp.).

B.Mid Grass Prairie–Rangeland in the High Plains, Rolling Plains and Edward's Plateau Ecoregions and is dominated by grama *(Bouteloua)* grasses. Other important grasses Texas wintergrass *(Nassella {= Stipa} leucotricha),* curly mesquite *(Hilaria belangeri),* tridens *(Tridens muticus),* three awn *(Aristida* spp.), cane & silver bluestem *(Bothriochloa* spp.), vine mesquite *(Panicum obtusum),* little bluestem *(Schizachyrium scoparium),* Indiangrass *(Sorghastrum nutans),* and cottontop *(Digitaria californica).*

C.Mesquite Savanna Openings–Rangeland found state wide. Moderately dense to dense mesquite *(Prosopis glandulosa)* shrubland interspersed with openings in shallow swales or playa-like depressions. Openings are often maintained by the activities of black-tailed prairie dogs. These grassland openings frequently contain buffalo grass *(Buchloe dactyloides),* blue grama *(Bouteloua gracilis)* and tobosa grass *(Pleuraphis {=Hilaria} mutica),* but grass composition will vary with intensity of grazing and by Ecoregion.

D.Playas (dry)–Rangeland found in High Plains, Rolling Plains, western Edwards Plateau and eastern Trans-Pecos Ecoregions. Habitat dominated by vine mesquite *(Panicum obtusum)* and buffalo grass *(Buchloe dactyloides),* and is normally found in localized depressions *(e.g. playas)* that retain more moisture than the surrounding landscape. When heavily grazed, buffalo grass (and/or forbs) tends to dominate the lowest areas, with Vine Mesquite virtually absent or apparent only at the edges. When un-grazed, vine mesquite can be abundant everywhere. During drought, this alliance may contain a significant amount of bare ground. Other grasses include grama *(Bouteloua)* spp., western wheatgrass *(Agropyron {= Pascopyrum} smithii),* and tumble grass *(Schedonnardus paniculatus).*

E.Old Fields/Cropland (No-Till)–Old fields and croplands occur statewide. In addition to plowed fields and fields with crops, this classification includes forb-dominated out-of-production cropland and no-till fields. The vegetation varies and is primarily comprised of crops and/or annual forbs.

F.Sand Sage Depression–This rangeland is interspersed with midgrass and short grass community types, and occurs in the High Plains and Rolling Plains Ecoregions. This evergreen shrubland or midgrass prairie alliance includes several distinct associations, all of which occur on sandy soils. Composition varies with precipitation, disturbance, and soil texture, with mid grasses common on high quality rangeland. Mesquite *(Prosopis glandulosa)* may be a component. Important grasses include little bluestem *(Schizachyrium scoparium),* sand dropseed *(Sporobolus cryptandrus),* big sandreed *(Calamovilfa gigantea),* three awn *(Aristida* spp.), grama *(Bouteloua* spp.), and lovegrass *(Eragrostis* spp.).

G.Creosote–Tarbush Openings–Rangeland found in the Trans-Pecos Ecoregion. This association is dominated by black grama *(Bouteloua eriopoda),* vine mesquite *(Panicum obtusum),* buffalo grass *(Buchloe dactyloides),* sideoats grama *(Bouteloua curtipendula),* creosote bush *(Larrea tridentata),* and tarbush *(Flourensia cernua).*

Playa on the High Plains

Landowner Form

To the landowner:

______________________________(volunteer name) is participating as a volunteer in Texas Black-tailed Prairie Dog Watch. Texas Black-tailed Prairie Dog Watch is a monitoring program that uses citizen volunteers to gather data about the status of Black-tailed prairie dogs in Texas. Although these species are not currently considered threatened and endangered, throughout their range there has been a drastic decline in the population. Texas Parks and Wildlife Department is very pleased to have the assistance of concerned Texans in monitoring black-tailed prairie dog populations.

We have, however, instructed our volunteers that they cannot collect data on private land without the approval of the private landowner. Accordingly, we have prepared this form for your approval. The sections described below are the releases that we and our volunteers are required to obtain from you under Section 12.103 of the Texas Parks and Wildlife Code. If you approve, then please sign one or both sections and provide a copy to our volunteer.

1. Use of information
This documents my approval for TPWD volunteers and employees to use (such as analyses) site-specific information from the property I own or manage. This may include placing that information onto a topographic map and entering the information into a Department database. Thus, the information could be viewed by the public.

________________________________ ________________

(Landowner or authorized agent signature) *(Date)*

2. Reporting information
This also documents my approval for TPWD volunteers and employees to report (such as in publications or technical reports) the above approved information in a manner that permits identification of the location of the specific parcel of property that I own or manage.

________________________________ ________________

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3. Other conditions
If there are any conditions that apply to this approval, please specify and initial below.

____

Name and Address
(of landowner or authorized agent)

Name ______________________________

Address ______________________________

City ______________________________

State, Zip ______________________________

Phone number______________________________

Optional:

Name of ranch or tract ______________________________

County ______________________________

Acreage ______________________________

Location ______________________________

Texas Parks and Wildlife Department maintains the information collected through this form. With few exceptions, you are entitled to be informed about the information we collect. Under Sections 552.021 and 552.023 of the Texas Government Code, you are also entitled to receive and review the information. Under Section 559.004, you are also entitled to have this information corrected. www.tpwd.state.tx.us <http://www.tpwd.state.tx.us/> (800) 792-1112 4200 Smith School Road, Austin, TX 78744

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John Young
Texas Black-tailed Prairie Dog Watch
Texas Parks and Wildlife Department
4200 Smith School Road
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Appendix A: Texas Black-tailed Prairie Dog Plant Community Alliances and Associations

The following plant community descriptions refer to plant alliances and associations in the Texas range of the black-tailed prairie dog. An alliance name includes dominant and diagnostic species, usually of the uppermost or dominant vegetation stratum/layer. An association name confers greater ecological refinement. Thus an alliance may be able to be broken down into multiple associations.

Preliminary descriptions were drafted in the field. After visiting multiple sites of a particular class, the description was compared to the Nature Serve Explorer Ecological Communities and Systems descriptions < http://www.natureserve.org/explorer/servlet/NatureServe?init=Ecol >. Vegetation types were then assigned to ground-truthed colonies, and verified by use of photos taken at the colonies. Seventeen alliances and associations found to support BTPD colonies in Texas are described below.

1a. *Buchloe dactyloides* (Buffalo Grass) Herbaceous Alliance

The buffalo grass alliance includes modified vegetation dominated by *Buchloe dactyloides*, in pastured and other disturbed areas, especially over clay or compacted soils. Other characteristic species include *Aristida oligantha*, *Bouteloua gracilis*, and *Sporobolus compositus*. This alliance is found primarily in the High Plains and sporadically in the western Rolling Plains Ecoregions of Texas.

1b. *Bouteloua gracilis - Buchloe dactyloides* (Blue Grama - Buffalo Grass) Herbaceous Association

This shortgrass prairie association is common across much of the central and southern Great Plains of the United States on flat or rolling uplands, extending to north central (and perhaps northwestern) Nebraska and southeastern Wyoming. The surface soil may be sandy loam, loam, silt loam, or loamy clay. The subsoil is often finer than the surface soil. This community is characterized by a moderate to dense sod of shortgrasses with scattered midgrasses and forbs. The dominant species are *Bouteloua gracilis* and *Buchloe dactyloid*es. The foliage of these species is 7-19 cm tall, though the flowering stalks of *Bouteloua gracilis* may reach 45 cm. The midgrasses are usually stunted by arid conditions and often do not exceed 70 cm. Other short graminoids found in this community are *Bouteloua hirsuta*, *Carex duriuscula*, *Carex inops ssp. heliophila*, and (in Nebraska) *Carex filifolia*. Several midgrasses occur regularly, such as *Aristida purpurea*, *Bouteloua curtipendula*, *Pascopyrum smithii*, *Schizachyrium scoparium*, *Elymus elymoides*, *Sporobolus cryptandrus*, *Hesperostipa comata* (= *Stipa comata*), and *Vulpia octoflora*. Forbs, such as *Astragalus* spp., *Gaura coccinea*, *Machaeranthera pinnatifida var. pinnatifida*, *Opuntia polyacantha*, *Plantago patagonica*, *Psoralidium tenuiflorum*, *Ratibida columnifera*, and *Sphaeralcea coccinea*, are common throughout this community. Shrubs are rare except in the southern part of the association's range where scattered individuals may occur. In Texas, shrub species include *Prosopis glandulosa*, *Bouteloua curtipendula*, and *Sporobolus cryptandrus*. This association is found primarily in the central and northern High Plains, but also in the Rolling Plains and Trans-Pecos Ecoregions of Texas.

2a. *Bouteloua curtipendula - Bouteloua eriopoda, Bouteloua gracilis* (Sideoats Grama - Black Grama, Blue Grama) Herbaceous Alliance

This broadly defined midgrass alliance includes several distinct associations. Shrubs such as *Ziziphus obtusifolia*, *Juniperus pinchotii*, *J. ashei*, *Opuntia* spp., and *Prosopis glandulosa* are common when the alliance is grazed. Important grasses include *Bouteloua gracilis*, *Nassella leucotricha* (= *Stipa leucotricha*), *Hilaria belangeri*, *Tridens muticus*, *Aristida* spp., *Bothriochloa barbinodis*, *Panicum obtusum*, *Schizachyrium scoparium*, *Sorghastrum nutans*, and *Digitaria californica*. In the Rolling Plains, the alliance is interspersed with steep, xeric *Juniperus pinchottii* shrublands and sandy *Artemisia filifolia* depressions. On the Edwards Plateau, the alliance is interspersed with *Quercus fusiformis-Juniperus ashei* woodlands, transitioning into dry *Hilaria belangeri-Bouteloua curtipendula* grasslands on the western plateau. This alliance occurs in Oklahoma and Texas. In Texas, this grassland is known primarily from the central and western Edward's Plateau, the High Plains and the eastern Rolling Plains Ecoregions.

2b. *Bouteloua eriopoda - Bouteloua gracilis* (Black Grama - Blue Grama) Herbaceous Association

This midgrass-dominated semi-desert grassland association inhabits moderate elevations (3500-5200 ft) of the Trans-Pecos mountains and plateaus. Sites are often flat to gently sloping, but can be moderately steep. Soils are often gravelly loam or sandy loam. On mesa tops the soils are finer-textured sandy loam or silty loam. Composition varies with abiotic factors and grazing history, with *Bouteloua eriopoda* often dominant on rocky slopes and *B. gracilis* dominant on deeper soils. Other important grasses include *B. curtipendula*, *Tridens* spp., *Bothriochloa* spp., and *Aristid*a spp. Annual grasses and shrubs and succulents such as *Opuntia imbricata*, *Prosopis glandulosa*, *Yucca elata*, *Y. torreyi*, *Condalia ericoides* are common when the alliance is grazed. This association is interspersed with or grades into pinyon-oak-juniper woodland at higher elevations and succulent desert shrubland on dry slopes. The association occurs on tablelands in a transition zone between the Southern Great Plains and the Chihuahuan Desert in southern New Mexico, and is known primarily from the Trans-Pecos Ecoregion in Texas.

3. *Artemisia filifolia* (Sandsage) Shrubland Alliance

This evergreen shrubland or midgrass prairie alliance includes several distinct associations, all of which occur on sandy soils. Composition varies with precipitation, disturbance, and soil texture, with midgrasses common on high quality rangeland. *Prosopis glandulosa* may is often a component. Important grasses include *Schizachyrium scoparium*, *Sporobolus cryptandrus*, *Calamovilfa gigantea*, *Aristida* spp., *Bouteloua* spp., and *Eragrostis* spp. The alliance is interspersed with midgrass and shortgrass community types. This alliance occurs in New Mexico and Oklahoma and Texas. In Texas, it occurs in the High Plains and Rolling Plains Ecoregions.

4. *Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua gracilis* (Little Bluestem - Sideoats Grama - Blue Grama) Herbaceous Association

This grassland association is occurs on level to moderately sloping uplands, but is more likely to be on steep ravine slopes. The loam, clay loam, silty loam, or silty soils are usually formed over limestone. They are shallow to moderately deep, well-drained, and usually contain a substantial amount of rock fragments. The vegetation often forms two layers, a shorter layer of grasses and a taller layer of mixed grasses and forbs. Cover is moderately dense to dense in most stands. The vegetation is characteristically dominated by *Schizachyrium scoparium*, *Bouteloua curtipendula*, and *Bouteloua gracilis*, with *Schizachyrium scoparium* often the tallest dominant grass. *Andropogon gerardii, Sporobolus cryptandrus,* and *Sorghastrum nutans* are present, especially on lower slopes. The shortgrasses *Buchloe dactyloides* and *Bouteloua hirsuta* grow on upper slopes and level ground. Forbs include *Ambrosia psilostachya, Dalea enneandra, Echinacea angustifolia, Liatris punctata, Calylophus serrulatus*, and *Psoralidium tenuiflorum*. This association is found in the south-central Great Plains of the United States, particularly in Kansas and Oklahoma. In Texas, it is found in the High Plains and Rolling Plains Ecoregions.

5. *Bothriochloa ischaemum* (King Ranch Beardgrass) Alliance

This alliance refers to pastures dominated by *Bothriochloa ischaemum*, a grass introduced from central Europe and Asia. This exotic species has been planted extensively along roadside rights-of-way, in converted native pastures and in hay meadows, and is now a dominant grass in many disturbed areas. This alliance is found in Oklahoma, Texas, and in the Mexican states of Coahuila, Nuevo León, and Tamaulipas. In Texas, it occurs in the Edwards Plateau, High Plains, Rolling Plains, and Trans-Pecos Ecoregions.

6. Old Fields/Croplands

Early successional forb dominated sites including newly plowed fields, no-till fields, and center pivot irrigation fields. Black-tailed prairie dogs will move into the portions of these sites where only shallow or surface disturbance occurs. The vegetation varies and is primarily comprised of crops and/or annuals. Old fields and croplands occur in all Texas Ecoregions.

7. *Pascopyrum smithii - Buchloe dactyloides - Phyla cuneifolia, Oenothera canescens* (Western Wheatgrass - Buffalo Grass - Wedgeleaf Frogfruit, Spotted Evening Primrose) Herbaceous Association

This wheatgrass playa grassland association represents the common vegetation type of playa lake basins (depressional wetlands) under rangeland conditions in the southern and central Great Plains of the United States. In the central plains, soils are dense silts and clays, occasionally loess-derived, that flood in winter and dry out by early summer. Perennial herbaceous graminoids and forbs <1 m tall dominate the association, with composition varying with the water level. In the central plains, *Pascopyrum smithii* is most abundant, and *Agrostis hyemalis, Eleocharis palustris, Eleocharis macrostachya, Elymus virginicus,* and *Hordeum jubatu,* can be locally abundant. *Buchloe dactyloides* can be abundant in grazed sites. Early-season ephemeral annuals include *Alopecurus carolinianus, Elatine rubella, Myosurus minimus, Veronica peregrina ssp. xalapensis,* and the more westward *Limosella aquatica* and *Plagiobothrys scouleri*. Perennial forbs, including *Ambrosia grayi, Phyla cuneifolia, Oenothera canescens, Rorippa sinuata*, and *Vernonia fasciculata,* are locally conspicuous. In the southern Plains, species characteristic of this association include *Buchloe dactyloides, Distichlis spicata*, and *Panicum obtusum*. In Texas, the association occurs in the High Plains and Rolling Plain Ecoregions.

8. *Panicum obtusum - Buchloe dactyloides* (Vine-mesquite - Buffalo Grass) Herbaceous Alliance

This association is dominated by *Panicum obtusum* and *Buchloe dactyloides*, but can also include *Bouteloua gracilis, Iva axillaris, Pascopyrum smithii, Ratibida tagetes*, and *Schedonnardus paniculatus*. The association occurs on mesic soils in pastures, prairies, riparian areas, and playa lakes. This alliance occurs in Oklahoma and Texas. In Texas, this association occurs in the northwestern Edwards Plateau, the High Plains, Rolling Plains and Trans-Pecos Ecoregions.

9. *Prosopis glandulosa var. glandulosa / Bouteloua gracilis - Buchloe dactyloides* (Honey Mesquite / Blue Grama - Buffalo Grass) Shrubland Association

This association is normally a moderately dense to dense shrubland interspersed with openings in shallow swales or depressions. Openings are maintained by black-tailed prairie dogs. These grassland openings contain *Buchloe dactyloides*, *Bouteloua gracilis*, and *Pleuraphis mutica*, and can contain and/or be surrounded by *Prosopis glandulosa var. glandulosa*. This association is frequently found in basins below sandstone and gypsum formations. In Texas, it occurs in the Edwards Plateau, High Plains, Rolling Plains, and Trans-Pecos Ecoregions of Texas.

9a. Unknown

During this inventory, a vegetation type was found in north central Pecos (and possibly Andrews) counties in a variety of sizes of mesquite openings. Elevations were 2300-2600 ft. The geology was primarily alluvium, with potential influence of intermittent stream flooding at some sites. Soils contained small calcareous and/or gypsiferous gravel in well drained loamy upland terraces above the Pecos River, and near intermittent tributary streams. Dominant species included *Bouteloua curtipendula*, *Buchloe dactyloides, Eragrostis* spp., and *Aristida wrightii*. *Stipa* spp. (= *Nassella leucotricha* or *Hesperostipa neomexicana*) was characteristic of these openings. The openings contained and/or were surrounded by *Prosopis glandulosa var. glandulosa* and *Koeberlinia spinosa*.

10. ***Larrea tridentata / Bouteloua hirsuta - Bouteloua gracilis - Bouteloua eriopoda*** **(Creosote bush / Hairy Grama - Blue Grama - Black Grama Shrub Herbaceous Association)**

This is a widespread association of disturbed areas that has spread into former desert grasslands and mixed shrublands. The association is composed of scattered xeromorphic shrubs, mainly *Larrea tridentata,* occurring in flats below 3500 ft., and includes *Parthenium incanum, Atriplex canescens, Flourensia cernua,* and *Acacia* spp. In Texas, it occurs in the Trans-Pecos Ecoregion.

11. ***Pleuraphis mutica - Scleropogon brevifolius*** **(Tobosa Grass - Burrograss) Herbaceous Association**

This association (similar to **7**) is a shallow depression with deep soils found near arroyos. Water from infrequent flooding creates locally improved vegetation in these depressions, making them attractive to prairie dogs. The dominant species are *Pleuraphis mutica* and *Scleropogon brevifolius*. This alliance is found in the western Trans-Pecos Ecoregion in Hudspeth county, and may occur in Culberson county as well.

12. ***Pleuraphis mutica - Buchloe dactyloides*** **(Tobosa Grass - Buffalo Grass) Herbaceous Association**

This shortgrass association occurs primarily on flats with heavy soils. When occupying a site that receives excess water runoff from the surrounding landscape, the association can function like a small, internally drained basin bottom. *Prosopis glandulosa var. glandulosa* may be scattered throughout, and common grasses include *Buchloe dactyloides*, *Panicum obtusum*, *Digitaria californica*, *Bouteloua* spp., *Tridens* spp., and *Sporobolus* spp. This association occurs near a variety of shrublands and mixed grasslands, including saline areas dominated by *Sporobolus airoides*. In Texas, the association occurs in the Edwards Plateau, southwestern Rolling Plains, and Trans-Pecos Ecoregions.

14. ***Pleuraphis mutica - Panicum obtusum*** **(Tobosa Grass - Vine-mesquite) Herbaceous Association**

This Chihuahuan Desert association occurs in closed basin bottoms, swales, playas and occasionally on lava flows at elevations from 4250-5000 ft. *Pleuraphis mutica (= Hilaria mutica)* is dominant and abundant. The presence of *Panicum obtusum* is diagnostic of the playa-like setting of this association. Overall, diversity is moderate with 32 species recorded for the association. Shrubs are not significant. This lowland basin grassland has had its range reduced by the impacts of livestock grazing during years of extreme drought. Few examples of this association remain that have not been significantly impacted by grazing and altered fire regimes. The majority of the remaining high-quality occurrences are found in remote areas where livestock impacts are minimal. The association occurs in southern New Mexico, southeastern Arizona, and probably occurs in northern Mexico. In Texas, it is found only in the Trans-Pecos Ecoregion.

15. *Yucca elata / Bouteloua eriopoda* (Soaptree Yucca / Black Grama Shrub) Herbaceous Association

This association is dominated by *Bouteloua eriopoda*, *Panicum obtusum*, *Buchloe dactyloides*, *Bouteloua curtipendula*, *Larrea tridentata*, and *Flourensia cernua.* Once an extensive desert grassland of the Chihuahuan Desert, the association has experienced significant declines throughout its range. Desert shrublands now occupy much of its former range. The best remaining examples are on military lands where they are protected from grazing. Found across southern New Mexico and into northern Mexico, this alliance extends into the Trans-Pecos Ecoregion in Hudspeth County, Texas.

2005 Inventory of the Black-tailed Prairie Dog in Texas

Billy Roberts, Rain Nox, Greg Lewellen, Mark Steele, Bryan Theall, and Eric Kasprzak, Greg Kerouac, and Jason Singhurst

Texas Parks and Wildlife Department, Austin.

Introduction

As part of the Texas Black-tailed Prairie Dog Conservation and Management Plan (TCMP), this inventory established an acreage estimate of the black-tailed prairie dog (BTPD) in Texas. This inventory is the second of four proposed at the time of this study, with the 3rd and 4th inventories planned for 2008 and 2011. The original inventory assessment (Kerouac et al 2004) conducted in 2003 setup the general framework for subsequent inventories including this one, though some changes have been implemented as technology, techniques and data availability improve.

Materials & Methods

The primary hardware used was Dell desktop personal computers and Xplore Technologies' iX104 GPS enabled PC tablet. All systems were endowed with sufficient memory and processing capabilities for handling large digital images and datasets quickly and efficiently. Additional equipment included external/mobile storage media, digital cameras, spotting scopes, binoculars and high-clearance vehicles. The primary software used to conduct this inventory was ESRI's ArcGIS/ArcInfo 9.0 and ArcPad. Other software used was the XTools extension for ArcGIS, Leica Geosystems' ERDAS Imagine and the Microsoft Office Suite. The initial data used in the study included 1-meter Digital Orthographic Quadrangles (DOQs) acquired from Texas Natural Resources Information System and confirmed prairie dog locations determined by the 2004 inventory.

General locations of study sites, termed Priority Areas, were selected based primarily on density of prairie dog occurrences determined by the 2004 inventory. Precise Priority Area boundaries were determined by local geologic and vegetative patterns and attempted to include areas of likely BTPD habitat while excluding areas unlikely to contain BTPD habitat. Twelve Priority Areas were created and digitized in ArcGIS.

DOQs were mosaicked by county and areas within Priority Areas were visually scanned for prairie dog signatures in the lab using Imagine. This system was abandoned early on in favor of ArcMap in an attempt to simplify the procedure. Interpreted signatures were digitized in the form of polygons. Signatures which were extremely unclear but might contain the BTPD were marked with a point. Interpreted signatures were organized separately by Priority Area and each Priority Area had an associated polygon interpretation layer and point interpretation layer. Field map packets were made for each Priority Area using ArcMap and displayed roads, confirmed sites from the 2004 inventory and newly interpreted point and polygon sites overlaid with the DOQs. Map packets were used for navigational purposes and as visual cues to allow field teams to locate the interpreted sites.

In the field, teams recorded the presence of active BTPD populations by confirming, modifying or omitting the interpreted polygons both manually on the field maps and digitally with ArcPad. Various lines and other notation were used to indicate limits of visibility and sections of interpreted polygons which should be expanded or added, reduced or eliminated based on the actual state of the ground site. Interpreted polygons that were verified and needed no changes were indicated as such, and completely new sites discovered by field teams were hand drawn on the field maps and in ArcPad. Digitally field-drawn polygons had only one attribute, the purpose of which was to indicate "new" or a site number meaning the area under the polygon contains a BTPD population or "omit" meaning the area under the polygon does not contain a BTPD population and should be removed from the interpreted polygon layer.

Global Positioning System (GPS) points were taken in the field at each site where evidence of the BTPD appeared whether or not the species was actually present. Presence or absence of the BTPD was indicated as an attribute of the point. Similar attributes for the Ferruginous Hawk and the Burrowing Owl were recorded for all points. Vegetation classification of the site, date, county and proximity to a former BTPD site was also recorded. If no former site existed, the site was recorded as "new." At least one digital photograph of every site was taken and linked to its respective point with a code. A duplicate record of each GPS point and its attributes was recorded manually on a paper form at the time the point was taken. Each day the GPS point layer from the previous day was saved as a new file and edited with new points.

Field data was retrieved by the lab in various formats. Digital data including attributed shapefiles and photographs were retrieved by the team in Austin from the teams in the field via email, upon returning the field units, on data sticks and on burned CDs throughout the course of the ground-truthing operation. Hard copies of data in the form of hand-marked field maps and paper field logs were retrieved in person and by snail mail.

Data was sorted by priority area and the attributed GPS point shapefiles were merged into single shapefiles. The GPS points were checked for quality and consistency with the field logs and duplicate or extraneous points were removed. Every entry for every feature was verified. Entries that did not match were noted and corrected. Prairie dog, hawk or owl absence or presence on a site was changed to indicate absence in the event of conflicting entries. The remaining shapefiles consisted of polygons and polylines representing ground-truthed BTPD areas and line features indicating site-limiting topography.

The original interpretation polygon layer was used as the base for creating the final truthed polygon layer. Polygons that were verified true with no modifications were maintained. Polygons that required editing were done so based on the information hand-drawn by the field teams on the field maps and the field-digitized polygons. Polygons that were verified not to contain the BTPD were deleted. Polygons that were not truthed were put into a separate layer and maintained for future reference. Final editing decisions were left to the judgment of the lab team.

Acreages for the truthed polygons, the non-truthed polygons, and the original interpretation polygons were calculated with XTools in ArcGIS and exported to database files. Microsoft Excel was used to calculate total acreage for areas visited, areas not visited, areas that contain the BTPD and areas that did not contain the BTPD. Excel was used to calculate final BTPD acreage statistics including minimum, maximum and best estimates for each Priority Area.

A site layer was created from the truthed polygon layer for each Priority Area. Truthed polygons were buffered at .25 km. All overlapping buffers were merged into single shapes and issued a site number. A site was issued the number of a site from the 2004 inventory if overlapped the old site. If a site overlapped more than one old site, it was issued a new number and the old site numbers were retired. If a site did not overlap an old site, it was issued a new number. A conversion table was created to keep track of which sites from the 2004 and 2005 inventories intermingled. Site shapefiles and conversion tables were placed in a geodatabase and related to create a visual site history for every polygon.

Final maps of the inventory were created with ArcGIS for each Priority Area.

Results

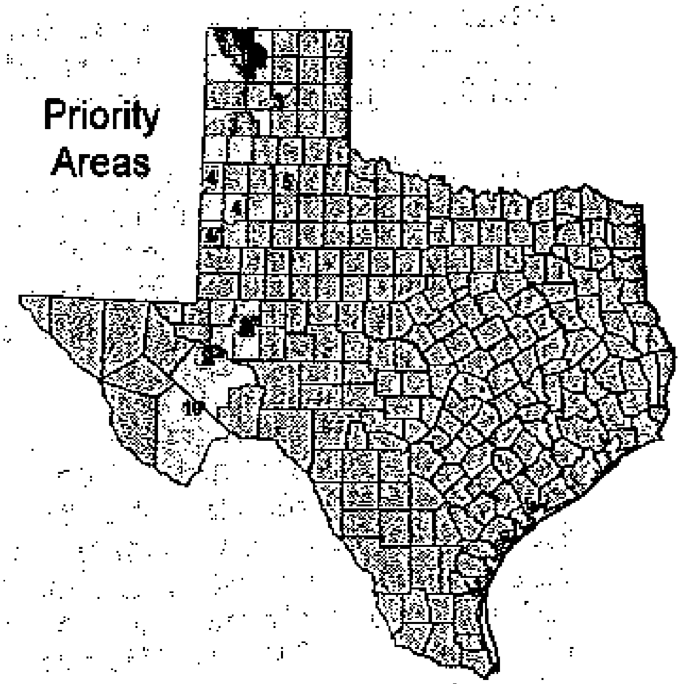
The inventory found 85,636 acres of the BTPD in seven Priority Areas covering 4,767,049 acres (Figure 1). A maximum of 135,314 acres of the BTPD is estimated for all Priority Areas, while 132,515 acres is considered the best estimate.

Priority Area 01 was found to contain 40,562 acres of the BTPD with 74,399 acres being the best estimate. Priority Area 03 was found to contain 19,885 acres with 28,345 acres being the best estimate. Priority Area 04 was found to contain 14,500 acres with 17,340 acres being the best estimate. Priority Area 05 was found to contain 1,811 acres with 1,845 acres being the best estimate. Priority Area 08 was found to contain 3,248 acres with 3,937 acres being the best estimate. Priority Area 09 was found to contain 851 acres with 1,245 acres being the best estimate. Priority Area 10 was found to contain 4,779 acres with 5,403 acres being the best estimate.

Texas Black-tailed Prairie Dog Priority Area Assessment 2005

Priority Area	Primary Counties	
01	Sherman	Dallam
	Hartley	Moore
Total Acres:	*1,450,155*	
03	Deaf Smith	
	Potter	Carson
	Randall	
Total Acres:	*1,156,535*	
04	Bailey	Hockley
	Yoakum	
Total Acres:	*928,921*	
05	Floyd	
Total Acres:	*254,048*	
08	Midland	Upton
Total Acres:	*443,427*	
09	Pecos	
Total Acres:	*331,798*	
10	Brewster	
Total Acres:	*202,167*	

Priority Areas



Priority Area	*Acres Found*	*Visited*	*Not Visited*	*Percent Visited*	*Estimate Factor*	*Minimum*	*Maximum*	*Best Estimate*
01	40,562	34,505	28,784	55%	1.2	40,562	69,346	74,399
03	19,885	27,800	11,828	70%	0.7	19,885	31,713	28,345
04	14,500	18,519	3,627	84%	0.8	14,500	18,127	17,340
05	1,811	6,011	113	98%	0.3	1,811	1,924	1,845
08	3,248	17,290	3,670	82%	0.2	3,248	6,918	3,933
09	851	1,933	895	68%	0.4	851	1,746	1,248
10	4,779	5,826	761	88%	0.8	4,779	5,540	5,403
Totals	85,636	111,884	49,678			85,636	135,314	132,515

Prairie Dog Estimates by Priority Area

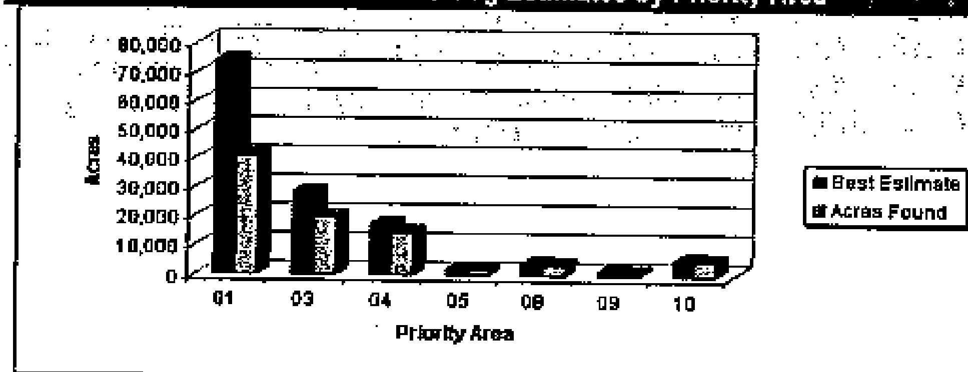


Figure 1. Black-tail Prairie Dog 2005 Priority Area Estimates

Discussion

The current estimate of the BTPD in Texas ranges from 85,000 to 135,000 acres. Interestingly, the Priority Areas used to define the boundaries of the 2005 inventory are significantly smaller than county-defined study areas used in the 2004 inventory, yet virtually the same acreages were generated from both inventories (Table 1). This result may be misleading. It is less likely that similar acreages are due to a stable population of the BTPD and more likely is a direct result of the availability of higher quality DOQs for the initial location of BTPD signatures and improved inventory techniques. Using county boundaries as the study areas, the 2004 inventory surveyed 80 counties encompassing a total of 63,690,657 acres. The 2005 inventory looked at portions of only 16 counties for a total study area consisting of 4,767,049 acres. This is only 7.5% of the area considered in the 2004 inventory. However the total area initially interpreted as BTPD in the 2004 inventory was 192,630 acres as compared with 161,562 in the 2005 inventory. The total acres found in 2004 was 84,273. Total not visited in 2004 was 72,752 so the total visited was 119,878.

Black-tailed Prairie Dog Inventory Comparison

	2004	2005	% of 2004
Counties	80	7.5	9.4%
Study Area	63,690,657	8,492,087	13.3%
Interpreted	192,630	161,562	83.9%
Visited	119,878	111,884	93.3%
Not Visited	72,752	49,678	68.3%
Found	84,273	85,636	101.6%

Table 1. Black-tail Prairie Dog Inventory Comparison between 2004 and 2005 in (comparing number of counties and acre units)

There are themes that account for minor error in both the 2004 and 2005 inventories. One is small artifacts that are hard to properly interpret whether or not they are indeed prairie dog colonies. Two, dispersal rate between the time the aerials were photographed and time of field ground truthing. Small artifacts (typical less than 2 acres) are not always discernable by the interpreters. Although a high percentage of colonies down to 1-2 acres or less were interpreted, some artifacts were impossible to make a confident interpretation. Spatial movement between aerial capture and ground truthing will continue to influence some minimal error in this type of interpretation technique. However, overall the methods that were used to produce this interpretation were highly accurate and will lend itself to an even higher accuracy assessment during future black-tailed prairie dog mapping surveys.

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