COLONY ACREAGE AND DISTRIBUTION OF THE BLACK-TAILED PRAIRIE DOG IN SOUTH DAKOTA, 2020.

SOUTH DAKOTA DEPARTMENT OF GAME, FISH AND PARKS
PIERRE, SOUTH DAKOTA

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Acronyms

ESRI	Environmental Systems Research Institute
GFP	South Dakota Department of Game, Fish and Parks
GIS	Geographic Information Systems
IFSAR	Interferometric Synthetic Aperture Radar
NAD	North American Datum
NAIP	National Agriculture Imagery Program
QC	Quality Control
USDA	United States Department of Agriculture
UTM	Universal Transverse Mercator

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Executive Summary

We documented 422,548 acres (170, 999 ha) of black-tailed prairie dog (*Cynomys ludovicianus*) colonies in 31 counties in South Dakota by visually interpreting aerial images within a GIS. Total colony acreage in 2020 was divided by landownership as follows: 119,333 acres (48,292 ha) on tribal lands and 303,215 acres (122,706 ha) on non-tribal land. The statewide (199,472 acres; 80,723.5 ha) and non-tribal (166,958 acres; 67,565.5 ha) colony acreage goals set forth in the state prairie dog conservation and management plan (Cooper and Gabriel 2005) were achieved in 2020, thus no changes in current management action are required.

Introduction

In response to a petition to list the black-tailed prairie dog (*Cynomys ludovicianus*) in 1998, several states began a cooperative process to retain management of this species. *The Black-tailed Prairie Dog Conservation Assessment and Strategy* (Van Pelt 1999) and *A Multi-state Conservation Plan for the Black-tailed Prairie Dog*, *Cynomys ludovicianus*, *in the United States* (Luce 2003) were produced. Van Pelt (1999) identified the need for multi-state management of the black-tailed prairie dog and Luce (2003) proposed long-term conservation actions for the multi-state management approach. The goal of both the conservation assessment and strategy and the multi-state conservation plan is to assure long-term conservation of the species, precluding the need for Endangered Species Act protection.

One of the proposed conservation actions outlined by Luce (2003) was the identification of colony acreage objectives at the national and state levels. The six acreage objectives developed were based on maintaining 1% and 0.1% of suitable habitat within core and secondary management areas, respectively as delineated by Bailey's ecoregions (Bailey et al. 1994). In South Dakota, the Northwestern Great Plains section was considered a core area, while the Nebraska Sandhills and North-central Great Plains sections were secondary management areas (Figure 1). South Dakota counties considered to be within the historic range of the species were within either the core or secondary management areas as delineated by the historical range of the species.

State-specific target acreage objectives outlined by Luce (2003) include maintaining:

1) a complex >5,000 acres (2,023.4 ha) in each state,
2) at least 10% of the total occupied acreage in colonies or complexes > 1,000 acres (404.7 ha) and
3) a species distribution within 75% or more of the counties in the historic range or historic geographic distribution.

A colony is a group of prairie dogs living together. A complex is a group of colonies within a certain distance of each other. The remaining acreage objectives apply to the range of the species within the United States and include:

4) maintaining at least the currently occupied acreage of black-tailed prairie dogs,
5) increase occupied black-tailed prairie dog acreage to at least 1,693,695 acres (685,414.0 ha) by 2011 and
6) maintaining at least the current black-tailed prairie dog occupied acreage in the two complexes greater than 5,000 acres (2,023.4 ha) that now occur on and adjacent to Conata Basin-Buffalo Gap National Grassland, South Dakota and Thunder Basin National Grassland, Wyoming.

Another important conservation objective identified by Luce (2003) was the implementation of state-level management plans. The South Dakota Department of Game, Fish and Parks (GFP) and South Dakota Department of Agriculture (now Department of Agriculture and Natural Resources) worked cooperatively to develop the *South Dakota Black-tailed Prairie Dog Conservation and Management Plan* (Cooper and Gabriel 2005). The plan was finalized and approved by the South Dakota legislature in 2005. One of the objectives in the state plan is to identify a state-specific acreage goal. The statewide black-tailed prairie dog colony acreage goal of 199,472 acres (80,723.5 ha) was set using those standards outlined by Luce (2003). To accommodate tribal management of black-tailed prairie dogs in South Dakota, the total state-wide colony acreage goal is divided by landownership with the goal of 166,958

acres (67,565.5 ha) on non-tribal land (state, federal, and private lands). Apportionment of the total state-wide acreage goal was done to recognize separate authority and management of black-tailed prairie dog acreage on tribal lands.

The strategy used to ensure the state meets its acreage objectives is the implementation of administrative and management actions in response to changes in colony acreage in the state (Cooper and Gabriel 2005). Actions change when non-tribal acreage increases or decreases: 1) >160,000 acres (64,749.7 ha), 2) between 160,000 and 125,000 acres (64,749.7 and 50,585.7 ha), and 3) <125,000 acres (50,585.7 ha). Sales of prairie dog toxicant would cease, with limited exceptions if the state-wide colony acreage trigger of < 145,000 acres (58,679.4 ha) is reached. Refer to Cooper and Gabriel (2005) for details on specific administrative and management actions. SDGFP has committed to monitoring colony acreage and distribution of black-tailed prairie dogs approximately every three years to determine what changes in administrative and management actions are needed and to monitor trends in acreage of this keystone species.

Study Area

The study area encompassed all or portions of 31 South Dakota counties which represent the current primary distribution of the species in the state (Figure 2). Black Hills topography was excluded by using 5-meter resolution interferometric synthetic aperture radar (IFSAR) digital elevation data to identify areas greater than 1,500 m elevation.

Methods

Interpretation

We acquired the 0.6 -meter resolution 2020 NAIP (National Agriculture Imagery Program) imagery (downloaded from https://nrcs.app.box.com/v/naip/folder/125278061791 on 11/05/2020 and 11/06/2020). The 2020 NAIP imagery for South Dakota was published on 10/30/2020, and the USDA typically makes NAIP imagery available for distribution 60 days after the end of a flying season. For each county we brought in the appropriate NAIP image and overlaid Public Land Survey System Section boundaries (downloaded from https://navigator.blm.gov/data on 5/17/2020). The Section boundaries functioned as a grid. Each Section was scanned for prairie dog colonies and every colony seen was digitized. Once a Section was completed, we marked it as checked and moved to the next Section. We typically scanned for prairie dog colonies at a scale of 1:7,000 – 1:10,000. This allowed each observer to cover ground in a reasonable amount of time while still being zoomed in enough to see any prairie dog colonies. Colonies from the 2012 mapping effort were occasionally used to assist in confirming the presence of a colony, but never to search for a colony. Each digitized polygon was considered a colony. Colonies that were intersected by roads or other natural features were digitized as separate colonies. All digitizing was performed with ArcGIS Pro 2.6.1.

Two primary characteristics were used to detect black-tailed prairie dog colonies on aerial images. Mounds of excavated soil are created at black-tailed prairie dog burrow entrances. These mounds are typically one to three meters in diameter and are often void of vegetation (Hoogland 2006a). Size, lack of vegetation and differences in soil color make burrow-entrance mounds detectable on aerial images. Black-tailed prairie dog herbivory within a colony causes changes in vegetation composition and height between a colony and surrounding landcover (Dalsted et al. 1981, Detling 2006). Contrast in vegetation was often the first characteristic observed when scanning for colonies (Figure 3a). Presence of burrow

mounds helped to confirm the area was a colony (Figure 3b). Vegetation contrast was used in combination with burrow presence to detect colonies and digitize polygons. Prairie dog mounds were easily detectable from NAIP imagery, but signs of status (active vs. inactive) and more fine-grained signs of colony activity (e.g., individual prairie dogs, fresh diggings, feces, etc.) could not be detected.

Initial Quality Control

Once an observer digitized all colonies in a county, a second observer selected a random 10% of the digitized colonies to perform an initial quality control. The second observer would check to see that the digitized colonies were indeed colonies and make any minor boundary edits as necessary.

Verification Activities

Once the colonies in a county had been fully digitized and gone through an initial quality control (QC), we performed truthing activities in that county to confirm the presence of select mapped colonies and determine activity status. In areas with adequate road coverage, we performed ground-truthing. For counties with limited road availability, we performed aerial-truthing. A few counties had a mix of both.

For each method we would compile a sample of prairie dog colonies to check and devise a route to check these colonies. Routes were drawn targeting large colonies or clusters of colonies. Once the colony polygons and route were selected and drawn, they were loaded onto ArcGIS Field Maps. ArcGIS Field Maps was ideal for this project because it allowed for data collection and editing in an offline environment. We also employed Avenza Maps to easily track our locations in real-time. We estimate our effective observation distance to be approximately 0.5 miles (0.80 km) from the roadside and a plane.

If a colony was inaccessible it was recorded as such. If a colony was accessible, it was marked as either active, inactive, or not a colony (misidentification). A colony was considered active if prairie dogs or signs of activity were seen (e.g., fresh diggings, clipped vegetation, etc.). Any new colonies seen that had not been digitized were also marked for later digitization. These were colonies that may have been missed during digitization, or newly formed colonies since the NAIP imagery was taken. Route modifications were made in the field as necessary to account for impassable or inaccessible roads (ground-truthing only).

During ground-truthing, two observers would drive the route and attempt to field verify the colonies. One observer was the driver and the other was the data recorder. Aerial-truthing was performed using a three-passenger fixed wing airplane (1982 Cessna 172 SkyHawk II). Two observers and a pilot flew each flight. The plane flew at approximately 115 mph (185.1 km/h) at 250 – 300 feet (76.2 – 91.4 meters) above ground.

Distribution and Ownership

Using ArcGIS Pro 2.6.1, we determined prairie dog colony acreage by county and land ownership. Acreages were calculated for each colony using NAD 1983 UTM Zone 13N or 14N depending on which zone it fell in. We divided landownership into 4 categories (state, federal, tribal, and other). County boundaries from the 2020 Census were acquired from the Census Bureau (downloaded from https://www.census.gov/cgi-bin/geo/shapefiles/index.php on 05/12/2021). State owned lands were further subdivided into School and Public Lands, Game Production Areas, and Parks and Recreation Areas. Federal lands were divided into Bureau of Land Management land, Corps of Engineers land,

National Park Service land, US Fish and Wildlife land, and US Forest Service land. Colony acres on tribal lands were determined based on the most recent tribal trust data available.

To calculate colony acres by county, the boundary of each county was used to clip the final GIS layer of prairie dog colonies. This was needed because some colonies straddle county lines. To calculate acreage by land ownership, we used the above clips of colonies by county and performed more clips, this time using each of the land ownership GIS layers to clip each layer of prairie dogs by county. Once all these clips were performed, they were merged back together as appropriate, and county and landownership type was summarized.

Complex Analysis

Monitoring the acreage and distribution of colonies provides only a part of what is happening on the landscape. The spatial arrangement of neighboring colonies provides information on the ecological resilience of this species and the quality of available habitat for wildlife species associated with the prairie dog. A complex is at least two or more colonies with a pre-defined maximum inter-colony distance (Hoogland 2006a; Figure 4). We categorized complexes by size (colony and non-colony area) and the number of colonies within a complex.

In the interest of providing information that is meaningful for the continued management and conservation of black-tailed prairie dog ecosystems, two sizes of complexes were generated in ArcGIS Pro 2.6.1 using different maximum inter-colony distances (Figure 4). The first and largest of the two was created by buffering colonies in our final colony layer by 1.86 miles (3 km). This provided a maximum inter-colony distance of 3.73 miles (6 km) between any colony boundaries defined by our digitizing. This distance represents a maximum distance traveled by prairie dogs dispersing among colonies (Hoogland 2006b). The second and smaller of the two complex sizes was similarly generated in a GIS but had a 0.78-mile (1.25 km) colony buffer distance. This provided a maximum inter-colony distance of 1.55 miles (2.5 km). This shorter inter-colony distance improves the probability of recolonization should a colony die out (Hoogland 2006b). Complex size is calculated as the sum of both the colony and non-colony area in the buffer.

Results

Eight observers were used for image interpretation. Each county was interpreted by a single observer. Three of those observers interpreted 74% of all counties in the study area. Colonies were detected in 29 of the 31 counties or portions of counties evaluated (Figure 5). No colonies were detected in Campbell and Lawrence counties.

There were 15,472 polygons digitized totaling 422,548 colony acres (170,999 ha). This represents 1.4% of the total area of the twenty-nine counties where colonies were detected (30,574,918 acres; 12,373,230 ha). Polygons ranged in size from less than one acre to 3,847 acres (1,557 ha). Average polygon size was 27.3 acres (SD = 81.0 [11.1 ha, SD = 32.8]). A small percentage of all colony acres occurred east of the Missouri River (2.1% or 8,714 acres; [3,526 ha]). Colonies in Meade, Oglala Lakota, Pennington, Dewey, and Corson counties accounted for half (50.0%) of all colony acres in the study area. Refer to Table 1 for total colony acres in each county.

Tribal and non-tribal colony acres

Total colony acreage was divided by landownership as follows: 119,333 colony acres (48,292 ha) on tribal lands and 303,215 colony acres (122,707 ha) on non-tribal lands (Table 1). Colony acreage on tribal lands (119,333 acres; 48,292 ha ha) accounted for 28.2% of the total colony acres mapped in 2020 (Figure 6). Oglala Lakota (formerly Shannon County) had the most colony acres on tribal lands (33,757 acres; 13,661 ha). Oglala Lakota, Dewey, and Corson counties have almost sixty percent (57.8%) of all colony acres found on tribal land.

Colonies on non-tribal lands (state-, federal- and privately-owned lands) accounted for 71.8% (303,215 acres; 122,707 ha) of the total colony acreage in 2020 (Figure 6). Meade County had the most colony acres on non-tribal lands (52,088 acres; 21,079 ha; Table 2). Non-tribal acreage was broken down further according to ownership: 59,229 acres (23,969 ha) on public lands and 243,986 acres (98,738 ha) on privately-owned lands. There were approximately 50,830 colony acres (20,570 ha) on federal land and 8,399 colony acres (3,399 ha) on state land (Table 3). Pennington County had the most colony acres on publicly owned lands (26,341 acres; 10,660 ha). Meade County had the most colony acres on private lands (49,411 acres; x ha). Pennington had the most acres on federal land (25,771 acres; 10,429 ha) and Meade had the most acres on state land (1,820 acres; 737 ha) and other land (49,411 acres; 19,996 ha). State and federal agencies own or manage lands with colonies that accounted for 2.0% (8,399 acres) and 12.0% (50,830 acres; 20,570 ha) of all colony acres mapped, respectively (Table 3, Figure 6). Private lands had the highest percent of all non-tribal colony acres (57.7% [243,986 acres; 98,737.6 ha]).

Large colonies

We digitized sixteen colonies in six counties with an area of at least 1,000 acres (404.7 ha; Table 4). There were no colonies greater than 5,000 acres (2,023 ha) in South Dakota in 2020. The largest colony was 3,847 acres (1,557 ha) in Pennington County. The total acreage of colonies greater than 1,000 acres (404.7 ha) accounts for 6.1% of the 422,548 colony acres (170,999 ha) mapped. At least one colony was present in 29 of the 38 counties included in the historic range of this species.

Verification

Digitized polygons were verified in the field by either driving or flying along routes that were chosen to maximize the number of colonies observed. This may have underrepresented colonies that were more isolated. Seven individuals conducted verification activities on 16 days from 9 March through 2 November 2021. (Table 5). Two aerial flights and 14 drives covered approximately 1,290 miles (2,076 km) and 3,200 miles (5,150 km), respectively (Table 6 and Figure 7).

We attempted to field verify 770 polygons representing 67,697 colony acres; we observed 557 digitized polygons. Of these, 213 polygons representing 10,301.5 acres were inaccessible, 505 polygons representing 53,587.4 acres were active colonies, 20 polygons representing 357.8 acres were inactive colonies, 32 polygons representing 3,450.1 acres were misidentified, and 3 colonies representing 86.7 acres were new colonies discovered during field verification. If a polygon was determined by field verification to be inactive or misidentified, it was removed from the final GIS layer. New colonies discovered during field verification were added to the final GIS layer.

Our field verification efforts represented 15.9% of the total colony acres before adjustments ((67,697 field validation acres / 426,269.2 initial total acres) x 100 = 15.9%). We removed the inactive and misidentified acres and added the new acres to arrive at our final colony acreage (422,548 final colony

acres = 426,269.2 initial total acres – (357.8 inactive colony acres + 3,450.1 misidentified colony acres) + 86.7 new colony acres). Based on our truthing efforts, we correctly identified 94.9% of digitized polygons as prairie dog colonies ((1 – (3,450.1 / 67,697)) x 100 = 94.9%) and missed only 0.1% (((86.7 / (67,697 + 86.7)) x 100 = 0.1%). Of the 53,945.2 (21,830.8 ha) acres confirmed as colonies, 99.3% were active (53,587.4 acres; 21,686.1 ha) and 0.7% were inactive (357.8 acres; 144.8 ha). If these trends hold true for the entire state, suggest we misidentified 21,724 acres (426,269.2 x 0.05 = 21,724) and missed 545 acres (426,269.2 x 0.001 = 545) for a total closer to 405,090 acres (426,269.2 - 21,724 + 545 = 405,090).

Colony complexes

Seventy-seven complexes were generated with a 3.73 mile (6 km) maximum inter-colony distance (Figure 8). Complex size ranged from 7,178 acres (2,904.8 ha) to 18,488,639 acres (7,482,087 ha) and averaged 259,365 acres (SD = 2,091,097.9, [104,961.9 ha, SD = 846, 240.7]). Complexes contained an average of 200.3 colonies (SD = 1,695.9). Half of the complexes (50.6%) contained either 2 or 3 colonies; 27.3% contained 4, 5, or 6 colonies. The largest complex contained 14,985 colonies. Average colony size within a complex ranged from less than an acre to 226.6 acres (91.5ha). At most, 3.6% of a complex was comprised of colony acres.

Nine hundred and one complexes were generated with a 1.55 mile (2.5 km) maximum inter-colony distance (Figure 9). Complex size ranged from 1,292 to 1,641,083 acres (523.0 to 664,125.5 ha). Average complex size was 9,909.3 acres (SD = 63,721 [4,010.2ha, SD =25,787.2]). Complexes contained an average of 16.5 colonies (SD =149.6). Forty-seven percent of the complexes contained 2 or 3 colonies; 23.5% contained 4, 5, or 6 colonies. The largest complex contained 2,636 colonies. Average colony size within a complex ranged from less than an acre to 388.9 acres (157.4 ha). At most, 17.5% of a complex was comprised of colony acres.

Discussion

State management plan objectives

The statewide (199,472 acres; 80,723.5 ha) and non-tribal (166,958 acres; 67,565.5 ha) colony acreage goals set forth by Cooper and Gabriel (2005) were achieved in 2020. Thus, there is no required change in state management actions.

Multi-state management plan objectives

South Dakota has met the three state-specific target acreage and distribution objectives outlined in the multi-state management plan (Luce 2003). Although there are no colonies in South Dakota >5,000 acres (2,023.4 ha), all complexes with a separation distance up to 6 km are >5,000 acres. Also, 19% (285) of the complexes with a separation distance up to 3 km are >5,000 acres. Less than 10% of the total colony acres in South Dakota are in colonies >1,000 acres (404.7 ha). All complexes are larger than 1,000 acres (404.7 ha). Black-tailed prairie dog colonies are present in at least 29 of the 38 counties (76%) found within the historic range of the species in South Dakota.

Trends in colony acreage and distribution

This report summarizes the sixth colony monitoring effort conducted by SDGFP. In 2014, a sampling method was used, and results are not directly comparable (Kempema et al. 2015). Total colony acreage in 2020 decreased 25% from 2012 (Figure 10). Total acreage in 2020 is similar to acreage mapped in 2003. Statewide colony distribution remains similar to previous mapping efforts with the majority of

colonies found west of the Missouri River. Since our mapping efforts began, slightly less than half of the colony acres mapped occurred on non-tribal lands. In 2020, 71.8% of colony acres occurred on non-tribal lands. The tribal landownership layer used to calculate these values was based on the most recent information available to us. Calculations based on updated tribal land ownership information may differ from what is reported here. Refer to Table 7 for trends in colony acres for each county. Please refer to Stukel et al. (2004), Kempema (2007), Kempema et al. (2009), and Kempema et al. (2015) for details on previous survey efforts.

High density area only

In 2006, counties or portions of counties were classified as having high or low colony acreage (Figure 11). A census of these counties has been conducted during five of the six monitoring efforts making a temporal comparison of colony acreage within this area useful. In 2006, transects were used to sample the colony acreages within the counties considered low acreage (Kempema 2007) and in 2014 a spatially balanced sampling grid was used to sample colony acres.

During the five years with census data, colony acres in high acreage counties represented approximately 85% of colony acres mapped in South Dakota each of those years. In 2020, 68% of all colony acres in South Dakota occurred in these counties. Both Todd and Oglala Lakota counties had drastic declines in colony acreage. Both counties historically have had high colony acres.

Both precipitation and plague can influence the acreage and distribution of prairie dog colonies. Archived weather data were downloaded from the High Plains Regional Climate Center (https://hprcc.unl.edu/stationtool/explore.php?sid=CWDS2&variable=pcpnAnn&startDate=20020101&endDate=20201231). We used data from the Cottonwood 2E weather station #391972 (northwestern Jackson County; Latitude 43.9599, Longitude -101.8538) as the best representative location for our area and because it provided a complete data set. Annual precipitation in 2020 was well below the 30-year average. Plague has been present in Todd and Oglala Lakota counties since the early 2000's and may help explain decline in colony acres in these counties.

Recommendations

In 2014 GFP implemented the method recommended by McDonald et al. (2011) to standardize monitoring across the species' range. As per Kempema et al. (2015), the sampling method did not provide the data needed to answer some of the questions posed in both the range-wide and state-level management plans. Given the differences between methods, results from the 2014 survey were not directly comparable with the other 5 census efforts conducted by GFP. Therefore, the methods implemented in this report will continue to be used to monitor the acreage and distribution of black-tailed prairie dogs in the state. However, GFP should continue to work with other states and researchers towards a reliable estimate of range-wide acreage and distribution. The method implemented by GFP is likely compatible with the recommended range-wide sampling method mentioned above. A sample of the census results could be taken to adhere to the range-wide methodology.

Despite the benefits of conducting a census using aerial imagery, improvements to the current methodology should be made. Photo interpretation is not completely accurate and efforts to verify the information in the field are currently made from the ground using a vehicle and from the air using a plane. The use of different verification methods may introduce variation. Also, the verification methods are not repeatable. Verification of photo interpretation should be done using only one method and

routes selected using a protocol that is repeatable by others. The use of the airplane proved to be the most time efficient given the amount of area that can be covered in a day. However, scheduling flights may pose a challenge in some instances and the use of vehicles may be preferred when training observers. In addition, those counties that lack mapped colonies (i.e. Campbell and Lawrence) also need to be verified to ensure that colonies were not missed during photo interpretation. Verification methods should produce a correction factor to address interpretation errors and inactive colony status. This would improve statewide colony acreage values. Development of this correction factor would likely require more intensive verification or a ground sampling effort.

Over the last 17 years, GFP has monitored the acreage and distribution of colonies on average every 3.4 years (excluding the 2014 effort). As per the state prairie dog management plan, GFP is to monitor every three years. During the 2020 effort, 10 people were involved including GIS, wildlife, and animal damage control program staff putting in over 2,700 hours. It has taken approximately two years from photo acquisition to final drafting of this report. Staff also need to incorporate other duties during colony monitoring. In addition, there was significant GIS staff turnover. Given the length of time a monitoring effort may take and the reliability GFP has shown in conducting monitoring efforts, frequency of monitoring should be decreased to occur approximately every 5 years.

Additional information would enhance the interpretation of colony acreage and distribution results. Plague and poisoning are known to influence the acreage and distribution of colonies. Although anecdotal information on plague presence and occurrence of outbreaks is available, especially in areas where black-footed ferrets have been reintroduced, there is no standardized disease monitoring program or comprehensive database to track and better understand plague in South Dakota.

More information on the acreage of colonies poisoned in South Dakota would also enhance our understanding of current colony acreage and distribution. Poisoning is one of the primary management tools used to control prairie dogs and was one of the threats (overharvest or lack of regulatory mechanisms) to the species evaluated during the proposed listing of this species under the Endangered Species Act. Lastly, an updated tribal lands layer is also needed to calculate the non-tribal colony acres more accurately.

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Tables

Table 1.Black-tailed prairie dog colony acreage and distribution on tribal and non-tribal lands in South Dakota, 2020

County		Colony Acres			
Name	**Area (acres)**	**Tribal**	**Non-tribal**	**Total**	**%**
Bennett	761,888	2,949	6,965	9,914	2%
Brule	541,745	0	292	292	0%
Buffalo	312,167	122	515	637	0%
Butte	1,450,570	0	7,710	7,710	2%
Campbell	493,335	0	0	0	0%
Charles Mix	736,151	0	73	73	0%
Corson	1,618,977	17,134	15,819	32,954	8%
Custer	997,800	0	23,934	23,934	6%
Dewey	1,564,972	18,086	21,914	40,001	9%
Fall River	1,119,465	0	16,820	16,820	4%
Gregory	674,254	72	2,022	2,093	0%
Haakon	1,169,237	0	4,290	4,290	1%
Harding	1,713,994	0	6,631	6,631	2%
Hughes	512,464	795	2,557	3,352	1%
Hyde	554,396	225	1,065	1,289	0%
Jackson	1,197,606	8,014	10,873	18,887	4%
Jones	621,368	0	6,042	6,042	1%
Lawrence	512,199	0	0	0	0%
Lyman	1,092,403	1,453	2,291	3,745	1%
Meade	2,228,994	3	52,088	52,091	12%
Mellette	838,966	9,192	9,150	18,342	4%
Oglala Lakota	1,341,666	33,757	10,748	44,506	11%
Pennington	1,782,054	3	41,576	41,579	10%
Perkins	1,849,583	0	21,966	21,966	5%
Potter	575,140	0	924	924	0%
Stanley	970,987	552	10,403	10,955	3%
Sully	684,923	0	1,441	1,441	0%
Todd	890,148	9,494	3,757	13,251	3%
Tripp	1,035,253	1,037	8,315	9,351	2%
Walworth	476,565	0	705	705	0%
Ziebach	1,261,182	16,442	12,330	28,772	7%
Totals	**31,580,452**	**119,333**	**303,215**	**422,548**	**100%**

Table 2. Black-tailed prairie dog colony acreage and distribution on public and privately-owned non-tribal lands in South Dakota, 2020.

	Public				
County	State	Federal	Total	**Private**	**Total**
Bennett	140	734	874	6,091	6,965
Brule	10	1	10	281	292
Buffalo	0	0	0	515	515
Butte	290	1,138	1,429	6,281	7,710
Campbell	0	0	0	0	0
Charles Mix	0	0	0	73	73
Corson	387	1,382	1,768	14,051	15,819
Custer	1,215	6,171	7,385	16,548	23,934
Dewey	425		425	21,489	21,914
Fall River	323	3,452	3,775	13,045	16,820
Gregory	2	10	12	2,009	2,022
Haakon	31	0	31	4,259	4,290
Harding	891	260	1,152	5,479	6,631
Hughes	26	42	68	2,489	2,557
Hyde	16	11	27	1,038	1,065
Jackson	78	2,153	2,231	8,642	10,873
Jones	148	276	424	5,618	6,042
Lawrence	0	0	0	0	0
Lyman	163	249	412	1,880	2,291
Meade	1,820	857	2,677	49,411	52,088
Mellette	87		87	9,062	9,150
Oglala Lakota	0	3,184	3,184	7,564	10,748
Pennington	571	25,771	26,341	15,235	41,576
Perkins	987	2,635	3,621	18,345	21,966
Potter	29	0	29	896	924
Stanley	171	2,503	2,674	7,730	10,403
Sully	153	0	153	1,288	1,441
Todd	0	0	0	3,757	3,757
Tripp	18	0	18	8,297	8,315
Walworth	20	1	22	684	705
Ziebach	400	0	400	11,930	12,330
Total	8,399	50,830	**59,229**	**243,986**	**303,215**

Table 3. Black-tailed prairie dog colony acreage and distribution on public lands in South Dakota, 2020.

State	Colony Acres
School and Public Lands	6,861
Game, Fish and Parks	
Game Production Areas	493
Parks and Recreation Areas	1,045
subtotal	8,399

Federal	Colony Acres
Bureau of Land Management	2,600
Corp of Engineers	881
National Park Service	12,693
U.S. Forest Service	33,912
U.S. Fish and Wildlife Service	745
subtotal	50,830
Total	**59,229**

Table 4. Location, number, and total acres of black-tailed prairie dog colonies greater than 1,000 acres in South Dakota, 2020.

County	# Colonies	Colony Acres
Corson	2	3,850
Dewey	2	2,591
Meade	6	9,662
Oglala Lakota	1	1,275
Pennington	4	7,169
Stanley	1	1,024
Total	**16**	**25,571**

Table 5. Date and location of activities conducted to evaluate aerial image interpretation of black-tailed prairie dog colony acres in South Dakota, 2021.

Month	Day	County
March	9	Brule, Buffalo, and Hyde
	22	Jones and Lyman
May	6	Mellette and Todd
June	9	Charles Mix and Gregory
	10	Corson, Dewey, Potter, Sully and Walworth
August	11	Oglala Lakota
September	15	Pennington
	16	Fall River
	23	Jackson
	27	Haakon
	28	Ziebach
October	8	Custer
	22	Bennett
	26	Hughes and Stanley
	27	Tripp
November	2	Butte, Harding, Meade, Perkins

Table 6. Miles driven or flown to verify aerial image interpretation of black-tailed prairie dog colony acres in South Dakota, 2021.

			Miles
County	Driven	Flown	**Total**
Bennett	147	0	147
Brule	48	0	48
Buffalo	65	0	65
Butte	0	173	173
Campbell	0	0	0
Charles Mix	77	0	77
Corson	0	216	216
Custer	263	0	263
Dewey	2	168	170
Fall River	182	0	182
Gregory	144	0	144
Haakon	179	80	259
Harding	0	205	205
Hughes	120	0	120
Hyde	86	0	86
Jackson	290	0	290
Jones	125	0	125
Lawrence	0	0	0
Lyman	132	0	132
Meade	37	122	159
Mellette	67	0	67
Oglala Lakota	177	0	177
Pennington	434	6	440
Perkins	38	219	257
Potter	0	5	5
Stanley	154	2	156
Sully	0	28	28
Todd	37	0	37
Tripp	160	0	160
Walworth	0	8	8
Ziebach	229	57	286
Total	3,193	1,290	**4,483**

Table 7. Black-tailed prairie dog colony acres and distribution in South Dakota over time, based on Game, Fish and Parks prairie dog monitoring efforts.

County	2003	2006	2008	2012	2020
Bennett	6,511	10,742	10,456	8,074	9,914
Brule	1,277	na	1,158	1,207	292
Buffalo	1,983	na	2,888	1,190	637
Butte	2,009	4,400	5,052	5,129	7,710
Campbell	0	na	136	300	0
Charles Mix	245	na	535	417	73
Corson	26,213	40,646	41,081	42,534	32,954
Custer	13,213	18,936	26,518	26,181	23,934
Dewey	48,342	58,720	80,655	37,510	40,001
Fall River	9,291	16,855	22,367	16,495	16,820
Gregory	1,131	1,457	1,715	2,056	2,093
Haakon	1,483	2,965	2,582	2,686	4,290
Hand	252	na	3	na	
Harding	2,976	4,235	4,110	2,063	6,631
Hughes	1,449	na	2,283	1,106	3,352
Hyde	729	na	2	1,147	1,289
Jackson	11,586	25,550	22,864	21,077	18,887
Jones	2,536	2,967	5,682	4,591	6,042
Lyman	5,781	10,853	10,749	10,780	3,745
Meade	18,116	23,115	27,091	30,784	52,091
Mellette	37,960	65,578	56,261	35,246	18,342
Pennington	36,804	57,909	63,489	69,287	41,579
Perkins	8,093	12,690	18,735	12,553	21,966
Potter	162	na	598	270	924
Oglala Lakota	90,736	144,336	119,483	95,695	44,506
Stanley	5,813	8,140	9,439	9,984	10,955
Sully	815	na	1,272	1,275	1,441
Todd	49,884	76,250	50,009	51,163	13,251
Tripp	3,360	8,708	4,813	7,075	9,351
Walworth	538	na	0	772	705
Ziebach	22,834	30,357	38,820	27,994	28,772
Totals	**412,122**	**625,409**	**630,846**	**526,641**	**422,548**

See Stukel et al. (2004), Kempema (2007), Kempema et al. (2009) and Kempema et al. (2015) for a description of the study area and methods used for each year. Not applicable (na) indicates these counties were not included in the survey in that particular year.

Figures

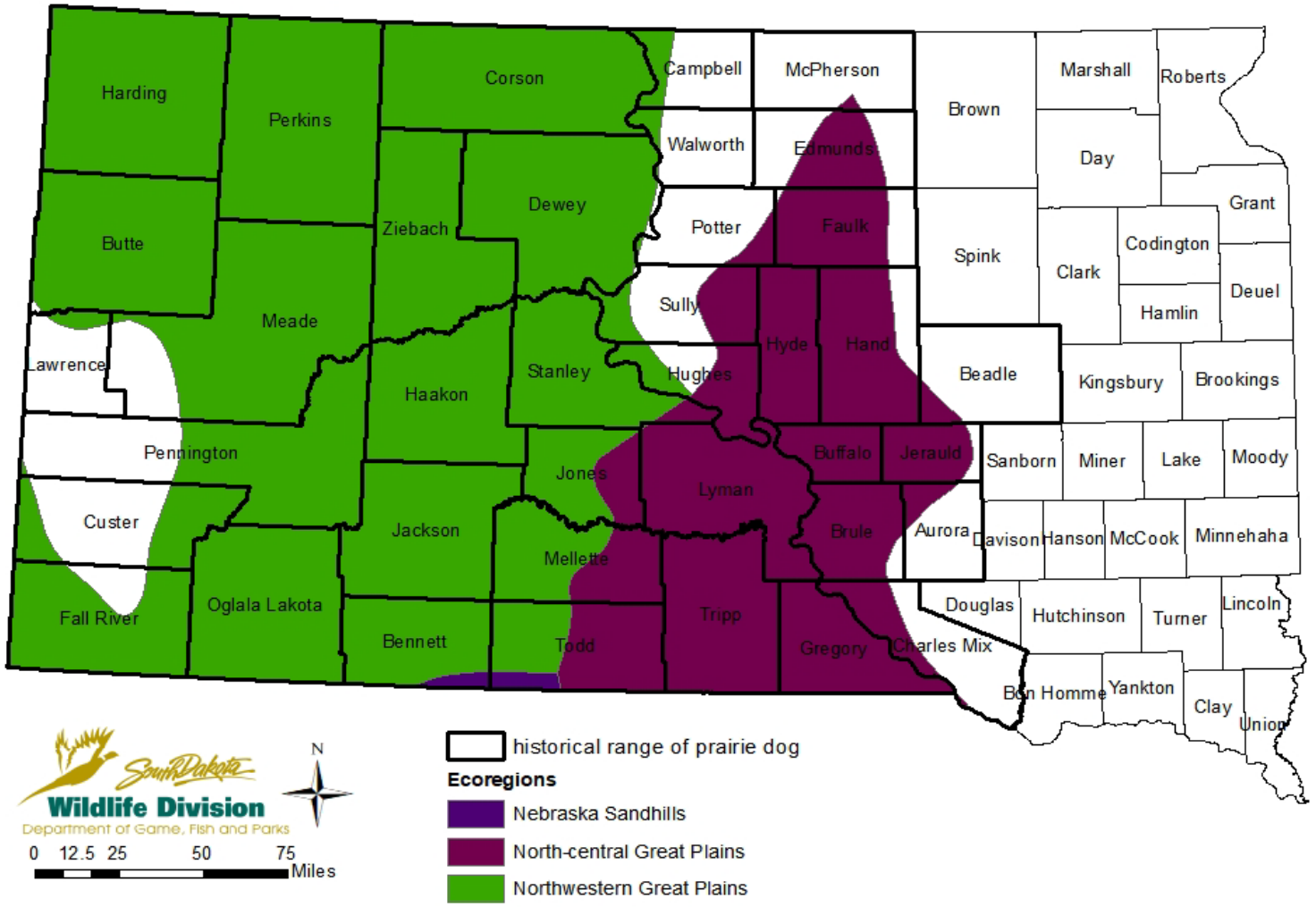

Figure 1. Core (Northwestern Great Plains) and secondary (Nebraska Sandhills and North-central Great Plains) management areas within the historical range of the black-tailed prairie dog (Hall 1981).

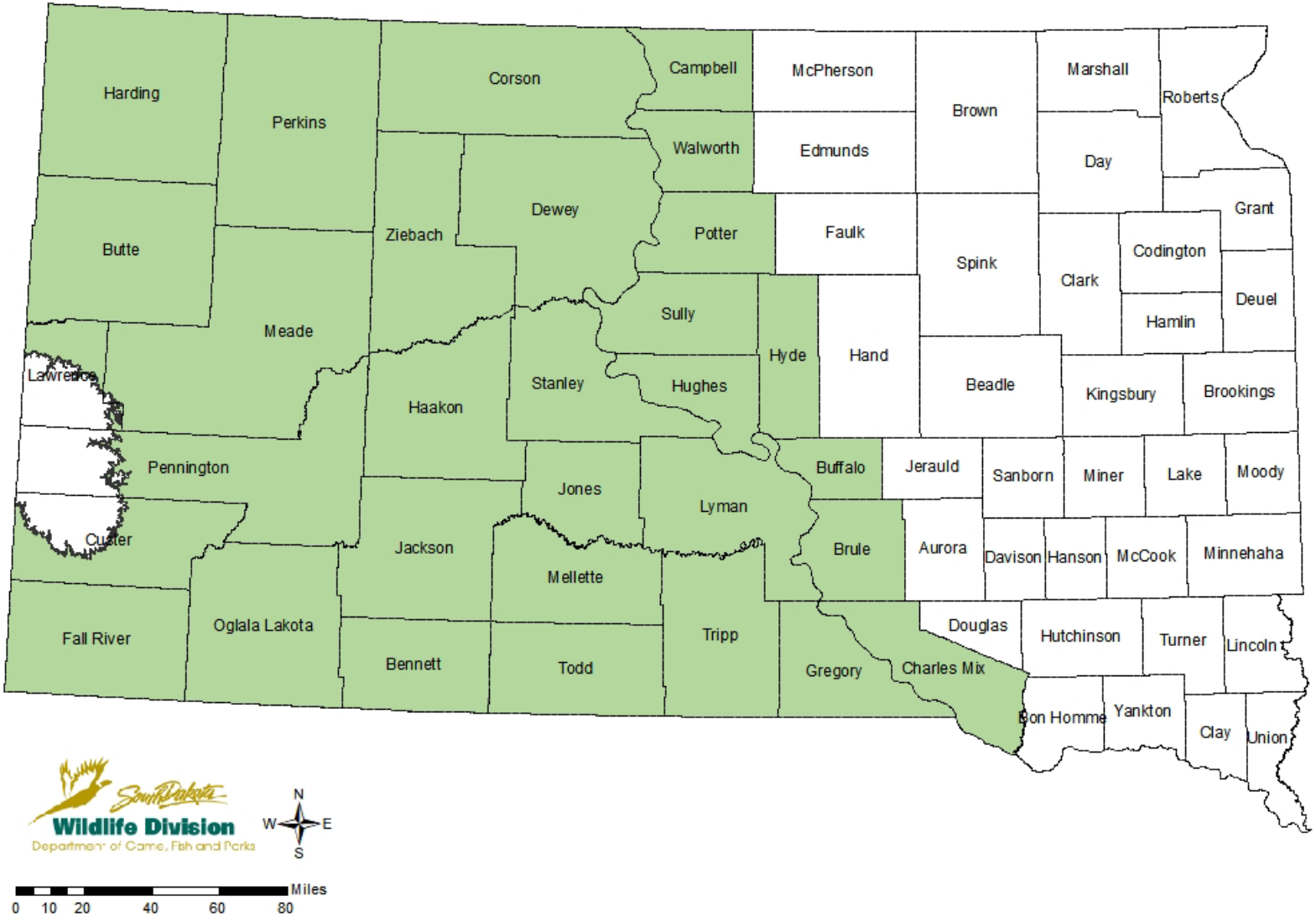

Figure 2. Study area searched for acreage and distribution of black-tailed prairie dog colonies in South Dakota, 2020.

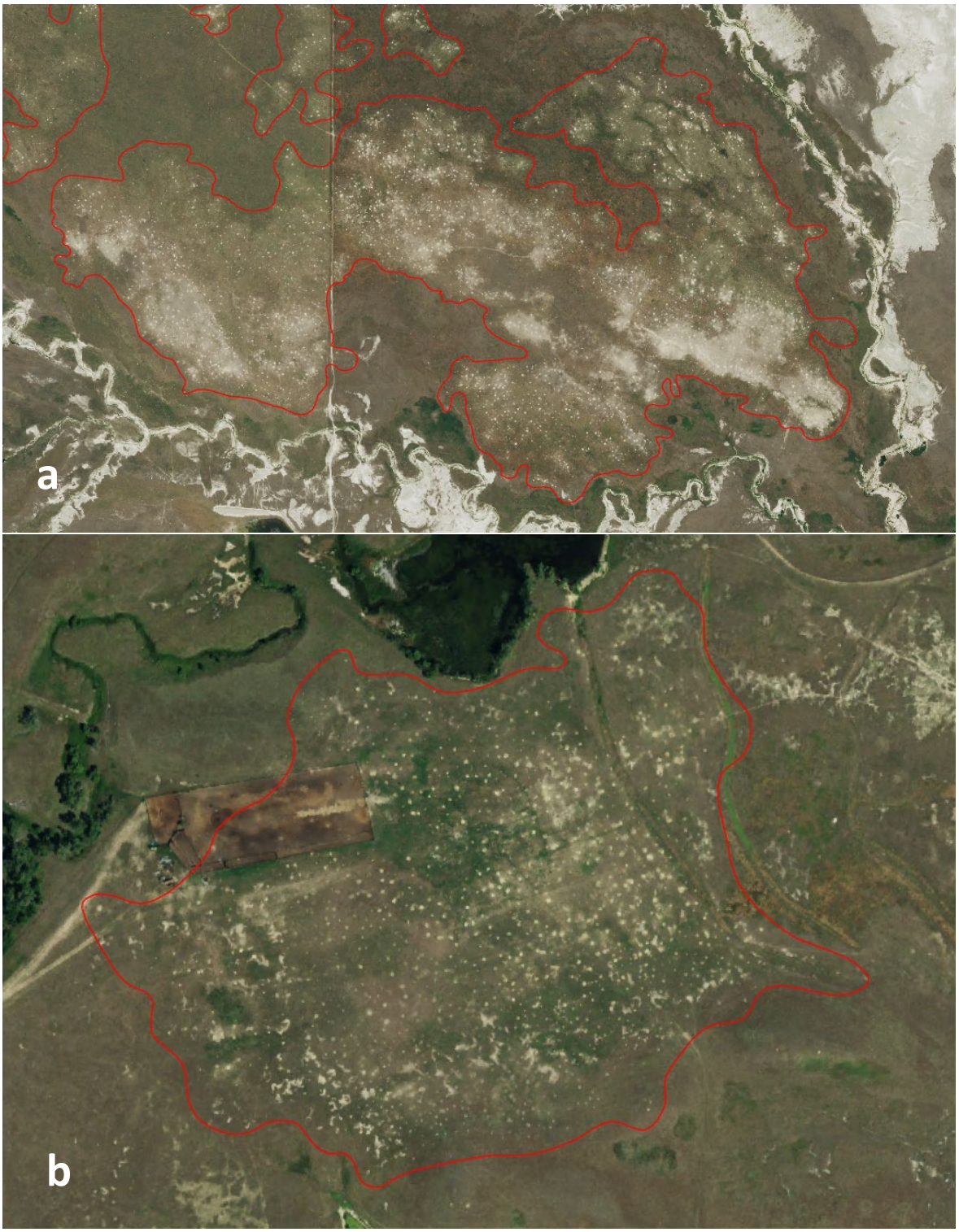

Figure 3. Aerial images showing (a) contrasting land cover and (b) burrow-entrance mounds used to indicate and delineate a black-tailed prairie dog colony. Digitized colony shown in red.

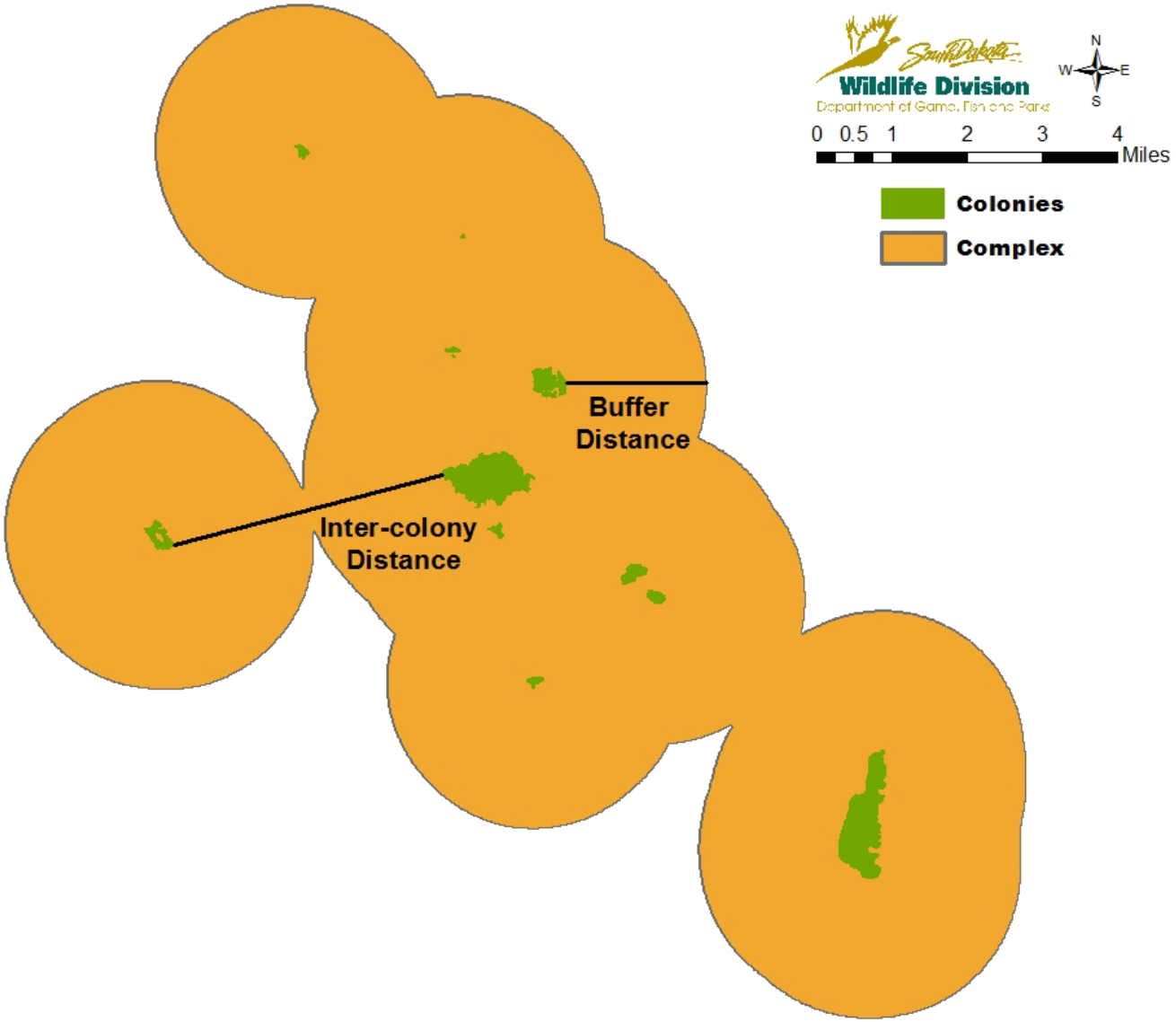

Figure 4. Illustration of a prairie dog complex.

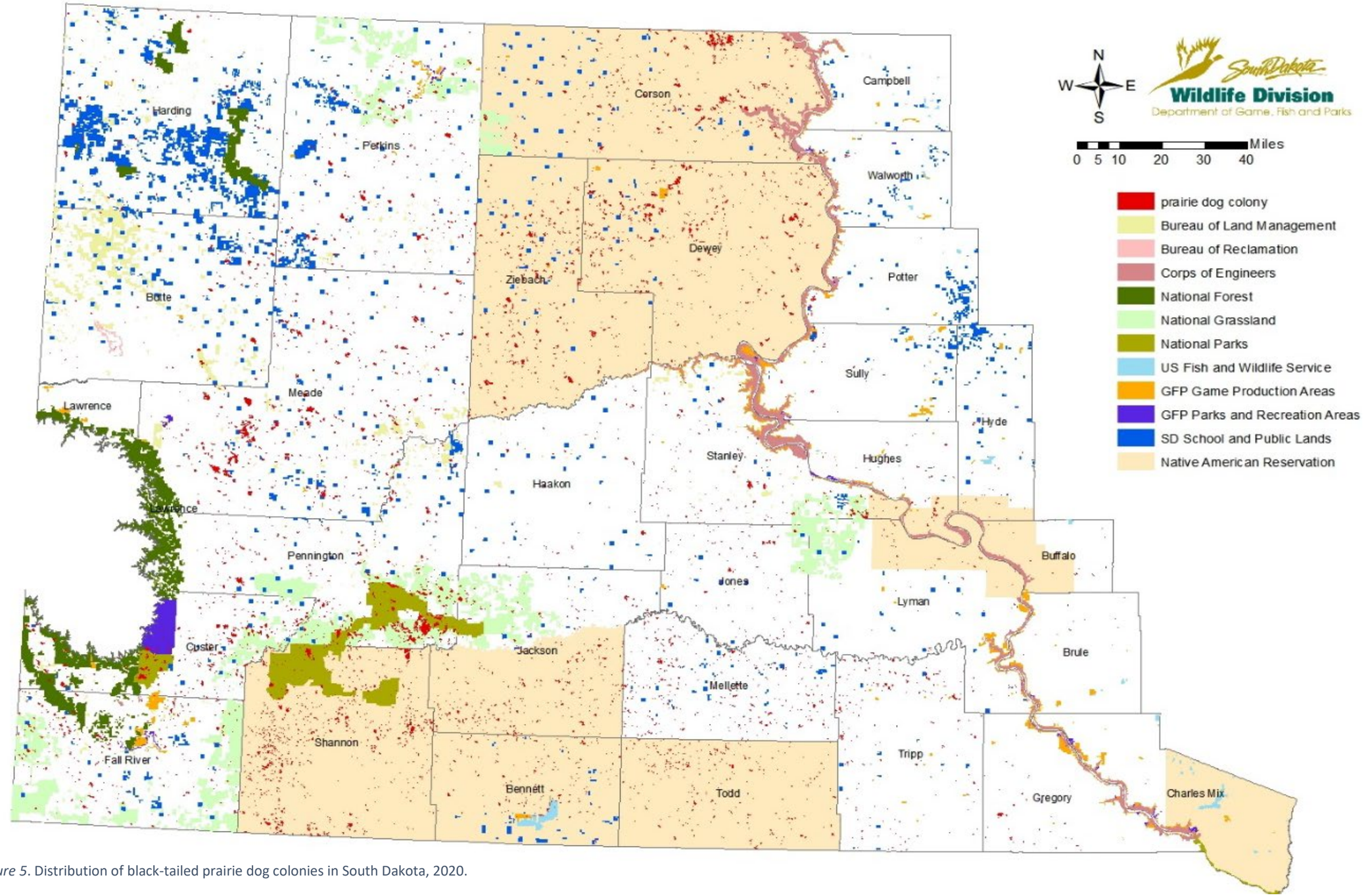

Figure 5. Distribution of black-tailed prairie dog colonies in South Dakota, 2020.

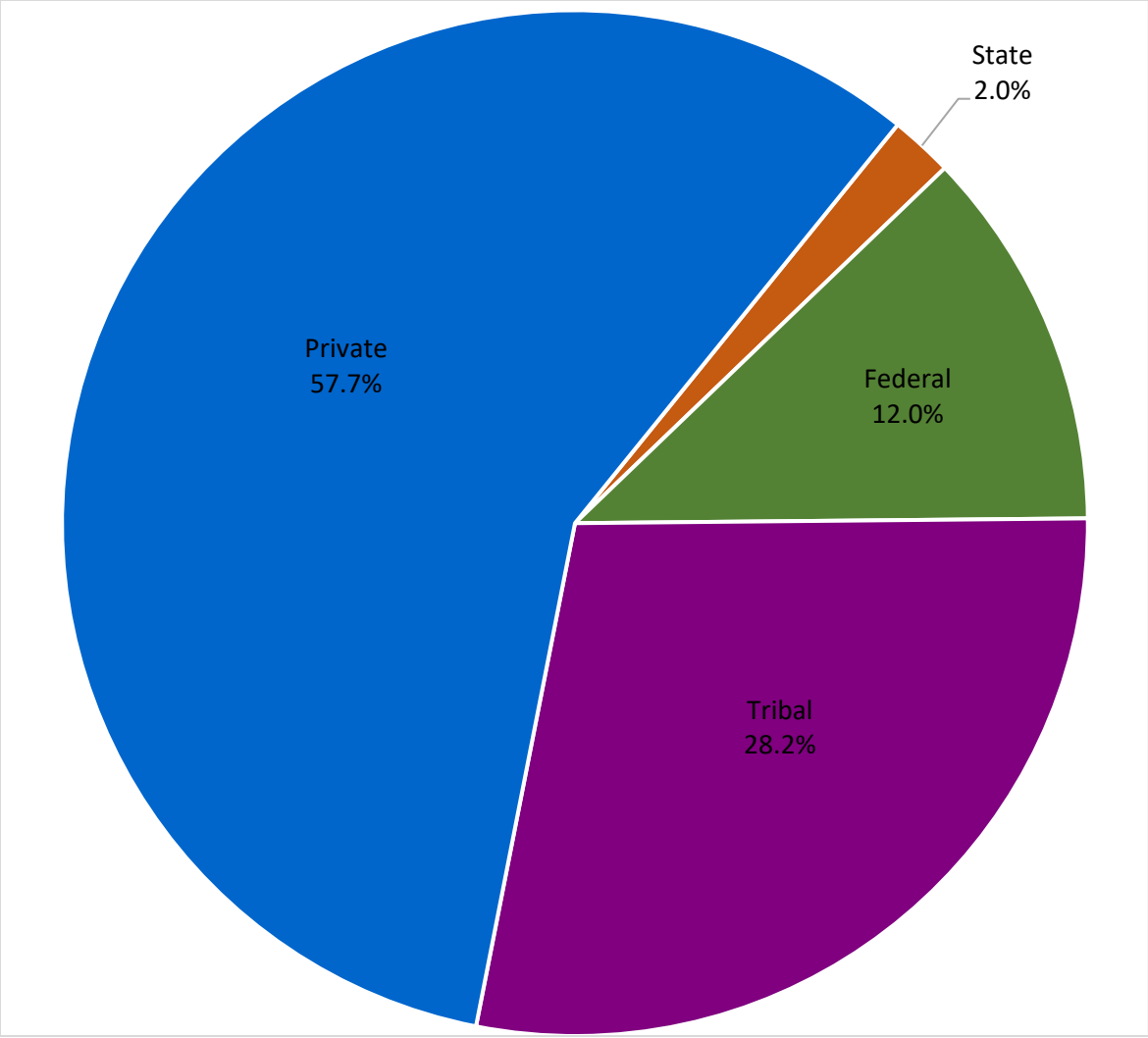

Figure 6. Percent composition of black-tailed prairie dog colony acres by land ownership in South Dakota, 2020. State-, federal-, and privately-owned lands are classified as non-tribal.

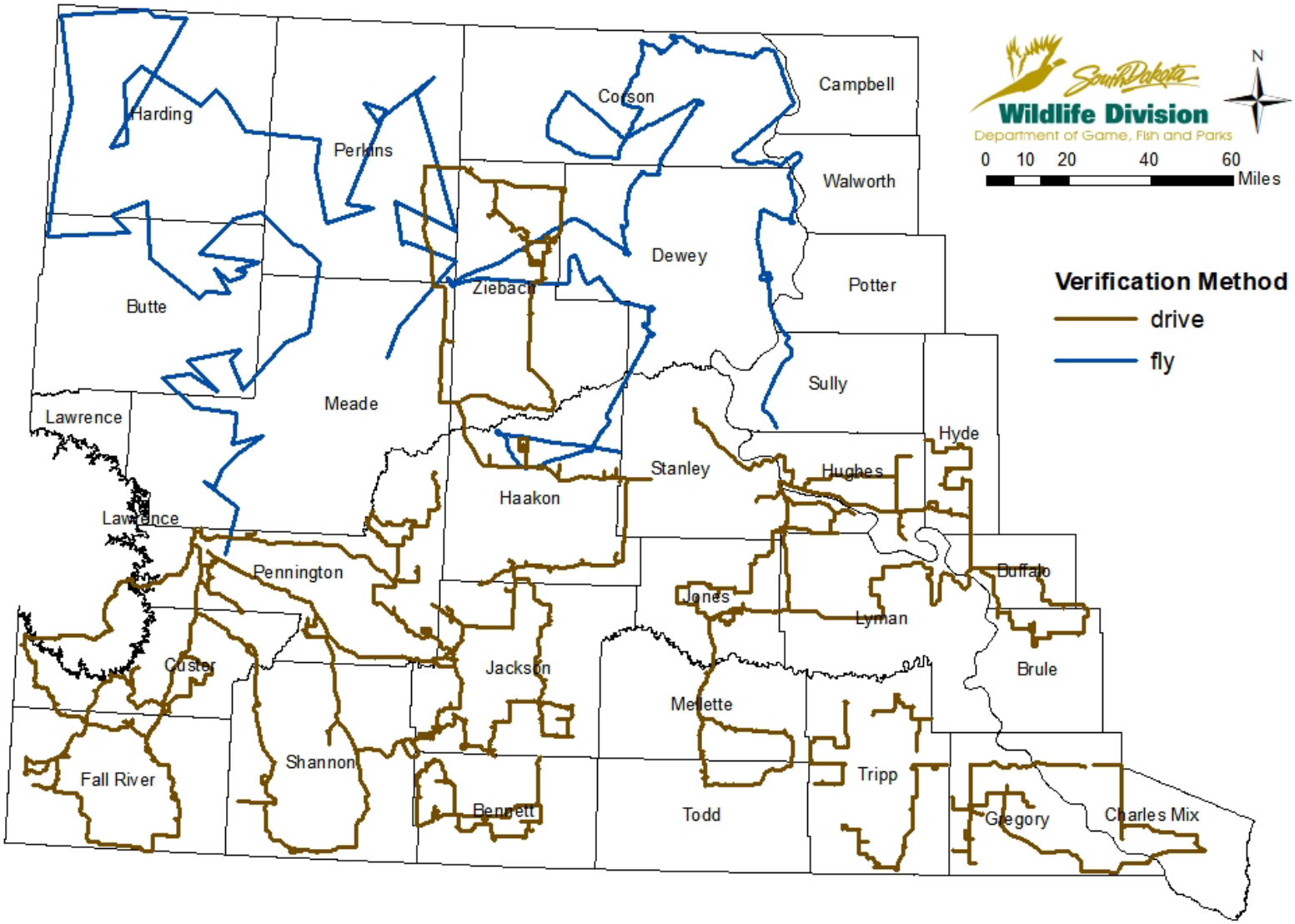

Figure 7. Location of routes used to verify aerial image interpretation of the distribution and acreage of black-tailed prairie dog colonies in South Dakota, 2021.

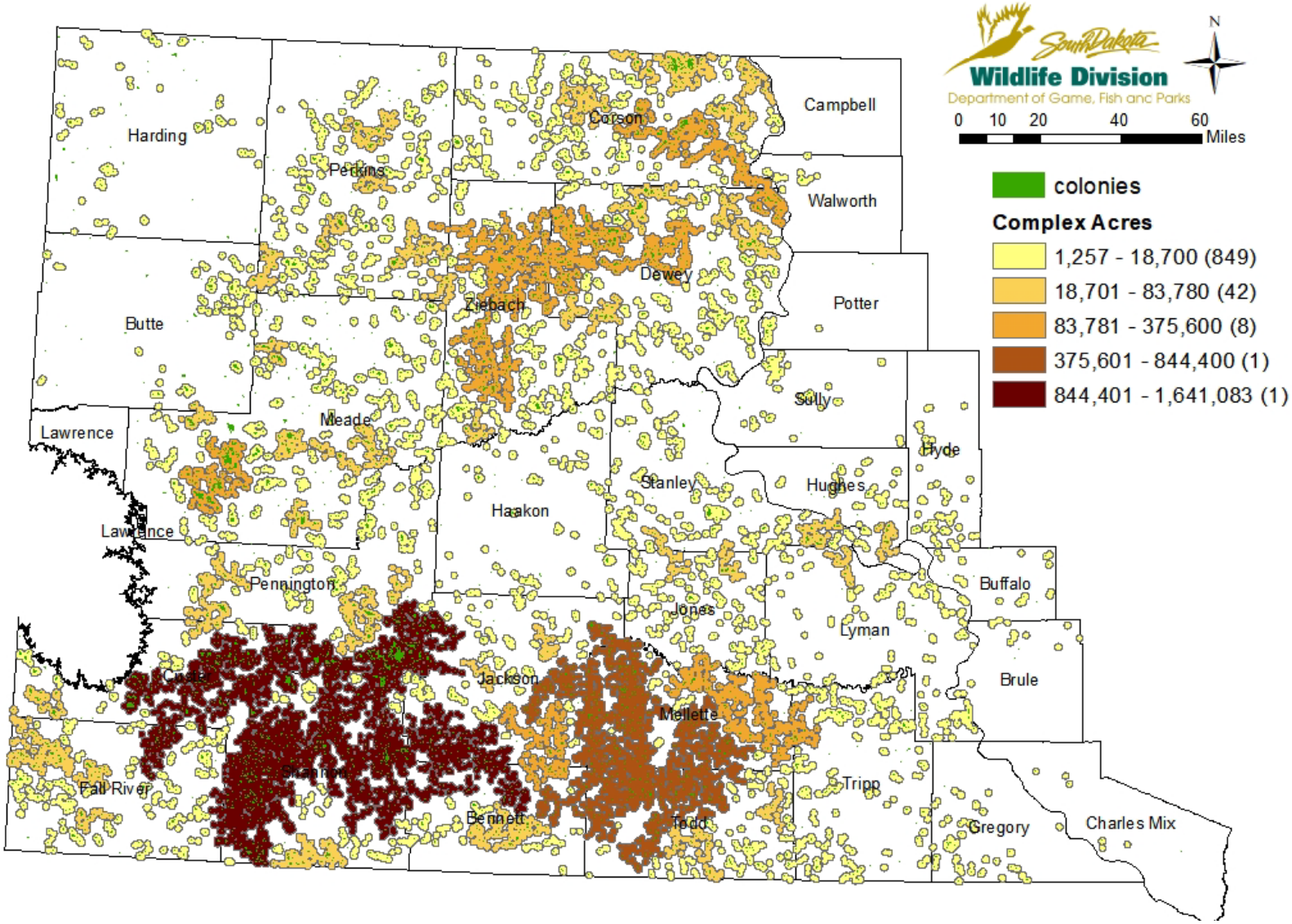

Figure 8. Black-tailed prairie dog complexes (≥2 colonies) and a maximum intercolony distance of 3.73 miles (6 km) in South Dakota, 2020.

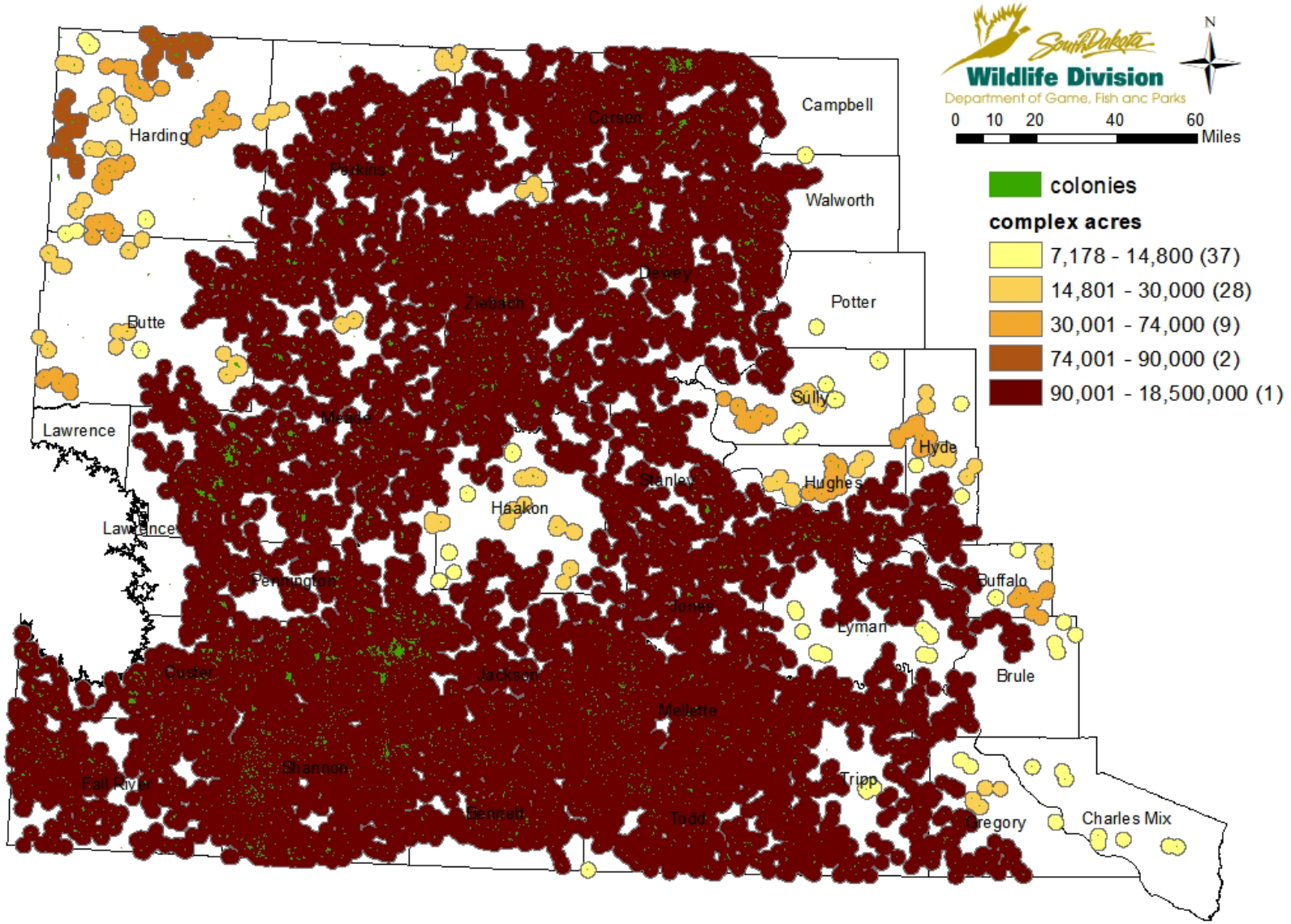

Figure 9. Black-tailed prairie dog complexes (> 2colonies) and a maximum intercolony distance of 1.55 miles (3 km) in South Dakota, 2020.

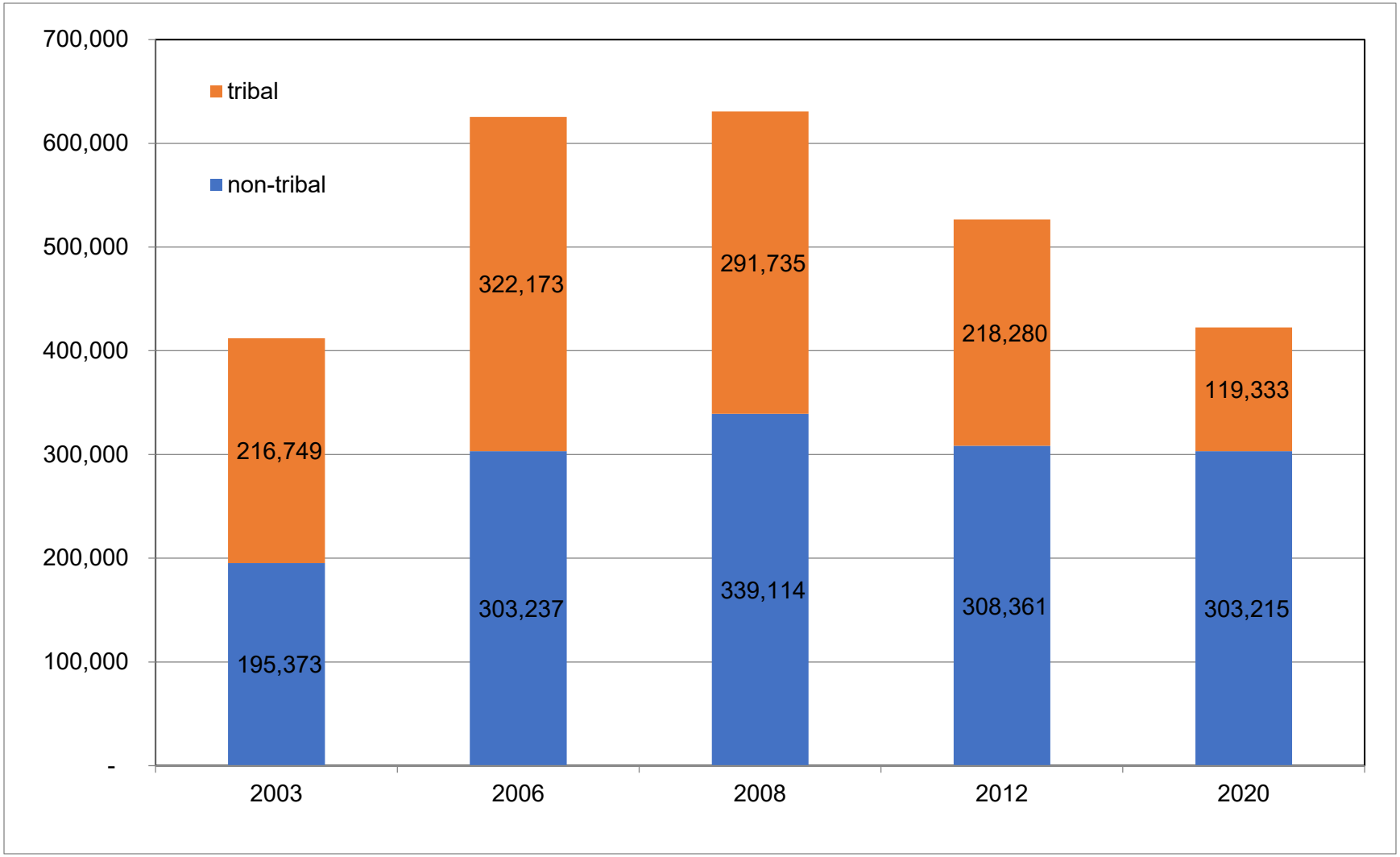

Figure 10. Black-tailed prairie dog colony acres in South Dakota over time. Refer to Stukel et al. 2004, Kempema 2007, Kempema et al. 2009, Kempema et al. 2015 and this report for details on study area and methods used during each year

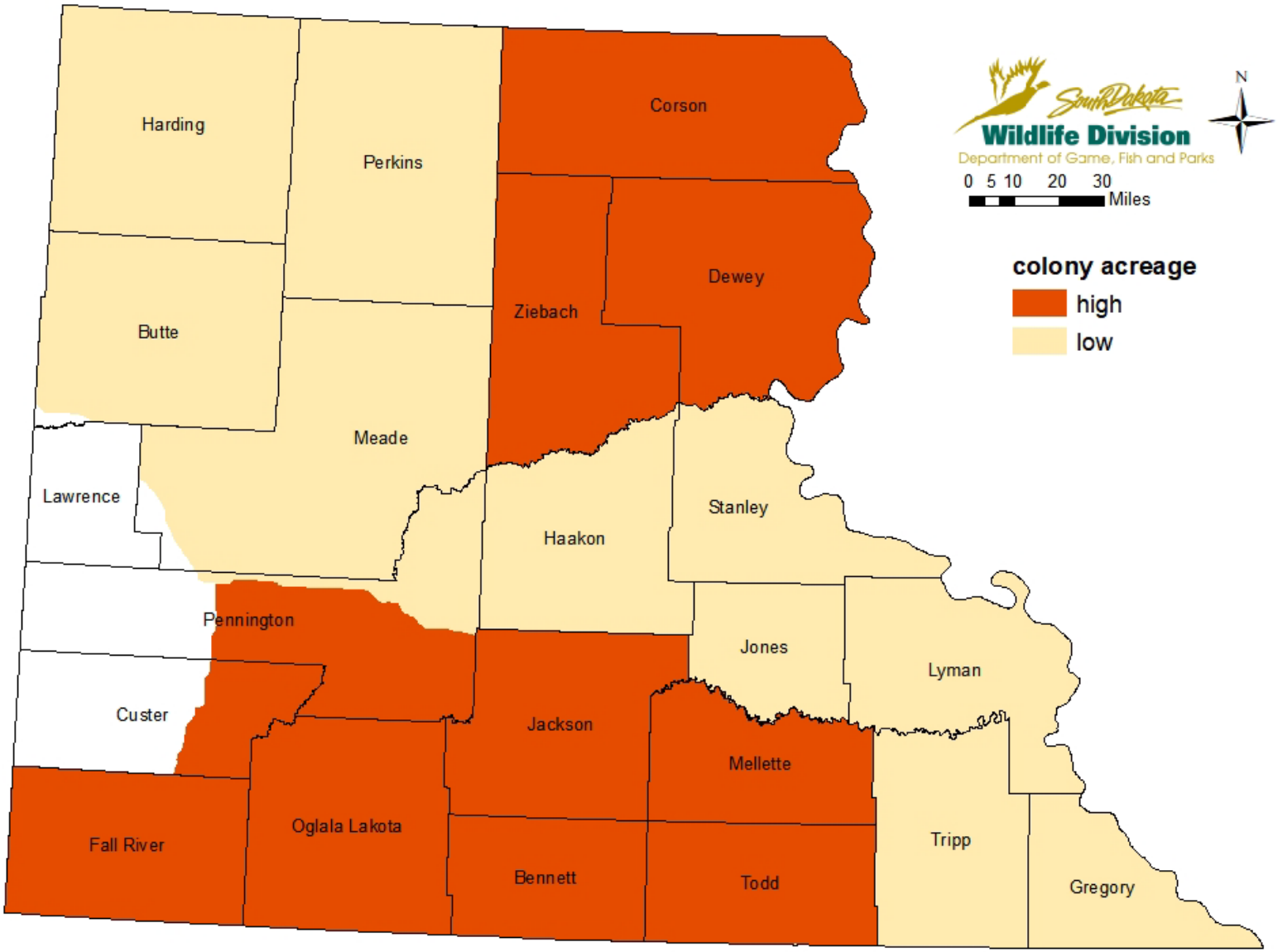

*Figure 11.*Classification of counties based on black-tailed prairie dog colony acres in 2006 (Kempema 2007).

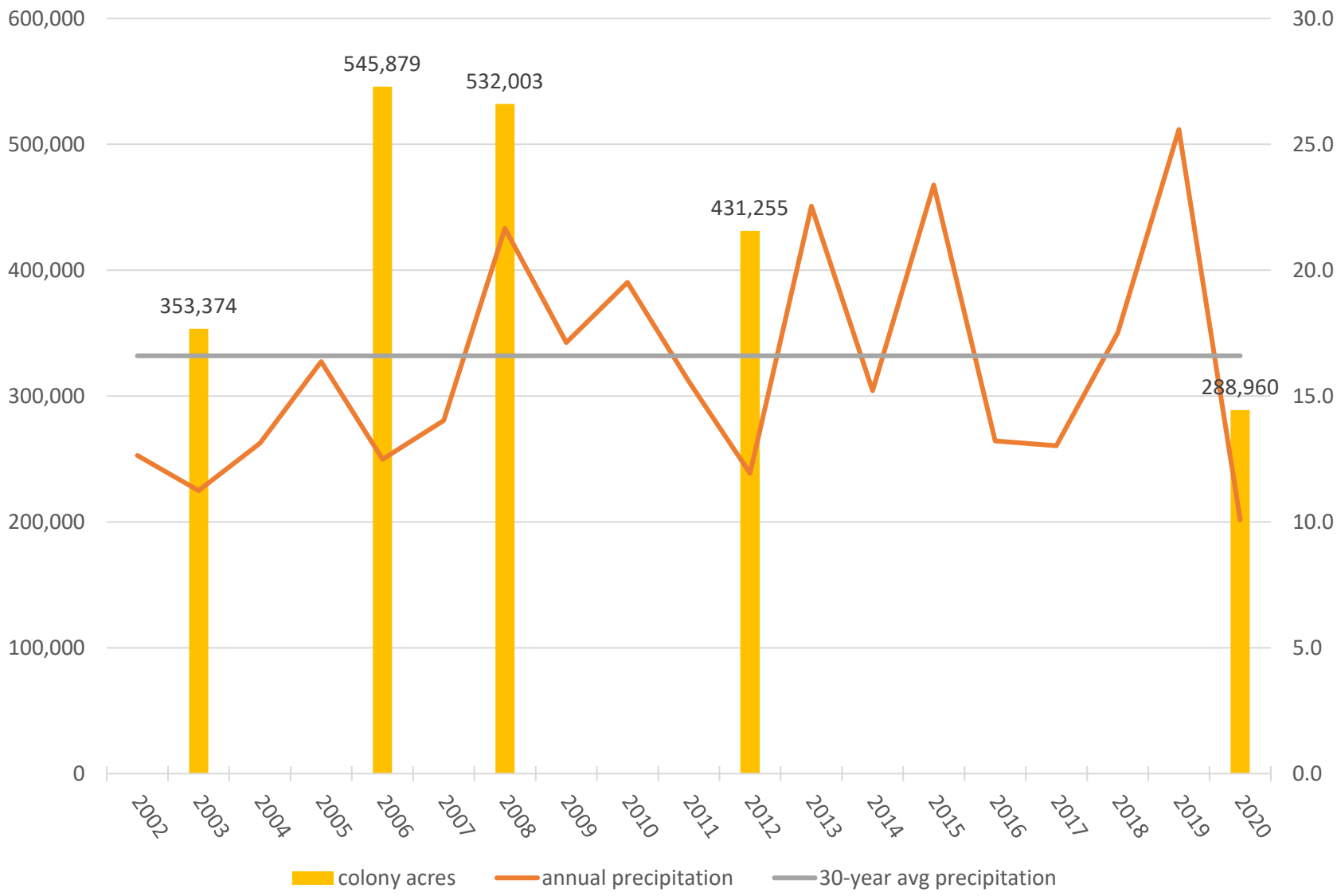

*Figure 12.*Black-tailed prairie dog colony acres in high acreage South Dakota counties (Kempema 2006). Annual precipitation values are from a weather station near Cottonwood, South Dakota.

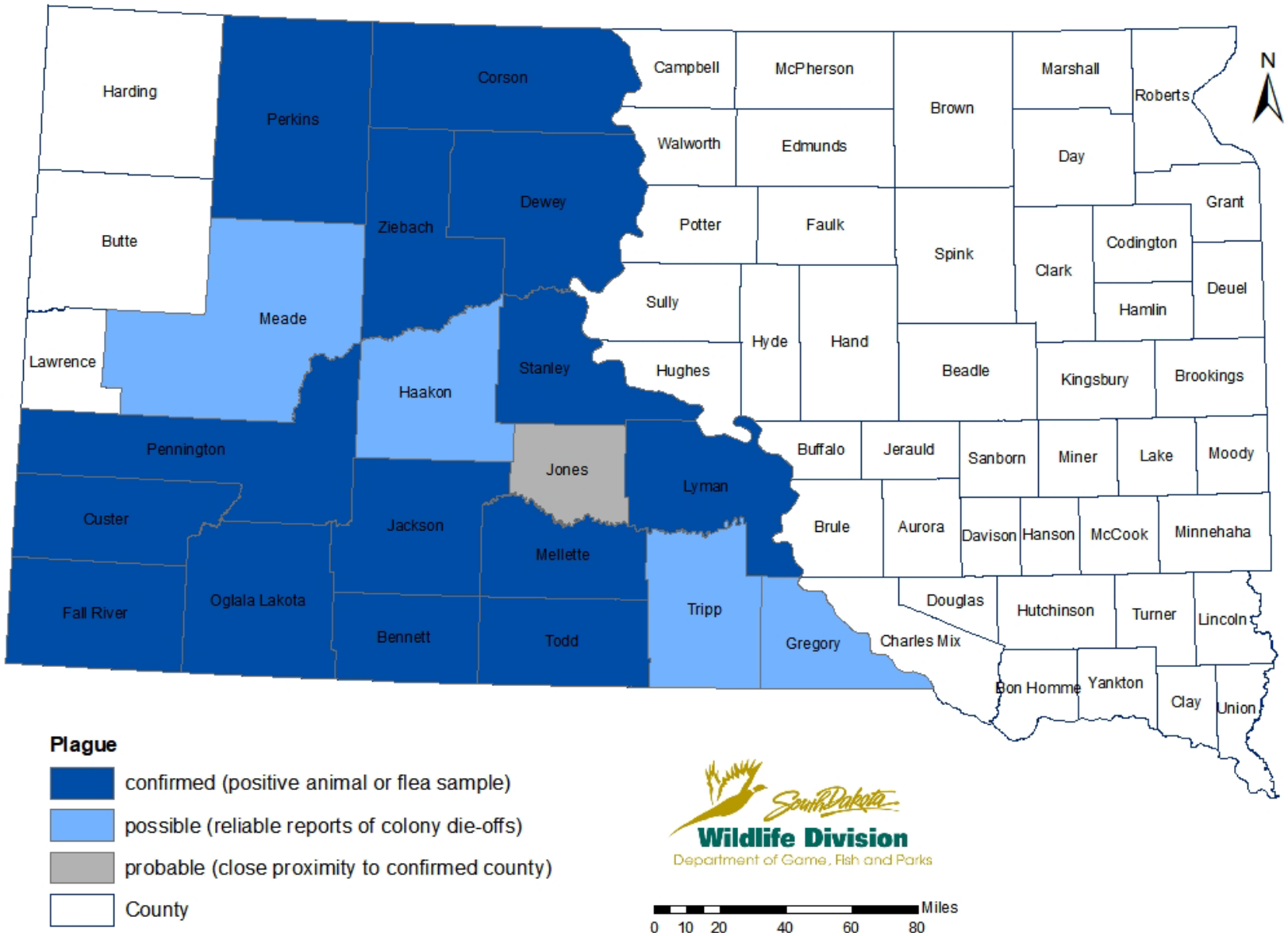

*Figure 13.*Distribution of plague (*Yersinia pestis*) in South Dakota as of 2022.