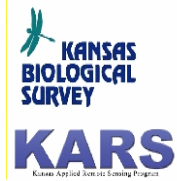




# Estimated Number and Area of Prairie Dog Colonies in Kansas in 2008

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Matt Peek, Kansas Department of Wildlife and Parks, P.O. Box 1525, Emporia, KS 66801, (620) 342-0658, [MattP@wp.state.ks.us](mailto:MattP@wp.state.ks.us)

Mike Houts, Kansas Applied Remote Sensing Program, University of Kansas, 129 Higuchi Hall, Lawrence, KS, 66045, (785) 864-1515 [MHouts@ku.edu](mailto:MHouts@ku.edu)

## Summary

Farm Service Agency (FSA) National Agriculture Imagery Program (NAIP) 2-meter resolution imagery from 2008 was used to locate prairie dog colonies in Kansas. Aerial surveys were then conducted to evaluate a portion of the colonies detected using NAIP imagery. From these efforts, rangewide estimates of the number and area of prairie dog colonies in Kansas were calculated. It was estimated that 4,257 colonies and 148,284 acres of prairie dogs existed in Kansas in 2008. Compared to the last rangewide prairie dog surveys in Kansas, which were conducted using aerial line transect surveys in 2000, the 2008 estimates represent a 10% decrease in the number of prairie dog colonies, and an 18% increase in colony area. Though prairie dogs appear abundant in approximately the western half of their range, substantial declines in the number and area of prairie dog colonies appear to have occurred in the east.

## Background & Methods

This project is a progression of recent prairie dog surveys conducted in Kansas. Prior to this effort, rangewide surveys were last conducted in Kansas using aerial line transect surveys in 2000 (Pontius, 2002). More recently, an assessment of 3 different survey techniques was conducted in order to identify a long-term survey technique for Kansas (Peek and Houts, 2008). As per the results of that effort, 2008 Farm Service Agency (FSA) National Agriculture Imagery Program (NAIP) 2-meter resolution imagery, available for free download off the internet, was used to identify the location and determine the area of prairie dog colonies in Kansas. Surveys were conducted within one mile (1.6 km) wide north/south transects, the center of which were spaced 4 miles (6.4 km) apart. In July 2009, following the completion of the NAIP survey, aerial surveys were conducted over a portion of the area to verify the accuracy of the colony identification.

As with Pontius (2002), prairie dog range in Kansas was divided into four quadrants to facilitate the survey effort. In the two western quadrants, stratified random sampling was used to identify ¼ of the transects. All colonies within selected transects were aeri-ally

evaluated for accuracy. Additional colonies opportunistically evaluated while flying from one selected transect to the next were also included in this analysis. In the two eastern quadrants where colonies were far more scarce, all of the colonies except for 5 in the Northeast (3 in Trego, 2 in Ness) were aerially evaluated.

As per the recommendation of Peek and Houts (2008), potential colonies detected in CRP were considered false positives and excluded from the analysis. Potential colonies in center pivot corners were also considered false positives and excluded from the analysis. These colonies were identified during the aerial survey, and the appropriateness of this decision was verified.

Activity status within a colony is an area that remains somewhat problematic. Since there are months of time between collection of NAIP satellite imagery and the aerial survey following the NAIP analysis, it is possible that activity status could change between survey techniques. Consequently, all colonies showing recent prairie dog activity (burrows with minimal or no vegetation and visible holes) during the aerial evaluation were included in this analysis, including colonies that were considered recently inactive. Colonies that were considered mostly inactive during the aerial survey were identified, and the entire area of these colonies was also included in the analysis. Colonies that had been inactive for a longer period of time (extensive vegetation on burrows and holes barely or not visible) were considered inactive at the time of the NAIP evaluation and excluded from this analysis among the false positives.

Based on the accuracy of NAIP colony identifications within each quadrant, colonies were randomly selected for exclusion from the analysis to achieve the proportion of accuracy determined during the flight check. But because larger colonies were more likely to be accurately identified, no colonies larger than the largest misidentified colony within each quadrant were eliminated from the analysis.

Data analysis was conducted using the model created by Pontius (2002). However, errors in Pontius' calculations were discovered and corrected for the 2008 survey. These errors impacted the results of the 2000 survey, so corrected values for this survey are provided below as well. Specifically, Pontius' model erroneously excluded transects that were surveyed, but within which no prairie dog colonies were identified. This error is apparent in Pontius' Table 1, in which transect sample sizes are provided. The actual number of transects surveyed are proved in the 2002 data tables below. While the western quadrant sample sizes are correct (i.e. prairie dog colonies were located in all of the western quadrants), 5 transects were erroneously excluded from the analysis in the northeast, and 10 were excluded in the southeast. The result of this error was that the colony and area estimates for the eastern quadrants were falsely inflated.

## **Results**

The number and area of prairie dog colonies identified using FSA NAIP imagery, and an evaluation of the accuracy of the NAIP technique based upon the results of the aerial

survey, can be found in Table 1. The NAIP technique was over 80% accurate in each quadrant in terms of area, but was less accurate with regard to the number of colonies identified. The number and area of colonies that were included in the analysis that were considered recently inactive or mostly inactive at the time of the aerial survey are provided in Table 2.

The corrected estimates for area and number of prairie dog colonies in Kansas in 2000 are found in Tables 3 and 4, respectively. The estimated area and number of prairie dog colonies in Kansas in 2008 are found in Tables 5 and 6, respectively. The estimated change in the number and area of prairie dog colonies in Kansas between 2000 and 2008 is provided in Table 7.

Table 1. Number and area of prairie dog colonies identified using FSA NAIP imagery, and the results of the aerial evaluation of the NAIP technique.

Quadrant	Initial NAIP Prairie Dog Colony Estimates		Prairie Dog Colonies Observed during Aerial Evaluation		Prairie Dog Colonies Accurately Identified		Percent of Prairie Dog Colonies Accurately Identified	
	Number	Area (ac)	Number	Area (ac)	Number	Area (ac)	Number	Area (ac)
northeast	37	595	32	520	16	425	50%	82%
northwest	629	17540	162	5220	132	5011	81%	96%
southeast	38	341	38	341	25	276	66%	81%
southwest	444	18790	145	4708	120	4326	83%	92%
Total	1148	37266	377	10789	293	10038	78%	93%

Table 2. Number and area of prairie dog colonies that were considered inactive and mostly inactive during aerial survey.

Quadrant	Inactive		Mostly Inactive	
	Number	Area (ac)	Number	Area (ac)
northeast	0	0	1	36
northwest	7	48	16	649
southeast	1	3	1	19
southwest	3	26	6	99
Total	11	77	24	804

Table 3. Estimated area of prairie dog colonies in Kansas in 2000.

Quadrant	Area (ac) of Quadrant	Estimated Area (ac) of Prairie Dog Colonies	Standard Error	90% Confidence Limits	Transects Sampled	Transect Population
northeast	8,177,280	4,714	1,350	(2,494; 6,935)	28	112
northwest	7,048,320	59,616	10,799	(41,852; 77,380)	27	108
southeast	8,467,840	10,278	2,374	(6,373; 14,183)	33	128
southwest	8,040,320	47,062	12,253	(26,906; 67,218)	32	132
Total	31,733,760	126,013	20,065	(93,006; 159,020)	120	480

Table 4. Estimated number of prairie dog colonies in Kansas in 2000.

Quadrant	Area (ac) of Quadrant	Estimated Number of Prairie Dog Colonies	Standard Error	90% Confidence Limits	Transects Sampled	Transect Population
northeast	8,177,280	296	63	(192; 400)	28	112
northwest	7,048,320	2,818	578	(1,867; 3,769)	27	108
southeast	8,467,840	283	60	(185; 382)	33	128
southwest	8,040,320	1,219	307	(714; 1,725)	32	132
Total	31,733,760	4,729	783	(3,441; 6,018)	120	480

Table 5. Estimated area of prairie dog colonies in Kansas in 2008.

Quadrant	Area (ac) of Quadrant	Estimated Area (ac) of Prairie Dog Colonies	Standard Error	90% Confidence Limits	Transects Sampled	Transect Population
northeast	8,177,280	2,118	659	(1,034; 3,202)	29	112
northwest	7,048,320	66,942	11,475	(48,066; 85,819)	27	108
southeast	8,467,840	1,121	305	(619; 1,623)	33	128
southwest	8,040,320	71,341	20,053	(38,353; 104,328)	32	132
Total	31,733,760	148,284	28,391	(101,580; 194,988)	121	480

Table 6. Estimated number of prairie dog colonies in Kansas in 2008.

Quadrant	Area (ac) of Quadrant	Estimated Number of Prairie Dog Colonies	Standard Error	90% Confidence Limits	Transects Sampled	Transect Population
northeast	8,177,280	94	22	(57; 130)	29	112
northwest	7,048,320	2,281	230	(1,902; 2,660)	27	108
southeast	8,467,840	101	23	(64; 139)	33	128
southwest	8,040,320	1,621	169	(1,343; 1900)	32	132
Total	31,733,760	4,257	344	(3,691; 4,823)	121	480

Table 7. Estimated change in the number and area of prairie dog colonies in Kansas from 2000 to 2008.

Quadrant	Change in Colony Number		Change in Colony Area (ac)	
	Number	Percent (%)	Number	Percent (%)
northeast	-202	-68	-2,596	-55
northwest	-537	-19	7,326	12
southeast	-182	-64	-9,157	-89
southwest	402	33	24,279	52
Total	-472	-10	22,271	18

## Discussion

The state's prairie dog population objective as provided in the Kansas Black-Tailed Prairie Dog Conservation and Management Plan (Kansas Black-Tailed Prairie Dog Working Group, 2002) was to maintain at least 130,000 acres, or to increase the area to 150,000 acres by 2012 if suitable landowner incentives were developed at the federal level. No such programs have been developed, but the latter objective was nearly met in 2008. However, the western half of the range is responsible for the relatively positive statewide status, and substantial declines have occurred in both number and area of prairie dog colonies in the east. In addition, both number and area of colonies have declined in the northwest quadrant since it was last surveyed in 2006 (Peek and Houts, 2008); by 7 and 24%, respectively.

The Plan also lists a strategy of maintaining the distribution of prairie dogs over 80% of the historic range (west of the Flinthills) in Kansas. Though vaguely defined in the Plan, it is questionable whether this strategy currently is being met. Other strategies relating to complexes are difficult to assess since a survey was conducted rather than a census.

Ants, gophers, and long inactive prairie dog colonies accounted for most of the false positives associated with the NAIP analysis. In many cases, it is difficult or impossible to differentiate these from active prairie dog colonies using NAIP imagery. Consequently, the follow up flight remains important. In addition, given that few prairie dog colonies exist primarily in agricultural land in Kansas (not to be confused with colonies that exist primarily in rangeland but extend into cropland), it is important to note landscape cover during NAIP analysis.

Recently inactive and mostly inactive colonies were included in this analysis. Though several large colonies were mostly inactive in the northwest, the northwest quadrant has a substantial number of prairie dogs, and the affect on each of the regions either with or without these colonies, especially when considered within the current confidence intervals, was minor.

In comparing the results between the 2000 and 2008 surveys, it is important to remember that the 2000 survey was conducted using the aerial line transect technique, while the

2008 survey used NAIP imagery, followed by aerial evaluation of the colonies. Based on the findings of the 2006 effort (Peek and Houts, 2008), the two survey types exhibit different detection probabilities, with the line transect survey detecting a smaller percent of the total estimated colony number than the NAIP technique (67 vs 81%). The line transect survey also detected a slightly smaller percent of the total estimated colony area than the NAIP technique in 2006 (91 vs 94%), but because area estimates with the line transect technique are based upon observer estimates, and different observers were used during the 2000 and 2006 surveys, line transect area detection rates cannot be adequately assessed from the 2006 effort.

## **Conclusions**

The NAIP technique performed adequately for this survey. Though false positives are still an area of concern with this technique, it is believed that these are adequately accounted for by identifying land cover types during the analysis, and by conducting an aerial survey of a portion of the colonies and correcting the initial values from which the estimates are calculated. The continuation of this technique in future surveys is recommended.

## **Acknowledgements**

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