Section-based Monitoring of Breeding Birds within the Shortgrass Prairie Bird Conservation Region (BCR 18)

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Executive Summary

In 2004, Rocky Mountain Bird Observatory (RMBO) implemented the fourth year of grassland bird-monitoring program within the shortgrass prairie region. During this year, RMBO conducted surveys in four western states (Nebraska, Colorado, Kansas, and Oklahoma) and five National Grasslands (Cimarron, Comanche, Kiowa, Pawnee and Rita Blanca). The objective of this program is to monitor population trends and distributions of grassland birds within the Shortgrass Prairie Bird Conservation Region (BCR 18) using section-based surveys, a road-based point count technique. A one square mile section is the basic land management unit of the prairie. The section-based survey technique was determined to be the most efficient and effective method for surveying and monitoring grassland birds (Hanni 2002) in a landscape dominated by private ownership.

RMBO surveyed 2,414 sections within BCR 18, 15 May – 3 July 2004. Sections were stratified by habitat then randomly selected for survey in proportion to habitat acreage on the landscape – 1,802 sections of native prairie habitat, 552 of dry-land agriculture habitat, and 60 of land in CRP. We observed 115 bird species. Included are 38 species of concern, as recognized by Partners In Flight (2004) and/or the participating state and federal agencies. We calculated density estimates for 49 species, analyzed by management unit, habitat type, percent shrub cover and percent grass cover >15 cm. Included among these density estimates are 22 species of concern, as recognized by Partners In Flight (PIF database 2004) and/or the participating state and federal agencies. We present distribution and index of abundance maps for 62 species.

In 2004, we conducted exploratory habitat analyses to determine habitat preferences of eight grassland bird species; Burrowing Owl, Loggerhead Shrike, Cassin's Sparrow, Brewer's Sparrow, Lark Bunting, Grasshopper Sparrow, McCown's Longspur and Chestnut-collared Longspur. Two habitat conditions were used in the analysis, percent shrub cover and percent grass cover >15 cm. We used a chi-square goodness of fit test (alpha .05) to detect significant differences between expected use based on availability and observed use within habitat condition categories. Figures were generated to illustrate significant preferences of habitat conditions by selected shortgrass prairie bird species (Neu et. al 1974, and Byers et. al 1984).

Long-term monitoring of Short Grass Prairie BCR region will provide valuable information on trends and distribution within a framework that allows land managers to make cooperative management decisions. Equipped with this information and habitat preferences of prairie birds, land managers will be able to target specific habitat conditions within and across management units to assess habitat suitability for species of concern. In addition, monitoring birds will provide data that can by applied to monitoring ecosystems, since bird species utilize an inclusive habitat spectrum within ecosystems. As a result bird monitoring provides a cost-effective means for monitoring ecosystems at a variety of scales.

Introduction

The Shortgrass Prairie BCR is a unique ecosystem stretching from southern South Dakota south through western Nebraska, eastern Wyoming, eastern Colorado, western Kansas, eastern New Mexico, Oklahoma's panhandle and western Texas. With in this region approximately 52% (280,800 km^2) of historic short grass prairie remains (Samson et al. 2004). Historically the Short Grass Prairie was characterized by dramatic variations in precipitation, fire and grazing mammals (Knopf 1988). Research in this region has identified the need for comprehensive conservation plans to maintain its ecological integrity.

Grassland birds have experienced steeper, more consistent, and geographically more widespread declines than any other guild of North American avian species (Sampson and Knopf 1996). Several species found in this ecosystem are endemic (found nowhere else) or are closely associated with the Great Plains grasslands (Mengel 1970) such as Baird's Sparrow, Cassin's Sparrow, Chestnut-collared Longspur, Ferruginous Hawk, Lark Bunting, Long-billed Curlew, McCown's Longspur and Mountain Plover.

Some managers have relied on data derived from the Breeding Bird Survey (BBS), currently the most extensive bird monitoring program in the U.S., to monitor bird populations (Robbins et al. 1989, Sauer 1993). The BBS, operational in the Great Plains since 1967, uses volunteers to conduct roadside surveys of birds across North America and produces indices of population abundance at the continental scale for many common bird species (Robbins et al. 1989). BBS data and analyses are relatively inexpensive and have proven to be a valuable source of information on bird population trends. BBS data can produce continental-scale relative abundance maps. These maps provide a reasonably good indication of the relative abundances of species well sampled by the BBS. However, many species and habitats are inadequately sampled by the BBS (Robbins et al. 1993, Sauer 1993), and BBS data do not reliably predict population trends at small geographic scales such as a National Grassland, states, or even larger eco-regions (i.e., BCRs) (Sauer 2000). According to the Partners In Flight, 85% of upland species breeding in the Shortgrass Prairie Bird Conservation Region (BCR 18) lack sufficient data to address current population trends (PIF database 2004). For these and other reasons, BBS data are generally insufficient to guide local and regional management decisions.

In response to this need, RMBO, in cooperation with the Colorado Division of Wildlife (CDOW), assessed field techniques in 2001 to determine which was most efficient for monitoring shortgrass prairie birds. We evaluated four techniques that were randomly allocated across the shortgrass prairie of Colorado: 1) section-based point counts, conducted at the section level from roads (n = 1,237 sections); 2) interior line transects, conducted at the section level away from roads (n = 48 sections); 3) Monitoring Colorado's Birds (MCB) point transects, conducted irrespective of sections and roads (n = 22 point transects); and 4) 30-mile driving line transects, conducted along roads, through all habitat types in Colorado (n = 87 line transects). We used program DISTANCE to estimate bird densities using each of the four techniques. The results suggested that the section-based point count technique was the most efficient in monitoring birds in the shortgrass prairie (Hanni 2002). Hereafter, we refer to this technique as section-based surveys.

RMBO designed the section-based survey technique based on the common unit of land management in the prairie, the 1 mi^2 section, hence the name 'section-based survey.' Section-based surveys provide data used to: 1) monitor bird population trends and changes in distributions of individual species; 2) relate vegetation characteristics and management practices to bird communities; and 3) determine geographic areas in which to focus conservation efforts.

What makes section-based surveys unique from other bird monitoring techniques is its efficiency and effectiveness in data collection. Efficiency is achieved by conducting the fewest number of surveys per section needed to maximize the number of species detected (Hanni 2002). The efficiency, in turn, increases observer coverage of the study area and increases statistical power of analysis, while maintaining the lowest possible cost. Effectiveness is achieved by potentially detecting population trends for 46 upland breeding species in BCR 18 within 5 - 24 years (CV = 3%, 41%, respectively). Included among these monitored species are 38 species of concern, as recognized by Partners In Flight (2004) and/or the participating state and federal agencies. Other advantages of RMBO's grassland bird monitoring program include: 1) stratification by habitat type; 2) sections are surveyed irrespective of landownership; and 3) data can be analyzed at a variety of scales such as county, state, National Grassland, or BCR.

In this document, we report the findings of the 2004 section-based surveys. Results are presented for BCR 18 as well as management units participating with RMBO's grassland bird monitoring program including four states (Nebraska, Colorado, Kansas, and Oklahoma) and four National Grasslands (Cimarron, Comanche, Kiowa, Pawnee and Rita Blanca). This report provides natural resource managers with information on grassland bird populations on both local and regional scales. Such knowledge can assist managers in making effective land management decisions regarding conservation of grassland birds and their habitat. Participating agencies include Colorado Division of Wildlife, Kansas Department of Wildlife and Parks, Nebraska Game and Parks Commission, Oklahoma Department of Wildlife Conservation, Oklahoma City Zoo, and USDA Forest Service.

Bird taxonomy and nomenclature in this report follow that of the American Ornithological Union Checklist for North American Birds, 7th edition and the Forty-third supplement.

Methods

Study Area

We conducted section-based surveys within the BCR 18 portions of Colorado, Kansas, Nebraska, and Oklahoma and on Cimarron, Comanche, Kiowa, Pawnee and Rita Blanca National Grasslands (Fig. 1). This arid region receives 300 - 500 mm of precipitation per year (Lauenroth 1992). Habitats surveyed include native shortgrass prairie, dry-land agriculture, and land in the Conservation Reserve Program (CRP). Native shortgrass prairie habitat is characterized by two dominant grass species, buffalo grass (*Buchloe dactyloides*) and blue grama (*Bouteloua gracilis*). Dry-land agriculture habitat includes non-irrigated field crops such as wheat, hay, and sorghum, or fallow fields. Land in CRP was once in agricultural production, but is now planted with cover, either native or non-native, to improve water quality and wildlife habitat, and control soil erosion.

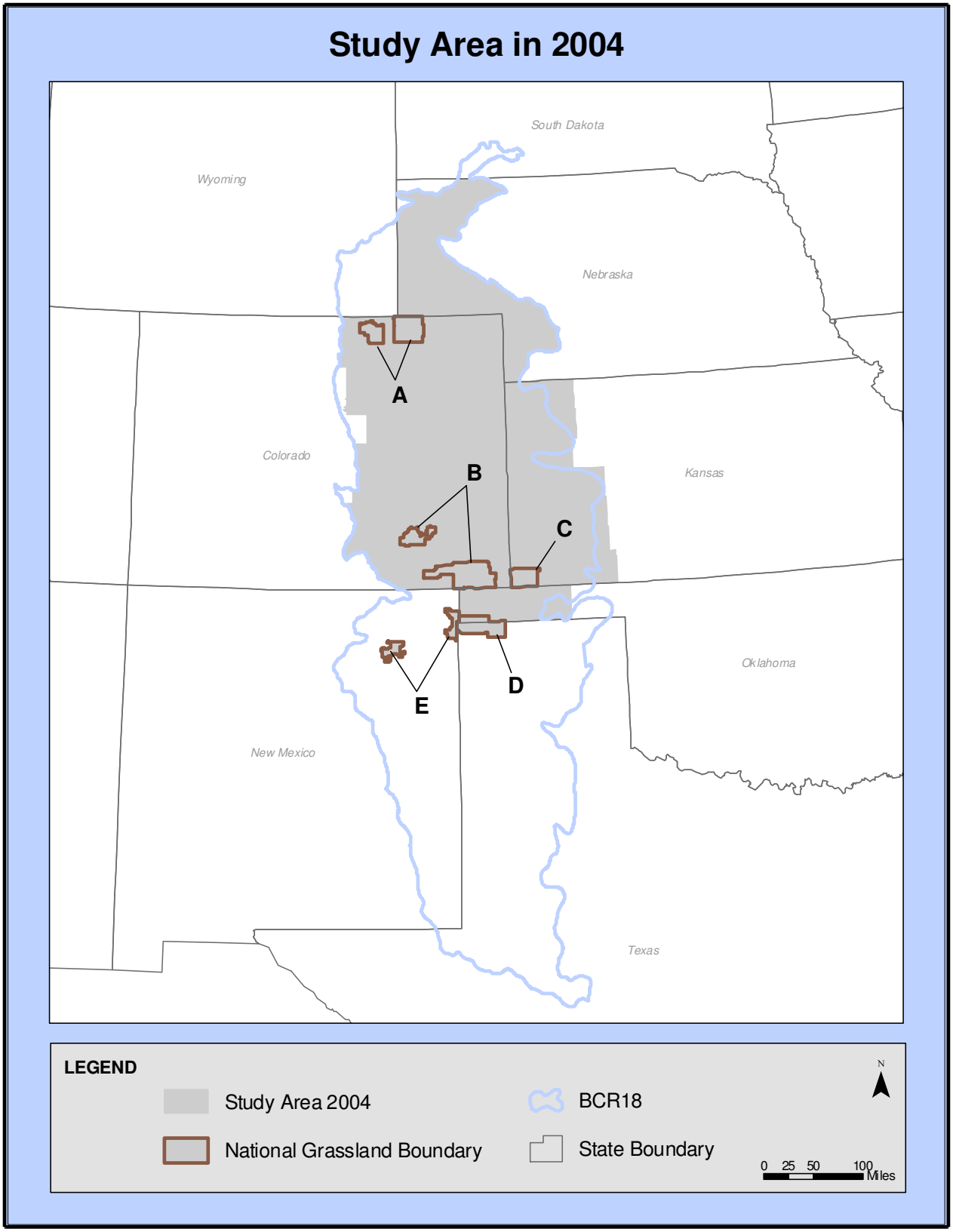

Figure 1. Study Area.

Section Selection

The Public Land Survey System (PLSS) defines sections as 1-mi^2 parcels of land. Prior to the commencement of the project, we used GIS to randomly select homogenous sections (600 - 700 acres) of native prairie and dry-land agriculture that lie adjacent to at least one road. Sections of were then randomly selected for survey in proportion to habitat acreage in the BCR 18 region of each state. We also randomly selected additional native prairie sections for survey on the National Grasslands to ensure adequate sample size for local analyses. If during the field season, a section was determined not to be a designated habitat type, then it was replaced with the closest qualifying section in a randomly selected direction. A GIS layer of CRP coverage is not available in most counties with the exception of Weld County, Colorado, so most CRP sections were identified on the ground and surveyed in replacement of non-qualifying sections or sections that were incorrectly identified as native prairie or dry-land agriculture in the GIS layer. Subsequently, the majority of CRP sections in Colorado are located in Weld County. In 2004, we selected 2,414 sections for survey – 1,802 of native prairie habitat, 552 of dry-land agriculture habitat, and 60 of land in CRP (Fig. 2).

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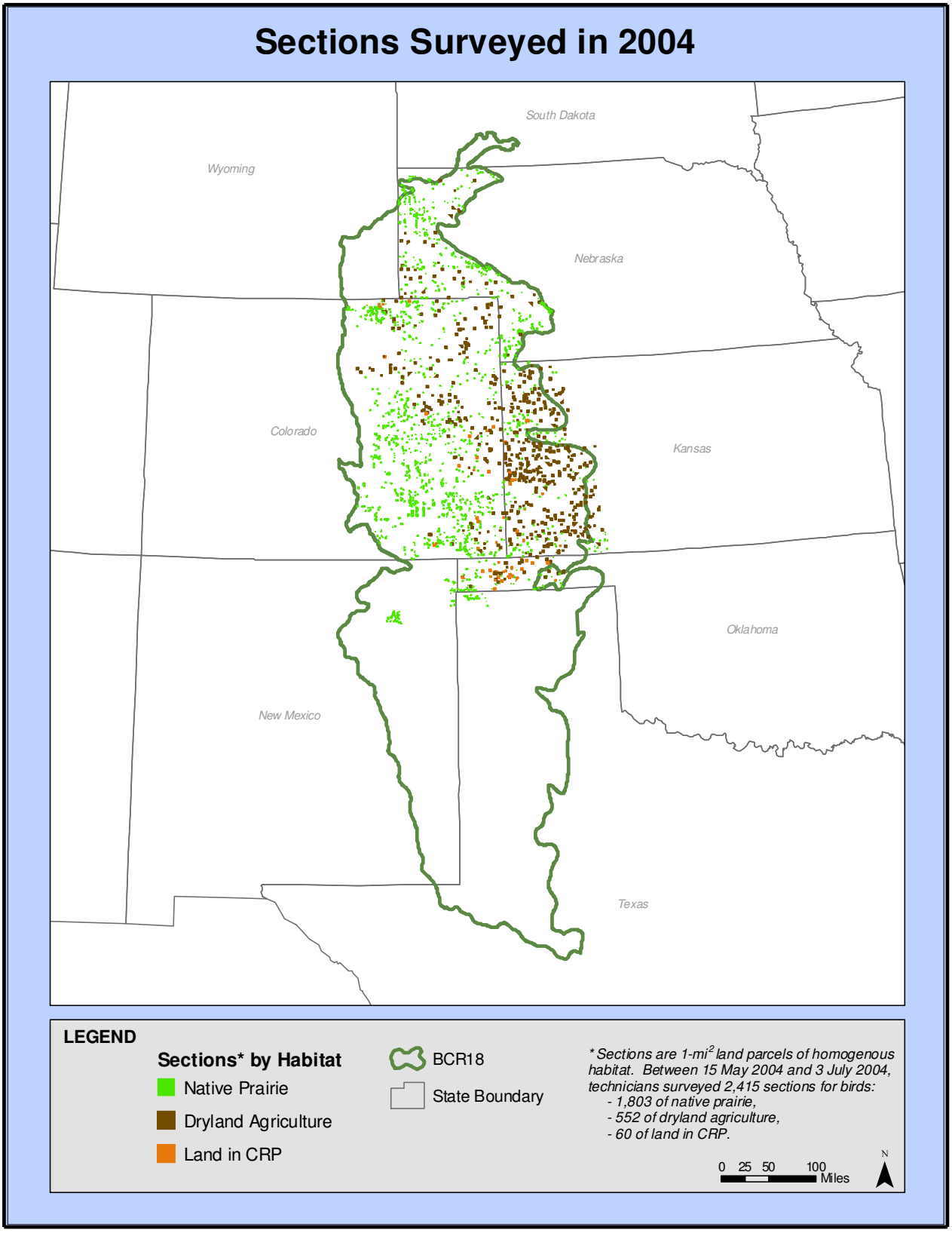


Figure 2. Sections surveyed by habitat type.

Point Count Locations at each Section

At each surveyed section, we conducted three road-based point counts. Three point counts per section maximizes the number of species detected and the number of sections surveyed per day; four counts per section do not yield significantly more species detections per section (Hanni 2002). We used a point-count data collection process, modified from Buckland et al. (1993) and Ralph et al. (1993), to establish road-based point count locations. We distributed point count locations on the roads bordering each section based on the number of roads surrounding the section (Fig. 3). For example, at sections adjacent to only one road, three point counts were conducted from that road. On sections bordered by two roads, we conducted two point counts along one road, and one point count along the other; the road on which we random ly selected the two count locations using a random number table. On sections bordered by three roads, we conducted one point count along each road. Where four roads surrounded the section, we randomly selected one road to eliminate using a random number table, and then we treated the section as a three-road section. Point count locations along each road were determined using a random number table and were recorded using a Garmin *etrex* global positioning system (GPS) unit. All point count locations were at least 0.2 mi apart and 0.1 mi from the section corners.

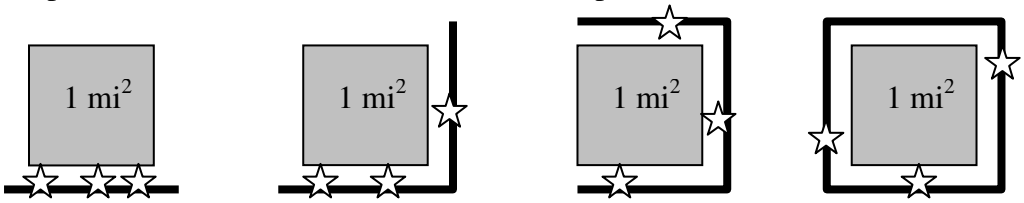


Figure 3. Examples of point count locations (stars) at a surveyed section (1-mi^2). The number of point count locations on each road (black lines) was based on the number of roads adjacent to the section. Locations of point counts along each road were determined using a random number table, spaced at least 0.2 mi apart and 0.1 mi from the section corners.

Data Collection

RMBO provided observer training at the Central Plains Experimental Range near Pawnee National Grassland, Colorado. Training consisted of three consecutive days via lecture and field practice. By the end of training, we deemed all observers proficient in grassland bird identification (visual and aural), distance estimation with rangefinders, GPS use, mapping skills, methodologies, vegetation identification and classification, and shrub cover estimation. RMBO provided each of the technicians with recordings of the songs and calls of grassland birds to continue sharpening bird identification skills after the three-day training period. Each of the technicians also received a reference guide to percent shrub cover that illustrated examples of actual percent cover for each of the different shrub species encountered in the field.

Observers conducted section-based surveys between 15 May and 3 July 2004. We considered arrival and reproductive periods of early and late-breeding bird species in our assumption that the majority of the species were on their breeding territories during this period. All birds detected are not necessarily local breeders. Observers conducted section-based counts from sunrise until no later than 1100 hours when detectable activity typically lessened or ceased. We recorded survey "start" and "end" times. Technicians did not conduct surveys during periods of rain or winds in excess of 18 mph. Observers recorded weather conditions, including percent cloud cover, wind speed (Beaufort scale), and temperature (Fahrenheit). We documented the legal

description, Township, range, and section (TRS), of the surveyed sections, at which, the observer conducted three 5-minute point counts from the road looking 180° into the section. For each bird seen and/or heard within the section, the observer recorded: species, sex (if known), distance from observer to point of first detection, method of detection (e.g., visually or aurally), and associated habitat (e.g., shrub, ground, or fence). We determined distance using a Bushnell Yardage Pro 500 Rangefinder. We recorded raptors and swallows detected at the section assuming that they were using the habitat; however, we tallied birds flying over a section separately.

We treated all dependent detections of individual birds as part of a 'cluster' together with the first independently observed bird, rather than as separate independent observations of those individuals. This means that if the detection of an individual bird is dependent upon the previous detection of another individual, the resulting observation is recorded as one independent detection with a cluster size of C, where C is the original individual detected plus the sum of any additional individuals detected as a result of the first individual revealing its presence. For example, a bird sings, and is thus detected independently, as a result, the observer detects a second individual. The resulting observation is recorded as a single detection with a cluster size of two birds. This practice ensures that we adhere more strictly to the assumption inherent in random sampling that all observations are independent of each other.

From each point count location, the observer recorded vegetation characteristics within a 150 m radius semi-circle within the section. Characteristics recorded include grass height, percent shrub cover, shrub species, and dominant shrub species. Grass height was classified as <15 cm or >15 cm (~ankle height). Where both height classifications existed, the proportion of each was recorded. Shrub cover was classified as <1%, 1%-3%, >3%-10%, or >10%.

The observers sketched the locations of all Black-tailed Prairie Dog colonies and playas visible within the section onto a data sheet and a map. The observers scanned all colonies, and all playas, with binoculars for to document the occurance of both Burrowing Owls and Mountain Plovers. Raptor nests were documented by recording UTM coordinates and by marking the location on a map.

Data Analysis

We used program DISTANCE version 5.0 (Thomas 1998-99) to analyze the point count data. Buckland et al. (1993) developed the notation, concepts, and analysis methods of DISTANCE . We calculated density estimates (D) for species that had a minimum of 20 observations or had a coefficient of variation (CV) of less than 50%, a level that indicates robust data. We did not include flyover detections in the DISTANCE analysis except for raptors, swallows and Common Nighhawk, which were assumed to be using the section. In 2004, we obtained density estimates by analyzing the data in the form of dependent observations or "clusters". We implemented this type of analyses to improve on the assumption of independent detections for species occurring in clusters and to reduce the bias of detecting clusters at farther distances. The four models used to find the most appropriate detection function were Half-normal Cosine, Uniform Cosine, Half-normal Hermite Polynomial and Hazard-rate Simple Polynomial. Analysis using DISTANCE assumes that: 1) all birds at distance zero are detected, 2) distances of the birds close to the points or line are measured accurately, and 3) birds do not move in response to the observer's

presence. In this analysis, we documented birds occurring within a 180˚ semicircle, so, we adjusted the sampling effort to 0.5. We also include density estimates by habitat condition (percent grass cover categories >15 cm and percent shrub cover) for which our data suggests there is little inter-annual variability. Based on this information, we decided to pool data from 2002 to 2004 only for the analyses providing density estimates for shrub cover and grass height.

We calculated the index of relative abundance used in the distribution maps using data collected by section-based surveys. We calculated the index of abundance, represented by graded map symbols, to reflect the average number of birds per point count for each section. This number was calculated by dividing the total number of individuals for each species detected on the section by the number of point counts conducted on that section.

Included in this report are charts showing utilization of certain habitat conditions versus their availability (the total number of point counts per habitat condition) for eight species in BCR18 (CO, NE, KS, NM, TX). We decided to pool the data across years, 2002-2004, after determining that species were utilizing similar habitat conditions between years. We used categorical chi-squared test with Bonferroni adjustments that maintains a strict alpha level of 0.05 across all pair wise comparisons. This method determines significant habitat preference or avoidance based on expected utilization and observed habitat use (Neu et. al, 1974, and Byers et. al, 1984). We examined two habitat conditions, percent coverage of grass height >15 cm categorized into ten intervals and percent shrub cover categorized into four intervals. The habitat condition, shrub cover, had an additional unknown category where shrub cover was not classified at the points. This category was included in the analyses to account for the unknown data within the data set. However, since the habitat conditions were not described in this category it was not included in the charts. Both habitat condition measurements were restricted to the 150 meter radius semi circle around the point count locations.

Results

BCR 18

In 2004, we observed 115 bird species (Appendix A) through section-based monitoring conducted in the BCR 18 portions of Colorado, Kansas, Nebraska and Oklahoma and on five National Grasslands; Cimarron, Comanche, Kiowa, Pawnee and Rita Blanca National Grasslands (Fig. 3). An asterisk represents bird species with significantly higher density estimates (confidence intervals that do not overlap).

Habitat

We documented 112 species in native prairie habitat in BCR 18, of which 40 (35%) were found exclusively in native habitat. We were able to obtain a sufficient number of detections to calculate density estimates for 49 species in this habitat type (Table 1). There were two species with higher densities (*) found in native prairie habitat when compared to dry-land agriculture and CRP habitat within BCR 18 (Table 1). We documented 73 species in dry-land agriculture. Of those species, 21 had a sufficient number of detections to estimate density (Table 2). Highest densities (*) for four species occurred in dry-land agriculture when compared to native prairie and CRP habitat within BCR 18 (Table 2). We documented 38 species in CRP habitat. Of those

species, eight had a sufficient number of detections to estimate density (Table 3). Highest density estimates (*) for two species occurred in CRP habitat when compared to native prairie and CRP habitat within BCR 18 (Table 3).

Table 1. Estimated densities for species detected in native prairie habitat within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	0.30	0.22	0.40	15%	112	
Scaled Quail	0.36	0.26	0.48	15%	74	X
Northern Bobwhite	0.18	0.11	0.30	25%	62	X
Northern Harrier	0.03	0.02	0.06	30%	18	
Swainson's Hawk	0.30	0.23	0.40	14%	147	X
Red-tailed Hawk	0.08	0.05	0.13	26%	38	
Ferruginous Hawk	0.03	0.02	0.06	28%	26	X
American Kestrel	0.18	0.11	0.29	24%	47	
Killdeer	1.33	0.96	1.85	17%	102	
Upland Sandpiper	0.09	0.06	0.15	27%	28	X
Long-billed Curlew	0.26	0.14	0.48	32%	77	X
Mourning Dove	15.45	13.52	17.65	7%	1491	
Burrowing Owl	0.48	0.29	0.79	26%	156	X
Common Nighthawk	1.38	1.03	1.84	15%	166	
Red-headed Woodpecker	0.11	0.05	0.23	39%	17	
Say's Phoebe	1.18	0.79	1.75	20%	72	X
Cassin's Kingbird	0.06	0.03	0.14	39%	13	
Western Kingbird	10.61	9.16	12.28	7%	706	
Eastern Kingbird	2.09	1.40	3.13	21%	87	
Loggerhead Shrike	0.62	0.41	0.92	21%	70	X
Chihuahuan Raven	0.02	0.01	0.03	35%	16	X
Horned Lark	95.58	86.22	105.95	5%	4666	X
Northern Rough-winged Swallow	0.94	0.51	1.75	32%	26	
Bank Swallow	0.82	0.37	1.78	41%	20	
Cliff Swallow*	22.29	16.27	30.53	16%	173	
Rock Wren	0.42	0.22	0.83	35%	22	
American Robin	0.47	0.30	0.73	23%	30	
Northern Mockingbird	0.87	0.70	1.08	11%	187	
Brown Thrasher	0.05	0.03	0.10	37%	19	
European Starling	3.30	1.80	6.05	32%	62	
Cassin's Sparrow	10.16	8.28	12.46	10%	1055	X
Brewer's Sparrow	1.76	1.02	3.01	28%	40	X
Vesper Sparrow	0.73	0.36	1.48	37%	36	
Lark Sparrow*	21.73	19.27	24.51	6%	905	X
Lark Bunting	35.99	32.44	39.92	5%	3518	X
Grasshopper Sparrow	10.50	8.29	13.29	12%	705	X
McCown's Longspur	1.64	1.20	2.26	16%	171	X
Chestnut-collared Longspur	1.33	0.91	1.94	19%	151	X
Blue Grosbeak	0.33	0.17	0.63	33%	23	
Dickcissel	0.52	0.22	1.25	46%	41	X
Red-winged Blackbird	2.52	1.82	3.50	17%	186	
Eastern Meadowlark	0.11	0.06	0.21	32%	16	X
Western Meadowlark	26.58	24.20	29.19	5%	5059	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Brewer's Blackbird	1.72	0.90	3.29	34%	51	
Common Grackle	1.74	1.18	2.57	20%	93	
Brown-headed Cowbird	3.39	2.30	5.00	20%	160	
Orchard Oriole	0.55	0.31	0.97	30%	25	
Bullock's Oriole	1.54	0.97	2.45	24%	81	X
House Sparrow	1.56	0.90	2.69	28%	40	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 2. Estimated densities for species detected in dry-land agriculture within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	1.97	1.58	2.46	11%	239	
Northern Bobwhite	0.11	0.04	0.30	50%	16	X
Northern Harrier	0.04	0.02	0.08	38%	15	X
Swainson's Hawk	0.43	0.27	0.70	25%	48	X
Killdeer*	5.94	3.32	10.61	30%	24	
Mourning Dove	15.13	12.96	17.67	8%	561	
Western Kingbird	8.25	5.67	12.01	19%	78	
Horned Lark*	145.57	126.31	167.76	7%	2180	X
Cliff Swallow	3.28	1.35	7.96	47%	20	
Barn Swallow	6.72	3.90	11.57	28%	55	
American Robin	1.04	0.58	1.88	31%	30	
Cassin's Sparrow	0.59	0.28	1.27	40%	17	X
Lark Sparrow	5.46	2.76	10.79	35%	22	X
Lark Bunting	29.17	25.38	33.52	7%	997	X
Grasshopper Sparrow	17.43	13.73	22.12	12%	192	X
Red-winged Blackbird*	13.26	10.78	16.31	11%	299	
Western Meadowlark	22.10	18.41	26.54	9%	1022	X
Brewer's Blackbird	0.70	0.32	1.55	42%	17	
Common Grackle	4.56	2.56	8.11	30%	57	
Brown-headed Cowbird	1.49	0.81	2.75	32%	26	
House Sparrow*	6.51	3.24	13.07	36%	41	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 3. Estimated densities for species detected in CRP habitat within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	2.33	1.10	4.93	39%	21	
Mourning Dove	24.76	15.81	38.80	23%	99	
Western Kingbird	3.12	1.33	7.31	45%	18	
Horned Lark	57.00	38.53	84.32	20%	72	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Cassin's Sparrow	10.16	4.53	22.83	42%	24	X
Lark Bunting	32.88	22.32	48.42	20%	120	X
Grasshopper Sparrow*	103.94	76.91	140.47	15%	202	X
Western Meadowlark*	52.74	42.10	66.06	11%	219	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (2004) and/or participating state and federal agencies.

Shrub Cover Categories

We analyzed bird use of shrub cover categories within BCR 18 by pooling data across years (2002-2004). We documented 104 species in habitat categorized as < 1% shrub cover. Of those species, 35 had a sufficient number of detections to estimate density (Table 4). We documented 81 species in habitat categorized as 1-3% shrub cover. Of those species, 30 had a sufficient number of detections to estimate density across the habitat (Table 5). We documented 66 species in habitat categorized as >3-10% shrub cover. Of those species, 27 had a sufficient number of detections to estimate density (Table 6). We documented 51 species in habitat categorized as >10% shrub cover. Of those species, 19 had a sufficient number of observations to estimate density (Table 7). Highest densities for four species (*) were found in > 10% shrub cover when compared to other shrub cover categories.

Table 4. Estimated densities for species detected in shrub cover categorized as < 1% within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	0.47	0.25	0.86	32%	45	X
Northern Bobwhite	0.24	0.11	0.52	41%	37	X
Swainson's Hawk	0.44	0.31	0.62	18%	83	X
Ferruginous Hawk	0.04	0.02	0.08	29%	21	X
American Kestrel	0.16	0.09	0.27	27%	36	
Killdeer	2.05	1.39	3.04	20%	66	
Long-billed Curlew	0.57	0.32	1.02	30%	46	X
Mourning Dove	12.74	10.60	15.31	9%	1052	
Burrowing Owl	0.45	0.33	0.61	16%	166	X
Common Nighthawk	0.74	0.40	1.37	32%	125	
Western Kingbird	10.11	8.65	11.82	8%	670	
Eastern Kingbird	0.89	0.56	1.43	24%	54	
Loggerhead Shrike	0.45	0.28	0.71	24%	53	X
Chihuahuan Raven	0.33	0.19	0.60	31%	64	X
Horned Lark	79.11	71.24	87.86	5%	6172	X
Cliff Swallow	9.78	7.22	13.26	16%	543	
Barn Swallow	4.36	3.04	6.26	19%	178	
American Robin	0.54	0.33	0.88	25%	33	
Northern Mockingbird	0.82	0.54	1.24	21%	152	
European Starling	0.19	0.09	0.39	39%	33	
Cassin's Sparrow	4.90	3.62	6.64	16%	515	X
Brewer's Sparrow	0.61	0.35	1.08	29%	39	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Vesper Sparrow	0.68	0.42	1.09	25%	45	
Lark Sparrow	8.24	6.75	10.06	10%	477	X
Lark Bunting	18.59	16.10	21.46	7%	2117	X
Grasshopper Sparrow	13.32	11.38	15.59	8%	602	X
McCown's Longspur	1.18	0.83	1.69	18%	97	X
Chestnut-collared Longspur	0.18	0.09	0.37	38%	20	X
Dickcissel	0.57	0.23	1.42	49%	27	X
Red-winged Blackbird	1.62	1.17	2.23	16%	205	
Western Meadowlark	41.59	39.47	43.83	3%	5344	X
Brewer's Blackbird	0.38	0.16	0.85	44%	31	
Brown-headed Cowbird	2.05	1.42	2.95	19%	71	
Bullock's Oriole	0.37	0.20	0.71	33%	36	X
House Sparrow	0.67	0.33	1.39	38%	36	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 5. Estimated densities for species detected in shrub cover categorized as 1-3% within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	0.12	0.06	0.25	37%	20	
Scaled Quail	2.39	1.61	3.55	20%	95	X
Swainson's Hawk	0.86	0.60	1.22	18%	117	X
Ferruginous Hawk	0.15	0.08	0.28	32%	27	X
American Kestrel	0.29	0.15	0.55	33%	24	
Killdeer	1.33	0.97	1.82	16%	95	
Mourning Dove	17.68	14.31	21.83	11%	777	
Burrowing Owl	0.93	0.44	1.96	39%	39	X
Common Nighthawk	1.70	1.19	2.43	18%	91	
Say's Phoebe	0.47	0.31	0.72	22%	30	X
Western Kingbird	11.65	9.71	13.97	9%	483	
Eastern Kingbird	0.56	0.35	0.87	23%	31	
Scissor-tailed Flycatcher	3.15	1.41	7.05	42%	21	X
Loggerhead Shrike	2.46	1.56	3.87	23%	42	X
Horned Lark	93.78	82.63	106.44	6%	3438	X
Barn Swallow	7.16	4.37	11.73	26%	97	
Northern Mockingbird	2.46	2.01	3.01	10%	245	
Cassin's Sparrow	15.28	11.38	20.52	15%	1161	X
Brewer's Sparrow	1.08	0.63	1.85	28%	36	X
Vesper Sparrow	1.49	0.84	2.66	30%	46	
Lark Sparrow	15.94	12.15	20.92	14%	562	X
Lark Bunting	15.37	13.20	17.89	8%	900	X
Grasshopper Sparrow	7.99	5.24	12.18	22%	191	X
McCown's Longspur	1.63	0.97	2.72	27%	65	X
Red-winged Blackbird	2.05	1.15	3.64	30%	47	
Eastern Meadowlark	0.32	0.13	0.79	48%	20	X
Western Meadowlark	41.52	38.86	44.37	3%	2868	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Brewer's Blackbird	0.77	0.32	1.86	46%	57	
Common Grackle	0.83	0.51	1.35	25%	58	
Bullock's Oriole	2.51	1.57	4.01	24%	46	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 6. Estimated densities for species detected in shrub cover categorized as >3-10% within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	1.36	0.83	2.20	25%	86	X
Northern Bobwhite	0.45	0.25	0.80	30%	33	X
Turkey Vulture	0.13	0.06	0.28	40%	26	
Swainson's Hawk	0.33	0.22	0.49	20%	43	X
Killdeer	1.38	0.85	2.24	25%	38	
Mourning Dove	21.50	17.16	26.95	12%	506	
Burrowing Owl	0.51	0.25	1.04	38%	47	X
Common Nighthawk	1.95	1.44	2.63	15%	84	
Say's Phoebe	0.35	0.18	0.69	34%	20	X
Western Kingbird	12.70	10.48	15.39	10%	284	
Loggerhead Shrike	1.20	0.79	1.82	22%	53	X
Chihuahuan Raven	1.27	0.71	2.29	31%	31	X
Horned Lark	88.74	74.81	105.26	9%	2033	X
Barn Swallow	10.42	6.35	17.11	26%	45	
Northern Mockingbird	5.18	4.24	6.32	10%	457	
Cassin's Sparrow	32.75	27.08	39.60	10%	1377	X
Brewer's Sparrow	1.00	0.52	1.89	33%	38	X
Vesper Sparrow	1.18	0.71	1.97	26%	25	
Lark Sparrow	25.02	21.52	29.07	8%	545	X
Lark Bunting	17.19	14.47	20.41	9%	717	X
Grasshopper Sparrow	10.00	7.23	13.82	17%	108	X
McCown's Longspur	1.24	0.43	3.54	58%	24	X
Red-winged Blackbird	0.78	0.42	1.45	32%	44	
Eastern Meadowlark	1.23	0.79	1.92	23%	45	X
Western Meadowlark	37.45	32.22	43.53	8%	1739	X
Brown-headed Cowbird	3.99	2.67	5.98	21%	63	
Bullock's Oriole	0.98	0.64	1.51	22%	39	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 7. Estimated densities for species detected in shrub cover categorized as >10% within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	1.73	0.93	3.21	32%	32	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Northern Bobwhite	0.96	0.48	1.91	36%	25	X
Swainson's Hawk	0.36	0.19	0.68	33%	21	X
Mourning Dove	21.18	15.71	28.55	15%	223	
Common Nighthawk	2.44	1.43	4.15	28%	32	
Western Kingbird	8.20	5.61	11.98	19%	91	
Loggerhead Shrike	5.44	2.90	10.19	33%	30	X
Chihuahuan Raven	1.18	0.66	2.12	30%	35	X
Horned Lark	42.61	28.90	62.82	20%	331	X
Northern Mockingbird*	12.12	9.00	16.33	15%	241	
Cassin's Sparrow*	53.59	42.35	67.81	12%	665	X
Brewer's Sparrow*	4.71	2.28	9.73	38%	30	X
Lark Sparrow*	45.88	35.62	59.10	13%	242	X
Lark Bunting	14.02	9.98	19.70	17%	178	X
Grasshopper Sparrow	7.97	4.62	13.76	28%	25	X
Eastern Meadowlark*	2.12	0.93	4.86	44%	22	X
Western Meadowlark	39.93	34.22	46.60	8%	530	X
Brown-headed Cowbird	4.64	2.44	8.84	34%	24	
Bullock's Oriole	4.06	2.30	7.16	29%	27	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Grass Height

We analyzed bird use of 10 separate percent coverage categories of grass height >15 cm within BCR 18, pooled across years (2002-2004). We documented 73 species in native prairie where grass >15 cm covers 0 to 10 percent. Of those species, 36 had a sufficient number of detections to estimate density across this category (Table 8). We documented 67 species in native prairie where grass >15 cm covers 11 to 20 percent. Of those species, 24 had a sufficient number of detections to estimate density across the 11 to 20 percent grass cover category (Table 9). We documented 68 species in habitat categorized as 21 to 30 percent grass cover. Of those species, nineteen had a sufficient number of detections to estimate density across this cover category (Table 10). Highest densities for one species (*) occurred in native prairie with 21 to 30 percent grass cover when compared to other grass cover categories (Table 10). We documented 70 species in native prairie categorized as 31 to 40 percent grass cover. Of those species, nineteen had a sufficient number of detections to estimate density across this cover category (Table 11). We documented 52 species in native prairie categorized as 41 to 50 percent grass cover. Of those species, thirteen had a sufficient number of detections to estimate density across this cover category (Table 12). We documented 68 species in native habitat categorized as 51 to 60 percent grass cover. Of those species, fifteen had a sufficient number of detections to estimate density across this cover category (Table 13). We documented 64 species in native prairie categorized as 61 to 70 percent grass cover. Of those species, sixteen had a sufficient number of detections to estimate density across this cover category (Table 14). We documented 71 species in native prairie categorized as 71 to 80 percent grass cover. Of those species, eleven had a sufficient number of detections to estimate density across this cover category (Table 15). We documented 63 species in native prairie categorized as 81 to 90 percent grass cover. Of those species,

thirteen had a sufficient number of detections to estimate density across this cover category (Table 16). We documented 60 species in native prairie categorized as 91 to 100 percent grass cover. Of those species, twelve had a sufficient number of detections to estimate density across this cover category (Table 17). Highest densities for one species (*) were found in native prairie with 91 to 100 percent grass cover when compared to other grass cover categories (Table 17).

Table 8. Estimated densities for species detected in 0-10% grass height >15 cm within BCR 18

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	0.96	0.73	1.24	13%	221	
Scaled Quail	1.98	1.31	3.00	21%	79	X
Northern Bobwhite	0.29	0.15	0.57	35%	24	X
Turkey Vulture	0.08	0.04	0.20	44%	23	
Swainson's Hawk	0.75	0.57	1.00	15%	143	X
Ferruginous Hawk	0.19	0.11	0.31	26%	38	X
American Kestrel	0.14	0.08	0.24	27%	28	
Killdeer	3.60	2.64	4.91	16%	183	
Long-billed Curlew	0.17	0.10	0.30	28%	49	X
Mourning Dove	19.07	16.44	22.13	8%	1020	
Burrowing Owl	0.90	0.63	1.29	19%	171	X
Common Nighthawk	0.92	0.61	1.39	21%	89	
Say's Phoebe	0.25	0.13	0.49	35%	21	X
Western Kingbird	7.36	6.16	8.79	9%	538	
Scissor-tailed Flycatcher	0.77	0.39	1.51	35%	31	X
Loggerhead Shrike	1.19	0.78	1.80	21%	59	X
Black-billed Magpie	0.15	0.06	0.35	46%	24	
Chihuahuan Raven	0.62	0.36	1.08	29%	214	X
Horned Lark	109.39	98.63	121.33	5%	5281	X
Cliff Swallow	22.80	14.34	36.24	24%	77	
Barn Swallow	8.60	5.59	13.24	22%	94	
American Robin	0.25	0.14	0.46	31%	27	
Northern Mockingbird	1.81	1.41	2.32	13%	232	
Cassin's Sparrow	7.11	5.84	8.65	10%	546	X
Brewer's Sparrow	0.95	0.57	1.57	26%	62	X
Vesper Sparrow	0.79	0.43	1.43	31%	23	
Lark Sparrow	12.45	9.35	16.57	15%	565	X
Lark Bunting	25.79	22.34	29.77	7%	1250	X
Grasshopper Sparrow	12.04	7.57	19.14	24%	470	X
McCown's Longspur	2.53	1.84	3.50	17%	138	X
Chestnut-collared Longspur	0.39	0.23	0.66	27%	48	X
Eastern Meadowlark	0.62	0.27	1.40	43%	24	X
Western Meadowlark	30.76	26.48	35.72	8%	2655	X
Brewer's Blackbird	0.60	0.29	1.21	37%	42	
Brown-headed Cowbird	1.73	1.14	2.64	22%	52	
Bullock's Oriole	0.53	0.32	0.89	26%	45	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 9. Estimated densities for species detected in 11-20% grass height >15 cm within BCR 18

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	1.41	0.71	2.81	36%	33	X
Northern Bobwhite	0.74	0.34	1.62	42%	20	
Swainson's Hawk	0.42	0.26	0.69	25%	41	X
Killdeer	1.94	1.33	2.81	19%	62	
Long-billed Curlew	0.21	0.12	0.37	29%	32	X
Mourning Dove	17.87	13.66	23.38	14%	316	
Burrowing Owl	0.32	0.17	0.61	33%	32	X
Common Nighthawk	1.58	1.04	2.39	21%	47	
Western Kingbird	14.47	10.97	19.10	14%	284	
Loggerhead Shrike	1.35	0.78	2.33	28%	30	X
Chihuahuan Raven	0.85	0.48	1.49	29%	49	X
Horned Lark	114.79	98.48	133.80	8%	2132	X
Barn Swallow	8.80	4.70	16.46	32%	41	
Northern Mockingbird	2.67	1.49	4.77	30%	99	
Cassin's Sparrow	15.88	13.38	18.85	9%	469	X
Brewer's Sparrow	0.90	0.44	1.84	37%	29	X
Lark Sparrow	22.17	16.79	29.28	14%	302	X
Lark Bunting	21.51	17.35	26.69	11%	541	X
Grasshopper Sparrow	4.49	2.76	7.30	25%	51	X
McCown's Longspur	0.91	0.53	1.55	28%	30	X
Western Meadowlark	31.83	29.02	34.91	5%	1245	X
Brewer's Blackbird	0.90	0.42	1.94	40%	29	
Brown-headed Cowbird	2.00	0.96	4.16	38%	27	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 10. Estimated densities for species detected in 21-30% grass height >15 cm within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	0.87	0.50	1.50	28%	35	X
Swainson's Hawk	0.59	0.37	0.93	23%	40	X
Killdeer	1.70	0.97	2.97	29%	35	
Mourning Dove	16.13	12.78	20.36	12%	294	
Common Nighthawk	1.64	1.08	2.47	21%	41	
Western Kingbird	13.86	10.66	18.03	13%	168	
Chihuahuan Raven	0.74	0.34	1.60	41%	25	X
Horned Lark	108.67	91.66	128.84	9%	1415	X
Cliff Swallow	8.04	3.33	19.40	47%	21	
Northern Mockingbird	4.05	2.74	5.97	20%	123	
Cassin's Sparrow	14.24	10.38	19.54	16%	371	X
Brewer's Sparrow	0.90	0.39	2.09	44%	20	X
Vesper Sparrow*	3.16	1.45	6.86	41%	27	
Lark Sparrow	15.77	12.08	20.60	14%	233	X
Lark Bunting	24.97	20.70	30.12	10%	507	X
Grasshopper Sparrow	7.74	5.07	11.82	22%	75	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
McCown's Longspur	1.03	0.48	2.20	40%	24	X
Western Meadowlark	37.84	28.25	50.69	15%	997	X
Brown-headed Cowbird	2.12	1.10	4.09	34%	35	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 11. Estimated densities for species detected in 31-40% grass height >15 cm within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	0.24	0.13	0.44	32%	23	X
Swainson's Hawk	0.55	0.34	0.89	25%	34	X
Long-billed Curlew	0.37	0.19	0.70	34%	22	X
Mourning Dove	11.35	7.75	16.62	20%	220	
Burrowing Owl	0.44	0.20	0.98	42%	21	X
Common Nighthawk	1.17	0.67	2.02	29%	32	
Western Kingbird	11.53	8.21	16.20	17%	143	
Horned Lark	91.11	74.55	111.35	10%	1234	X
Barn Swallow	5.01	2.91	8.61	28%	34	
Northern Mockingbird	2.54	1.91	3.38	15%	138	
Cassin's Sparrow	17.62	12.03	25.79	20%	418	X
Lark Sparrow	14.31	11.17	18.32	13%	162	X
Lark Bunting	20.34	16.68	24.80	10%	460	X
Grasshopper Sparrow	7.85	4.45	13.86	29%	90	X
McCown's Longspur	1.20	0.58	2.50	38%	25	X
Chestnut-collared Longspur	0.46	0.21	1.02	42%	21	X
Eastern Meadowlark	0.85	0.41	1.74	37%	21	X
Western Meadowlark	44.96	40.28	50.18	6%	1225	X
Brown-headed Cowbird	2.82	1.63	4.88	28%	28	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 12. Estimated densities for species detected in 41-50% grass height >15 cm within BCR 18.

Common Name	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	1.19	0.57	2.46	38%	20	X
Mourning Dove	18.35	13.04	25.83	18%	99	
Common Nighthawk	1.78	0.78	4.02	43%	20	
Western Kingbird	9.25	6.39	13.38	19%	89	
Horned Lark	109.59	92.95	129.21	8%	561	X
Barn Swallow	16.44	8.49	31.83	35%	31	
Northern Mockingbird	5.66	4.16	7.71	16%	92	
Cassin's Sparrow	29.77	23.41	37.86	12%	228	X
Lark Sparrow	14.59	9.78	21.77	21%	68	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Lark Bunting	28.25	19.62	40.68	19%	312	X
Grasshopper Sparrow	10.23	7.31	14.30	17%	54	X
McCown's Longspur	2.19	1.06	4.51	38%	23	X
Western Meadowlark	49.97	39.27	63.57	12%	575	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 13. Estimated densities for species detected in 51-60% grass height >15 cm within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	0.70	0.36	1.38	35%	20	X
Swainson's Hawk	0.40	0.20	0.80	36%	22	X
Mourning Dove	15.22	11.63	19.91	14%	159	
Common Nighthawk	1.92	1.03	3.58	32%	31	
Horned Lark	90.38	73.03	111.84	11%	898	X
Barn Swallow	5.15	2.18	12.13	46%	23	
Northern Mockingbird	2.02	1.39	2.95	19%	81	
Cassin's Sparrow	20.94	14.85	29.52	18%	325	X
Lark Sparrow	14.79	10.67	20.51	17%	144	X
Lark Bunting	25.23	19.28	33.03	14%	358	X
Grasshopper Sparrow	11.23	8.49	14.86	14%	96	X
Western Meadowlark	51.32	45.65	57.71	6%	1071	X
Brown-headed Cowbird	2.57	1.39	4.76	32%	24	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 14. Estimated densities for species detected in 61-70% grass height >15 cm within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Scaled Quail	1.38	0.64	3.01	41%	21	X
Killdeer	0.75	0.39	1.43	34%	23	
Mourning Dove	28.36	21.27	37.81	15%	230	
Common Nighthawk	1.18	0.67	2.08	29%	38	
Western Kingbird	11.71	8.47	16.19	17%	123	
Loggerhead Shrike	1.48	0.80	2.72	32%	21	X
Horned Lark	122.84	107.50	140.37	7%	1079	X
Barn Swallow	1.79	0.81	3.93	42%	20	
Northern Mockingbird	3.87	2.72	5.50	18%	129	
Cassin's Sparrow	28.40	20.83	38.72	16%	474	X
Lark Sparrow	20.88	15.93	27.36	14%	207	X
Lark Bunting	37.10	29.54	46.60	12%	491	X
Grasshopper Sparrow	18.73	13.23	26.53	18%	105	X
Western Meadowlark	56.79	51.14	63.06	5%	1183	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Brown-headed Cowbird	3.56	1.81	7.02	35%	22	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 15. Estimated densities for species detected in 71-80% grass height >15 cm within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Northern Bobwhite	0.53	0.26	1.11	38%	30	X
Mourning Dove	20.96	16.65	26.38	12%	344	
Western Kingbird	10.87	8.11	14.56	15%	111	
Horned Lark	89.00	78.51	100.88	6%	947	X
Barn Swallow	6.30	2.62	15.14	47%	30	
Cassin's Sparrow	22.10	16.16	30.21	16%	444	X
Lark Sparrow	26.25	20.07	34.34	14%	175	X
Lark Bunting	28.77	23.41	35.36	11%	430	X
Grasshopper Sparrow	14.72	11.34	19.11	13%	138	X
McCown's Longspur	1.31	0.56	3.06	45%	20	X
Western Meadowlark	48.92	40.35	59.32	10%	1375	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 16. Estimated densities for species detected in 81-90% grass height >15 cm within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	0.55	0.26	1.15	38%	22	
Northern Bobwhite	0.81	0.37	1.74	40%	20	X
Killdeer	1.19	0.57	2.49	38%	20	
Mourning Dove	39.04	29.90	50.99	14%	246	
Western Kingbird	13.27	9.34	18.84	18%	117	
Horned Lark	76.14	58.01	99.93	14%	475	X
Northern Mockingbird	1.21	0.75	1.95	25%	43	
Cassin's Sparrow	18.55	14.54	23.66	12%	230	X
Lark Sparrow	15.89	11.39	22.16	17%	112	X
Lark Bunting	41.55	33.27	51.90	11%	440	X
Grasshopper Sparrow	31.64	23.55	42.51	15%	135	X
Chestnut-collared Longspur	0.62	0.27	1.41	44%	24	X
Western Meadowlark	53.50	40.07	71.41	15%	722	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

Table 17. Estimated densities for species detected in 91-100% grass height >15 cm within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	0.74	0.36	1.51	37%	24	

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Upland Sandpiper	0.41	0.21	0.82	35%	20	X
Mourning Dove	18.30	15.02	22.28	10%	331	
Western Kingbird	7.68	5.68	10.39	15%	93	
Eastern Kingbird	1.97	0.92	4.22	40%	28	
Horned Lark	57.17	45.57	71.72	12%	613	X
Cassin's Sparrow	14.39	9.97	20.77	19%	110	X
Lark Sparrow	19.42	14.32	26.34	16%	151	X
Lark Bunting	23.51	14.16	39.05	26%	460	X
Grasshopper Sparrow*	70.92	56.86	88.45	11%	298	X
Western Meadowlark	70.73	60.23	83.05	8%	1272	X
Brown-headed Cowbird	12.77	7.23	22.57	30%	55	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of conern as recognized by Partners In Flight (2004) and/or participating state and federal agencies.

States

Nebraska

We observed 71 species in the BCR 18 portion of Nebraska (Appendix A). Of those species, 22 had a sufficient number of observations to estimate density in native prairie habitat (Table 18) and eight had sufficient numbers in dry-land agriculture (Table 19).

Table 18. Estimated densities for species detected in native prairie within the BCR 18 portion of Nebraska.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Swainson's Hawk	0.09	0.04	0.21	41%	22	X, X
Red-tailed Hawk	0.09	0.05	0.16	31%	20	
Killdeer	0.89	0.48	1.69	33%	22	
Upland Sandpiper	0.42	0.24	0.74	29%	19	
Long-billed Curlew	0.53	0.31	0.92	28%	33	
Mourning Dove	13.92	11.43	16.95	10%	330	
Burrowing Owl	0.29	0.12	0.70	46%	20	
Common Nighthawk	0.67	0.38	1.18	29%	41	
Western Kingbird	10.78	7.96	14.59	16%	80	
Eastern Kingbird	3.02	1.84	4.96	25%	42	
Horned Lark	66.95	53.28	84.12	12%	959	X
Cliff Swallow	12.71	7.01	23.03	31%	40	
Barn Swallow	7.03	4.49	11.00	23%	33	
Lark Sparrow	39.26	31.72	48.58	11%	279	X, X
Lark Bunting	54.55	46.30	64.25	8%	890	X, X
Grasshopper Sparrow	21.78	18.26	25.98	9%	267	X, X
McCown's Longspur	0.94	0.47	1.91	37%	64	
Chestnut-collared Longspur	5.28	3.61	7.72	20%	146	
Red-winged Blackbird	3.45	1.79	6.66	34%	28	
Western Meadowlark	43.91	40.40	47.73	4%	1492	X
Common Grackle	4.67	2.64	8.26	30%	42	

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Brown-headed Cowbird	4.56	2.79	7.46	25%	36	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Nebraska Partnership for All Bird Conservation (X).

Table 19. Estimated densities for species detected in dry-land agriculture within the BCR 18 portion of Nebraska.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	2.09	1.15	3.78	30%	21	
Mourning Dove	11.84	7.41	18.90	24%	45	
Western Kingbird	9.10	5.26	15.76	28%	24	
Horned Lark	104.89	79.13	139.04	14%	137	X
Lark Bunting	36.15	23.25	56.23	22%	66	X,X
Red-winged Blackbird	14.28	8.25	24.73	28%	27	
Western Meadowlark	30.28	22.54	40.69	15%	113	X
Common Grackle	10.82	5.55	21.08	34%	23	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Nebraska Partnership for All Bird Conservation (X).

Colorado

We observed 88 species in the BCR 18 portion of Colorado (Appendix A). Of those species, 33 had a sufficient number of detections to estimate density in native prairie habitat (Table 20), eight had sufficient numbers in dry-land agriculture (Table 21) and four in CRP (Table 22).

Table 20. Estimated densities for species detected in native prairie habitat within the BCR 18 portion of Colorado.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	0.09	0.05	0.17	30%	19	
Scaled Quail	0.46	0.22	0.96	39%	25	X
Swainson's Hawk	0.35	0.26	0.49	17%	87	X
American Kestrel	0.10	0.06	0.18	28%	20	
Killdeer	1.34	0.81	2.22	26%	78	
Long-billed Curlew	0.13	0.07	0.23	31%	26	X,X
Mourning Dove	15.76	13.23	18.77	9%	858	
Burrowing Owl	0.51	0.33	0.77	22%	71	X,X
Common Nighthawk	1.06	0.77	1.46	16%	86	
Say's Phoebe	0.82	0.52	1.29	23%	39	X
Western Kingbird	10.55	8.60	12.94	10%	421	
Eastern Kingbird	0.83	0.47	1.47	30%	25	
Loggerhead Shrike	0.52	0.32	0.83	24%	48	X
Chihuahuan Raven	0.06	0.04	0.10	25%	28	X
Horned Lark	116.44	104.76	129.42	5%	3226	X
Cliff Swallow	8.22	4.39	15.37	33%	42	
Barn Swallow	5.63	3.24	9.78	29%	53	

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Northern Mockingbird	1.11	0.86	1.43	13%	152	
European Starling	13.67	5.31	35.19	51%	27	
Cassin's Sparrow	11.02	8.50	14.29	13%	671	X
Brewer's Sparrow	1.58	0.89	2.79	30%	27	X
Vesper Sparrow	0.57	0.29	1.11	35%	23	
Lark Sparrow	11.66	9.96	13.65	8%	397	X
Lark Bunting	36.83	33.66	40.31	5%	2466	X
Grasshopper Sparrow	5.88	4.62	7.49	12%	211	X
McCown's Longspur	2.18	0.92	5.19	46%	101	X
Red-winged Blackbird	1.70	1.23	2.35	17%	105	
Western Meadowlark	19.43	15.81	23.88	11%	2408	X
Brewer's Blackbird	3.79	2.00	7.18	33%	43	
Common Grackle	0.75	0.39	1.41	33%	34	
Brown-headed Cowbird	3.27	2.31	4.64	18%	88	
Bullock's Oriole	1.29	0.84	1.97	22%	60	
House Sparrow	1.73	0.82	3.67	39%	22	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Colorado Division of Wildlife (X).

Table 21. Estimated densities for species detected in dry-land agriculture within the BCR 18 portion of Colorado.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Swainson's Hawk	0.32	0.18	0.57	30%	21	X
Mourning Dove	17.57	14.20	21.74	11%	255	
Western Kingbird	4.50	2.84	7.11	24%	53	
Horned Lark	137.68	121.97	155.42	6%	773	X
Lark Bunting	37.51	25.94	54.23	19%	507	X
Grasshopper Sparrow	7.69	4.44	13.31	28%	48	X
Red-winged Blackbird	5.42	3.38	8.69	24%	82	
Western Meadowlark	14.97	9.51	23.55	23%	347	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Colorado Division of Wildlife (X).

Table 22. Estimated densities for species detected in CRP habitat within the BCR 18 portion of Colorado.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Western Meadowlark	44.86	30.54	65.87	19%	64	X
Horned Lark	58.22	27.39	123.76	39%	20	X
Lark Bunting	21.57	12.76	36.45	26%	32	X
Grasshopper Sparrow	48.35	26.36	88.69	30%	31	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Colorado Division of Wildlife (X).

Kansas

We observed 79 species in the BCR 18 portion of Kansas (Appendix A). Of those species, 22 had a sufficient number of detections to estimate density in native prairie habitat (Table 23); twelve had sufficient numbers in dry-land agriculture (Table 24) and five in CRP (Table 25). In native prairie habitat (Table 22), the highest densities of two species (*), and in CRP habitat (Table 45) the highest density of one species (*) occurred in Kansas when compared to other management units.

Table 23. Estimated densities for species detected in native prairie habitat within the BCR 18 portion of Kansas.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	1.05	0.70	1.59	21%	43	
Northern Bobwhite	1.95	1.33	2.86	20%	50	X
Killdeer	3.31	1.46	7.51	43%	28	
Mourning Dove	18.94	15.00	23.92	12%	208	
Common Nighthawk*	8.00	4.84	13.24	26%	58	
Say's Phoebe*	4.67	2.31	9.44	36%	18	
Western Kingbird	15.54	10.41	23.19	21%	87	
Eastern Kingbird	2.06	1.05	4.05	35%	18	
Horned Lark	68.64	53.97	87.31	12%	263	X
Cliff Swallow	28.99	12.41	67.73	45%	28	
Barn Swallow*	42.12	22.71	78.12	32%	31	
Brown Thrasher	0.31	0.15	0.63	37%	13	
Cassin's Sparrow	19.54	11.78	32.39	26%	170	X
Lark Sparrow	25.68	14.08	46.82	31%	100	X
Lark Bunting	13.94	8.68	22.39	24%	57	X
Grasshopper Sparrow	35.34	25.67	48.66	16%	108	X
Dickcissel	4.87	2.16	10.97	43%	26	X
Red-winged Blackbird	4.34	2.27	8.28	33%	26	
Western Meadowlark	54.17	42.37	69.24	13%	744	X
Common Grackle	2.82	1.26	6.32	43%	15	
Brown-headed Cowbird	3.59	2.02	6.37	30%	24	
House Sparrow	4.27	1.85	9.83	44%	17	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Kansas Department of Wildlife and Parks (X).

Table 24. Estimated densities for species detected in dry-land agriculture within the BCR 18 portion of Kansas.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	2.32	1.90	2.82	10%	190	
Swainson's Hawk	0.57	0.29	1.14	35%	19	X
Mourning Dove	14.71	11.47	18.86	13%	297	
Western Kingbird	6.87	3.69	12.79	32%	44	
Horned Lark	167.31	141.52	197.79	9%	1183	X

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Barn Swallow	10.32	5.32	20.02	34%	23	
Lark Bunting	29.56	23.07	37.88	13%	396	X
Grasshopper Sparrow	25.11	18.90	33.36	15%	124	X
Red-winged Blackbird	20.84	15.01	28.94	17%	195	
Western Meadowlark	26.78	23.72	30.22	6%	712	X
Common Grackle	7.73	3.30	18.10	45%	22	
House Sparrow*	10.88	4.33	27.36	49%	22	

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Kansas Department of Wildlife and Parks (X).

Table 25. Estimated densities for species detected in CRP habitat within the BCR 18 portion of Kansas.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Mourning Dove	32.65	16.72	63.75	34%	27	
Horned Lark	90.29	48.26	168.94	32%	24	X
Lark Bunting	26.62	12.20	58.06	39%	22	X
Grasshopper Sparrow*	150.40	98.27	230.19	21%	37	X
Western Meadowlark	51.90	34.01	79.20	21%	56	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Kansas Department of Wildlife and Parks (X).

Oklahoma

We observed 50 species in the BCR 18 portion of Oklahoma (Appendix A). Of those species, ten had a sufficient number of detections to estimate density in native prairie habitat (Table 26), four species in dry-land agriculture (Table 27) and five species in CRP habitat (Table 28). In native prairie (Table 26), the highest densities of one species occurred in Oklahoma when compared to other management units.

Table 26. Estimated densities for species detected in native prairie habitat within the BCR 18 portion of Oklahoma.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Long-billed Curlew	1.15	0.54	2.45	39%	17	X, X
Mourning Dove	19.96	12.38	32.18	24%	49	
Burrowing Owl	5.05	2.37	10.76	39%	24	X, X
Western Kingbird*	68.27	31.84	146.39	40%	24	
Horned Lark	72.99	48.21	110.50	21%	84	
Cassin's Sparrow	41.91	22.98	76.43	31%	58	X
Lark Sparrow	45.36	23.08	89.15	35%	25	X
Lark Bunting	53.56	25.58	112.14	38%	26	X
Grasshopper Sparrow	122.78	64.40	234.07	33%	33	X
Western Meadowlark	60.10	42.43	85.14	18%	161	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Oklahoma Department of Wildlife Conservation (X).

Table 27. Estimated densities for species detected in dry-land agriculture within the BCR 18 portion of Oklahoma.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Mourning Dove	13.14	5.51	31.34	45%	18	
Horned Lark	112.15	67.14	187.33	26%	65	X
Lark Bunting	24.10	9.82	59.16	47%	22	X
Western Meadowlark	57.18	35.86	91.16	24%	57	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Oklahoma Department of Wildlife Conservation (X).

Table 28. Estimated densities for species detected in CRP habitat within the BCR 18 portion of Oklahoma.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Mourning Dove	22.20	9.13	53.99	47%	60	
Horned Lark	35.66	20.00	63.59	29%	31	X
Lark Bunting	32.44	17.60	59.78	31%	63	X
Grasshopper Sparrow	110.76	77.59	158.11	18%	127	X
Western Meadowlark	51.49	35.26	75.18	19%	94	X

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X) or Oklahoma Department of Wildlife Conservation (X).

USDA Forest Service

We observed 64 species on Pawnee, Comanche, Kiowa, Cimarron and Rita Blanca National Grasslands within BCR 18 (Appendix A). Of those species, 17 had a sufficient number of detections to estimate density in native prairie habitat (Table 29).

Table 29. Estimated densities for species detected in native prairie habitat on USFS lands (Pawnee, Comanche, Kiowa, Cimarron and Rita Blanca National Grasslands) within BCR 18.

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Ring-necked Pheasant	0.29	0.16	0.53	31%	29	
Scaled Quail	0.60	0.28	1.28	40%	18	X,
Swainson's Hawk	0.34	0.23	0.50	21%	40	X,
Long-billed Curlew	1.11	0.58	2.11	34%	31	X,X
Mourning Dove	8.61	6.05	12.25	18%	137	
Burrowing Owl	1.13	0.70	1.84	25%	57	X,X
Common Nighthawk	0.92	0.45	1.88	37%	25	
Western Kingbird	10.36	7.12	15.07	19%	87	
Horned Lark	73.89	55.98	97.53	14%	562	
Barn Swallow	7.56	3.61	15.84	38%	33	
Northern Mockingbird*	1.34	0.86	2.09	23%	40	
Cassin's Sparrow	25.73	19.61	33.77	14%	285	X,X
Lark Sparrow	22.18	15.28	32.21	19%	106	X,
Lark Bunting	20.61	15.20	27.93	16%	314	X,

Species	D	D LCL	D UCL	D CV	n	Species of Concern
Grasshopper Sparrow	18.19	11.94	27.69	22%	56	X,X
McCown's Longspur	5.86	3.35	10.24	29%	52	X,X
Western Meadowlark	26.24	23.26	29.59	6%	605	X,

D = density estimate expressed in birds/km^2, D LCL & D UCL = lower and upper 95% confidence limits of D, D CV = coefficient of variation for D, n = number of detections used to calculate D. Species of concern as recoginzed by Partners In Flight (X), USDA Forest Region 2 (X).

Habitat Analyses

In 2004, we conducted habitat utilization versus availability analyses to help determine what habitat conditions species are selecting. We evaluated utilization versus availability of two separate conditions, percent grass cover >15 cm and percent shrub cover, for the following species, Burrowing Owl, Loggerhead Shrike, Cassin's Sparrow, Brewer's Sparrow, Lark Bunting, Grasshopper Sparrow, McCown's Longspur and Chestnut-collared Longspur. Total habitat availability, number of point counts conducted, in percent grass cover and percent shrub cover are displayed in Tables 30 and 32. Tables 31 and 33, exhibit the total number of bird detections, by species, in the two habitat conditions (grass cover and shrub cover). Figures 4-19 show habitat utilization versus availability. We used a categorical chi-squared goodness of fit test, to determinie if the results were significant. An asterisk indicates significant differences (0.05).

Table 30. Total number of point counts used to evaluate grass cover >15 cm categories within BCR 18.

	0-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%
Total Availability	3490	2108	1632	1531	787	1320	1422	1671	1073	1280

Table 31. Total number of bird detections for grass cover >15 cm categories within BCR 18. Significant (.05) preference or avoidance is represented by a $^+$ or $^-$, respectively.

Species	0-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%
Burrowing Owl	**$^+$106**	14	**$^-$7**	15	**$^-$2**	8	**$^-$7**	12	9	**$^-$5**
Logger-head Shrike	**$^+$64**	28	16	12	8	15	19	18	12	12
Cassin's Sparrow	**$^-$454**	403	366	350	**$^+$214**	299	**$^+$428**	**$^+$399**	208	**$^-$148**
Brewer's Sparrow	**$^+$66**	24	17	16	11	12	10	16	10	**$^-$7**
Lark Bunting	**$^-$632**	461	451	378	227	307	402	362	**$^+$354**	**$^+$425**
Grasshopper Sparrow	**$^-$88**	**$^-$51**	**$^-$76**	93	51	90	92	126	**$^+$117**	**$^+$300**
McCown's Longspur	**$^+$122**	27	18	18	14	12	16	20	**$^-$4**	**$^-$9**
Chestnut-collared Longspur	31	13	8	12	6	7	7	8	11	6

Table 32. Total number of point counts used to evaluate shrub cover categories within BCR 18.

	<1%	1-3%	3-10%	>10%
Total Availability	8326	3827	2507	944

Table 33. Total number of bird detections in shrub cover categories within BCR 18. Significant (.05) preference or avoidance is represented by a $^{+}$ or $^{-}$, respectively.

Species	<1%	1-3%	3-10%	>10%
Burrowing Owl	178	71	42	$^{-}$**8**
Logger-head Shrike	$^{-}$**89**	77	$^{+}$**64**	$^{+}$**36**
Cassin's Sparrow	$^{-}$**914**	$^{+}$**1336**	$^{+}$**1666**	$^{+}$**825**
Brewer's Sparrow	$^{-}$**82**	62	57	$^{+}$**35**
Lark Bunting	$^{+}$**5995**	$^{-}$**1622**	$^{-}$**1105**	$^{-}$**307**
Grasshopper Sparrow	$^{+}$**1098**	$^{-}$**333**	$^{-}$**198**	93
McCown's Longspur	$^{+}$**398**	$^{-}$**130**	$^{-}$**35**	$^{-}$**18**
Chestnut-collared Longspur	$^{+}$**175**	$^{-}$**12**	$^{-}$**2**	$^{-}$**3**

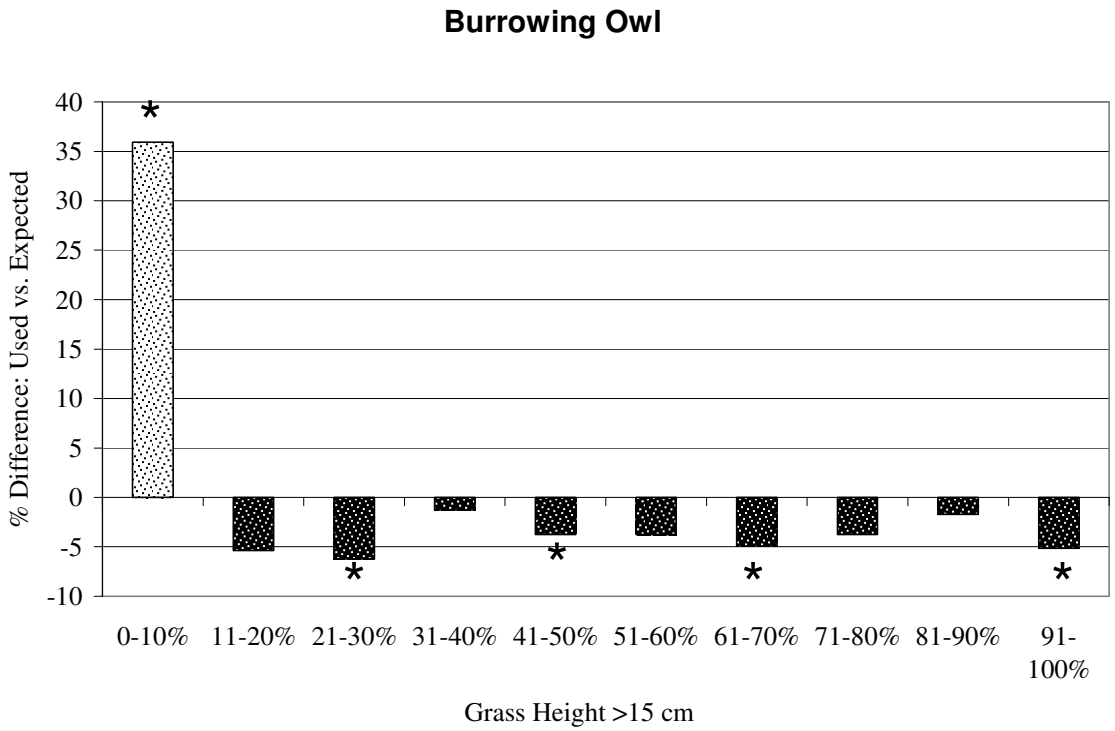
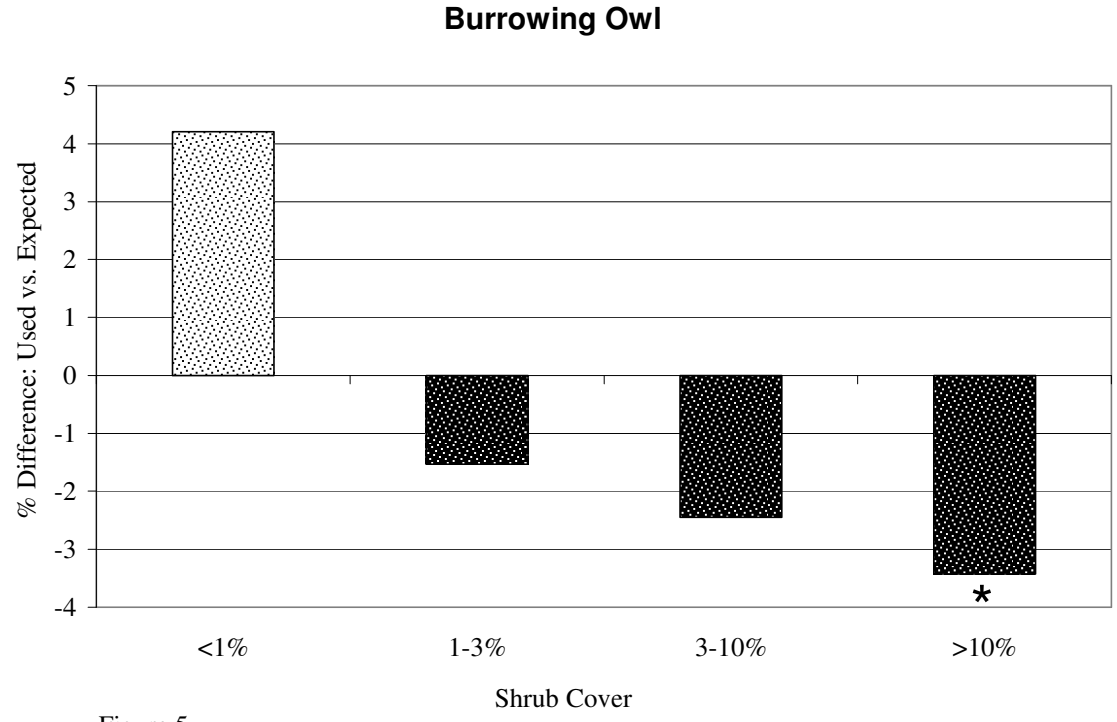


Figure 4.



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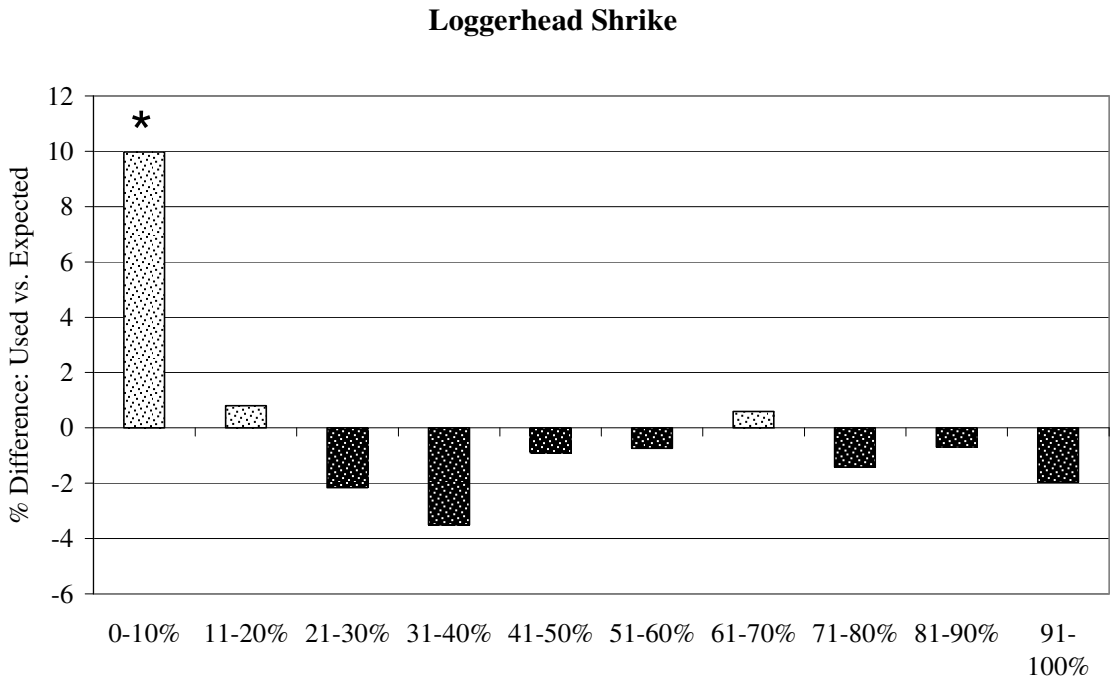

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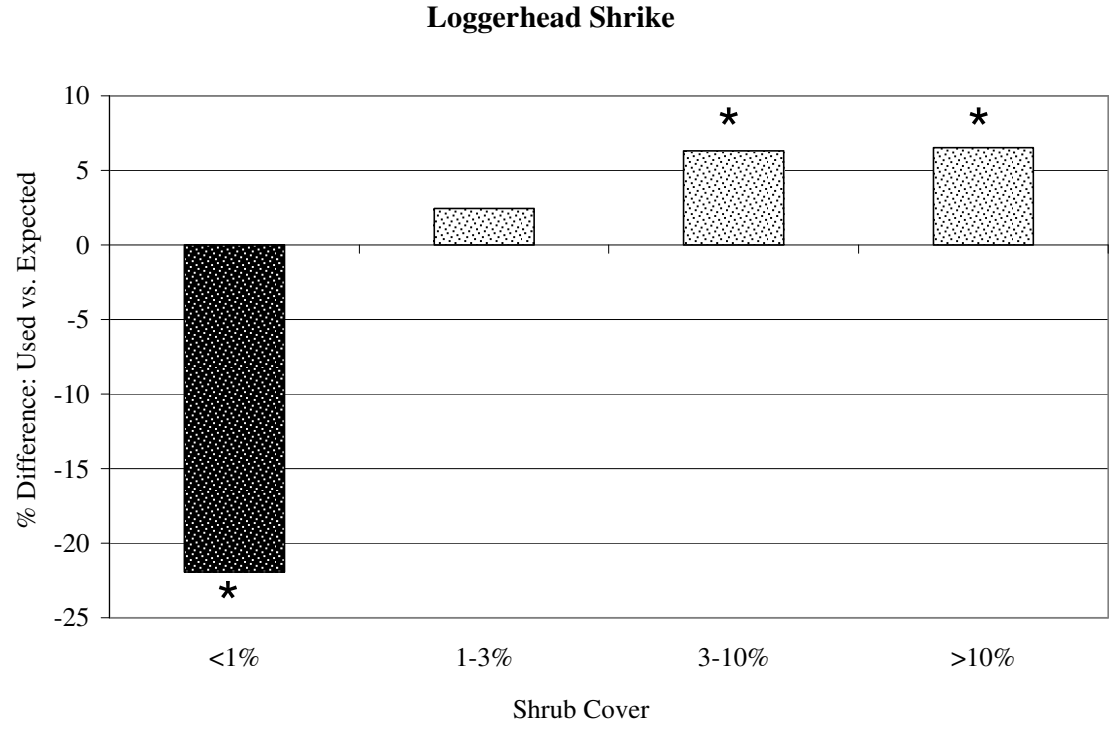

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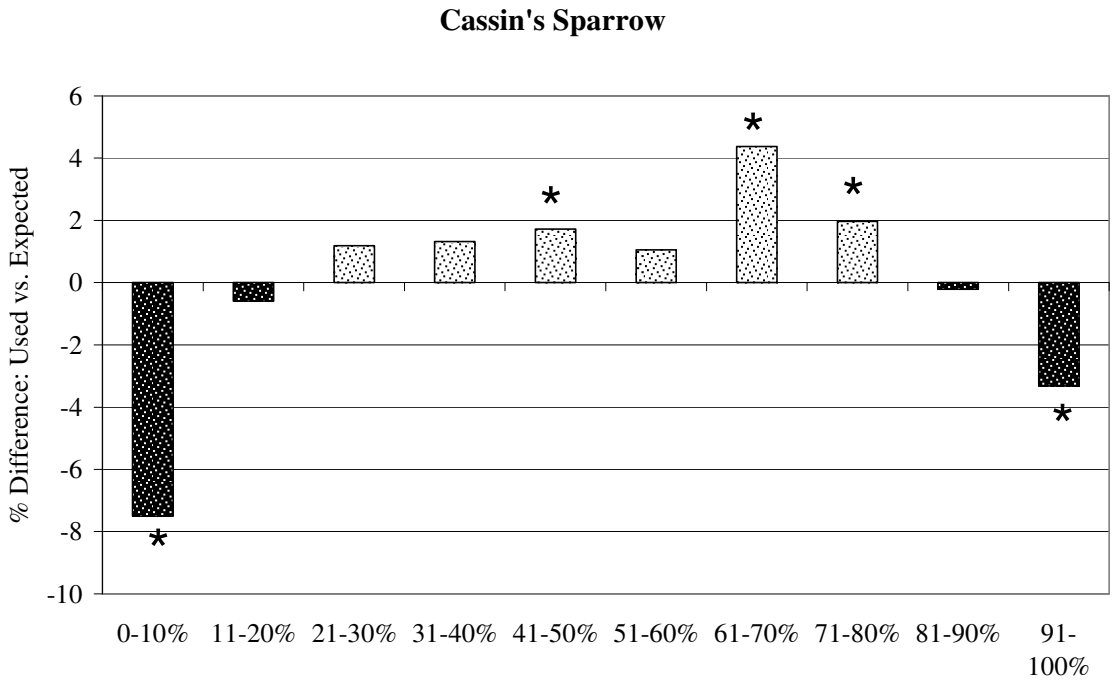

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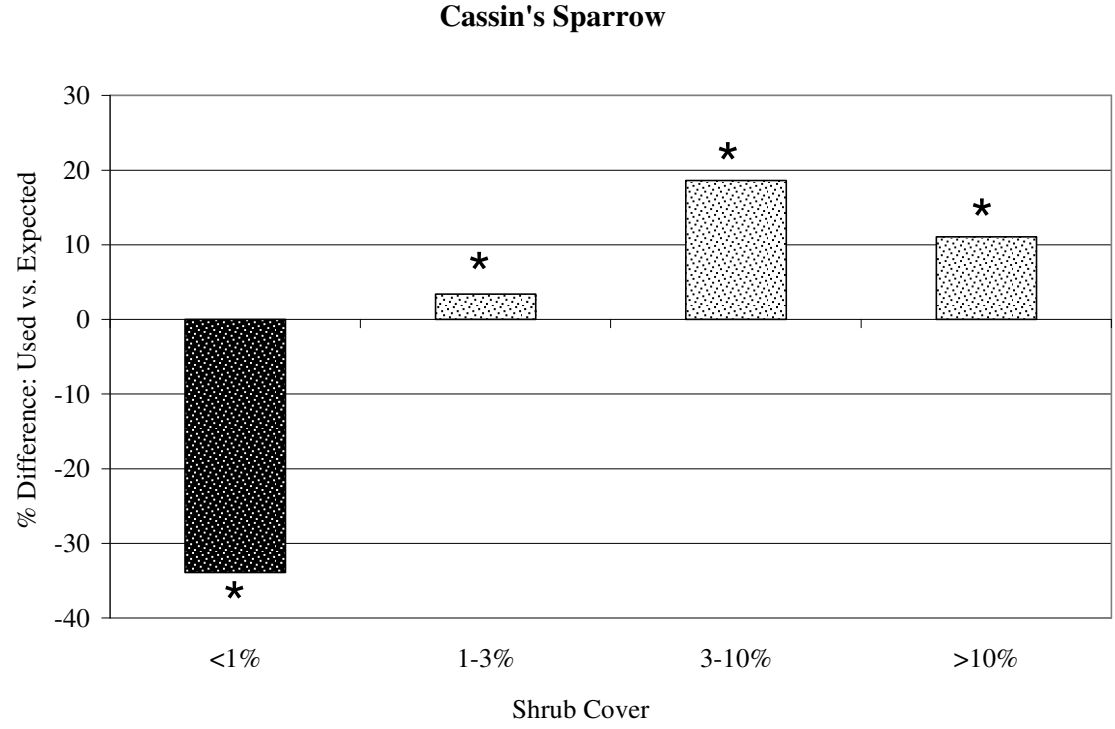

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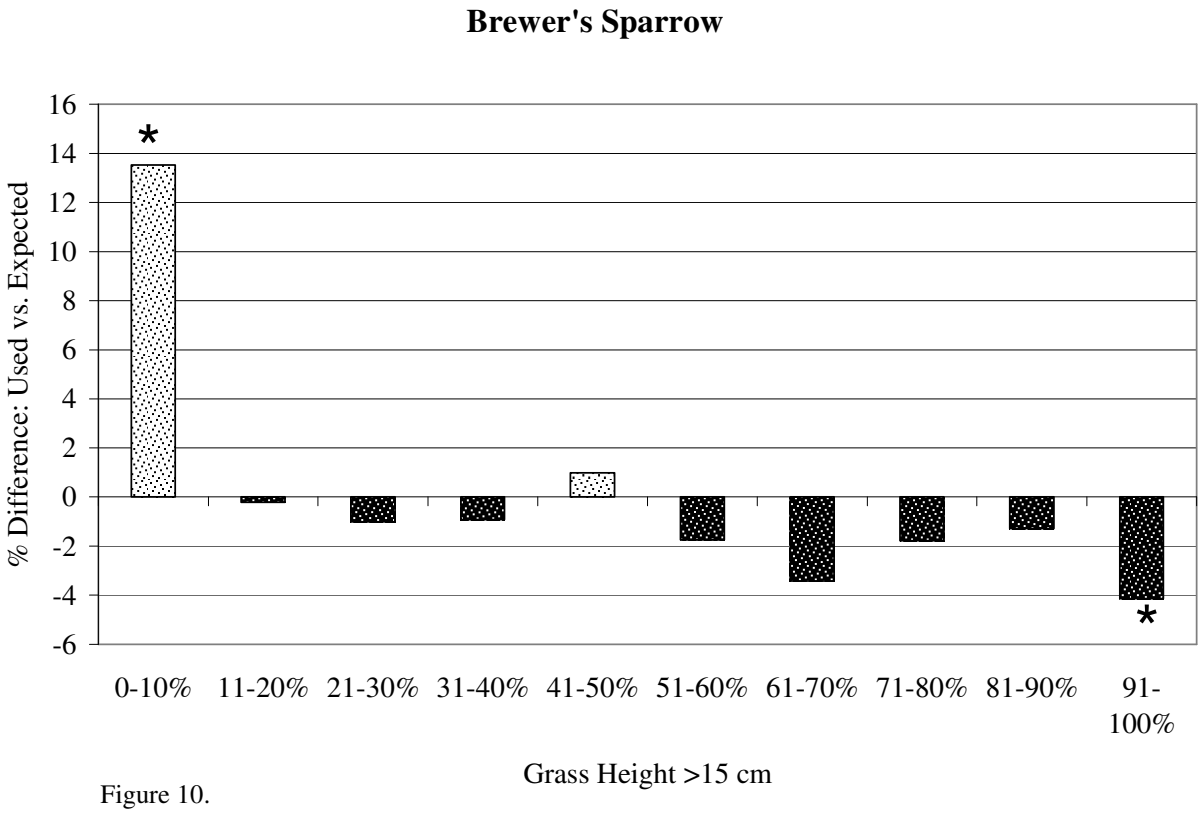

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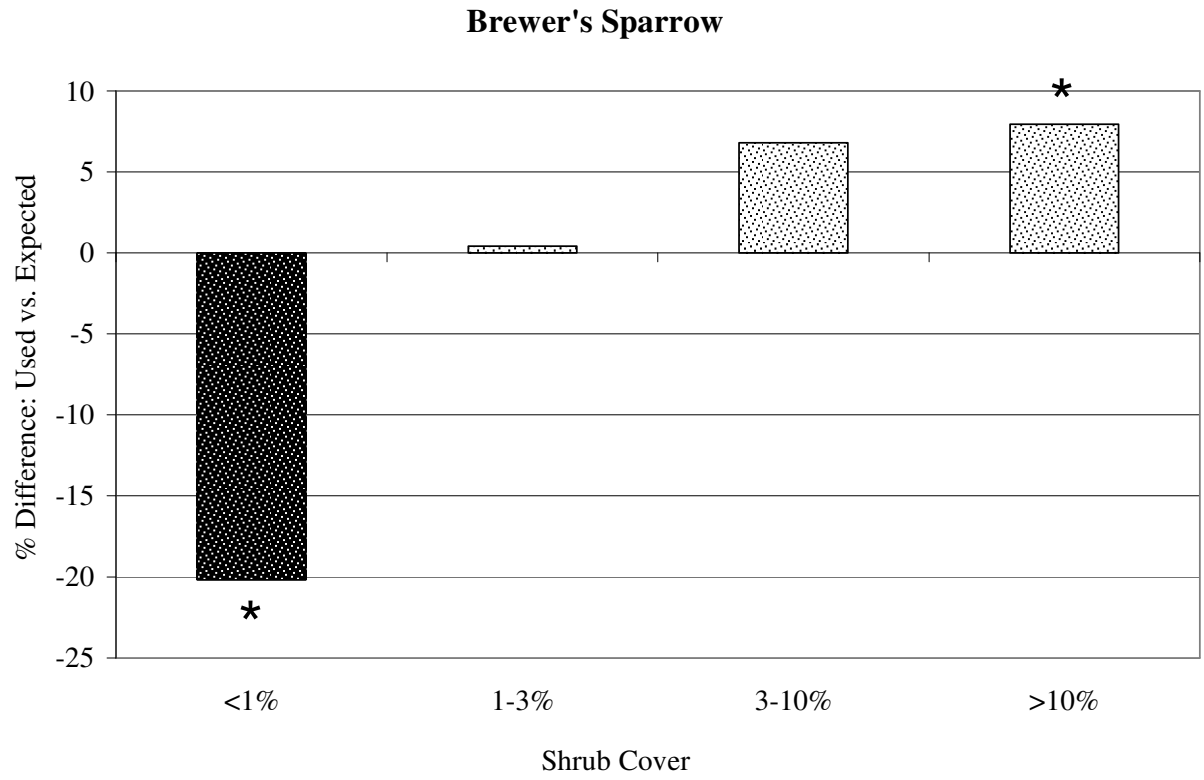

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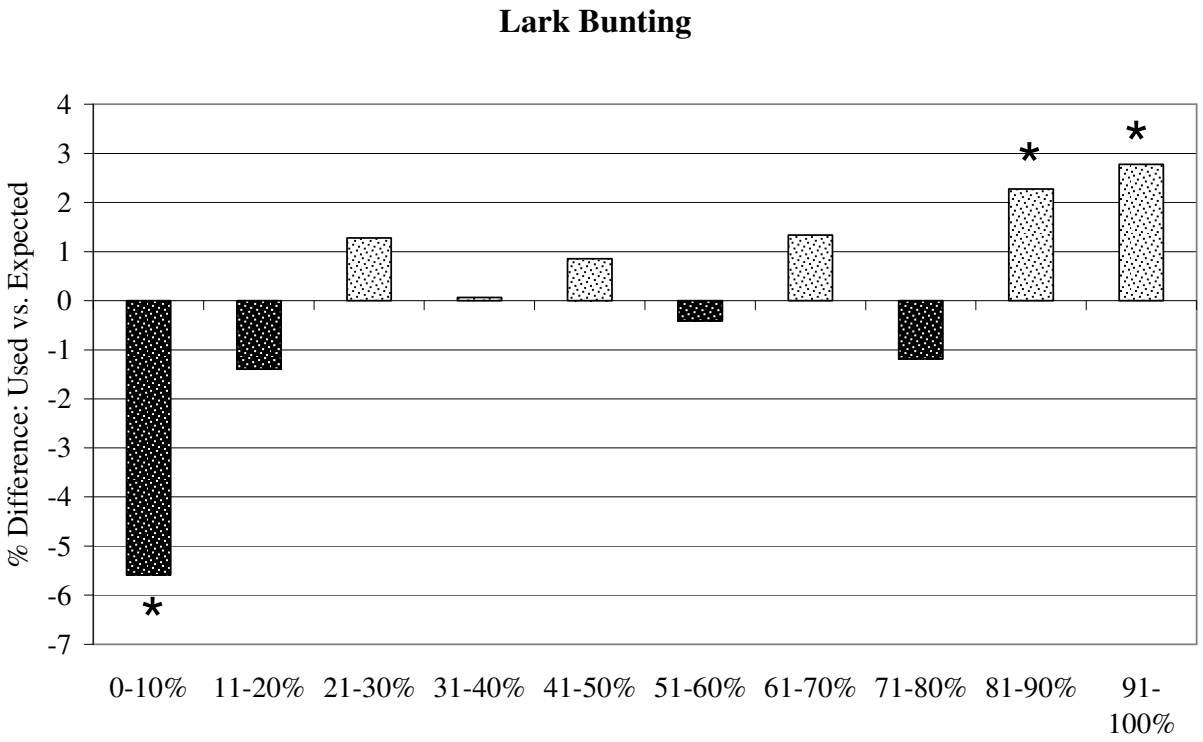

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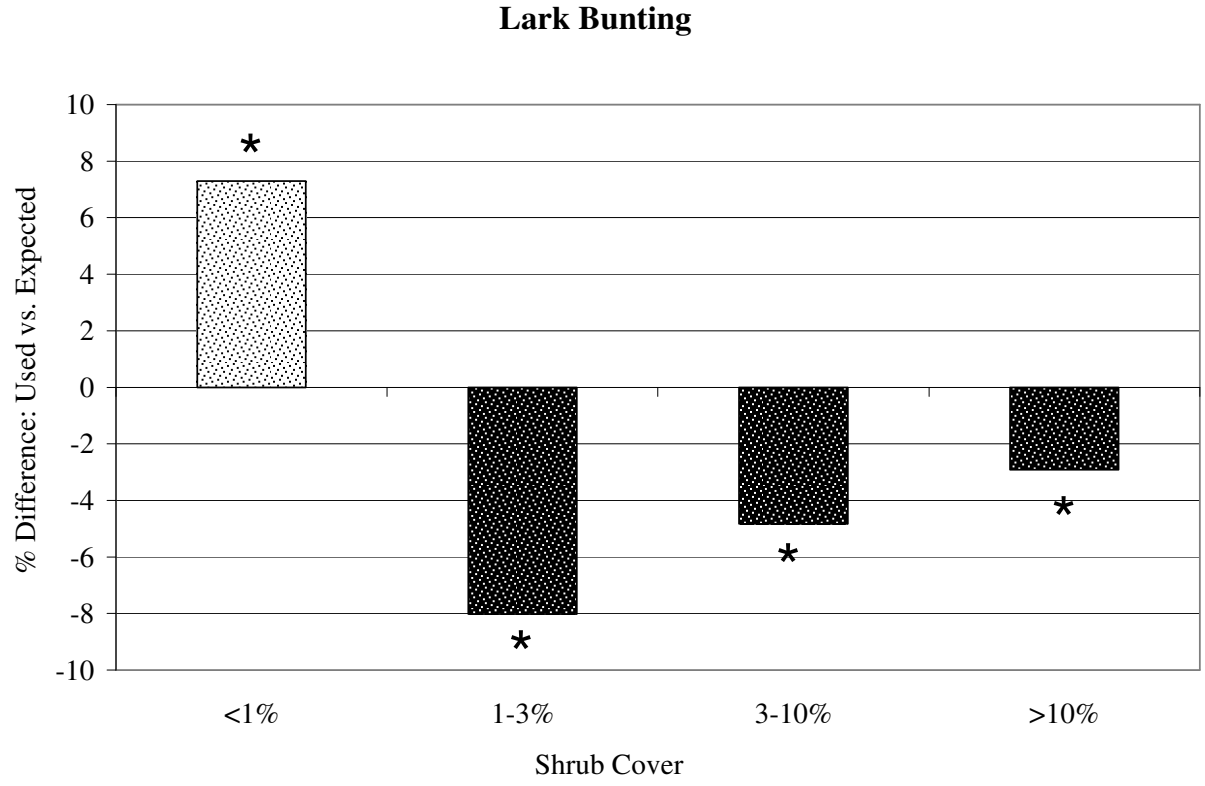

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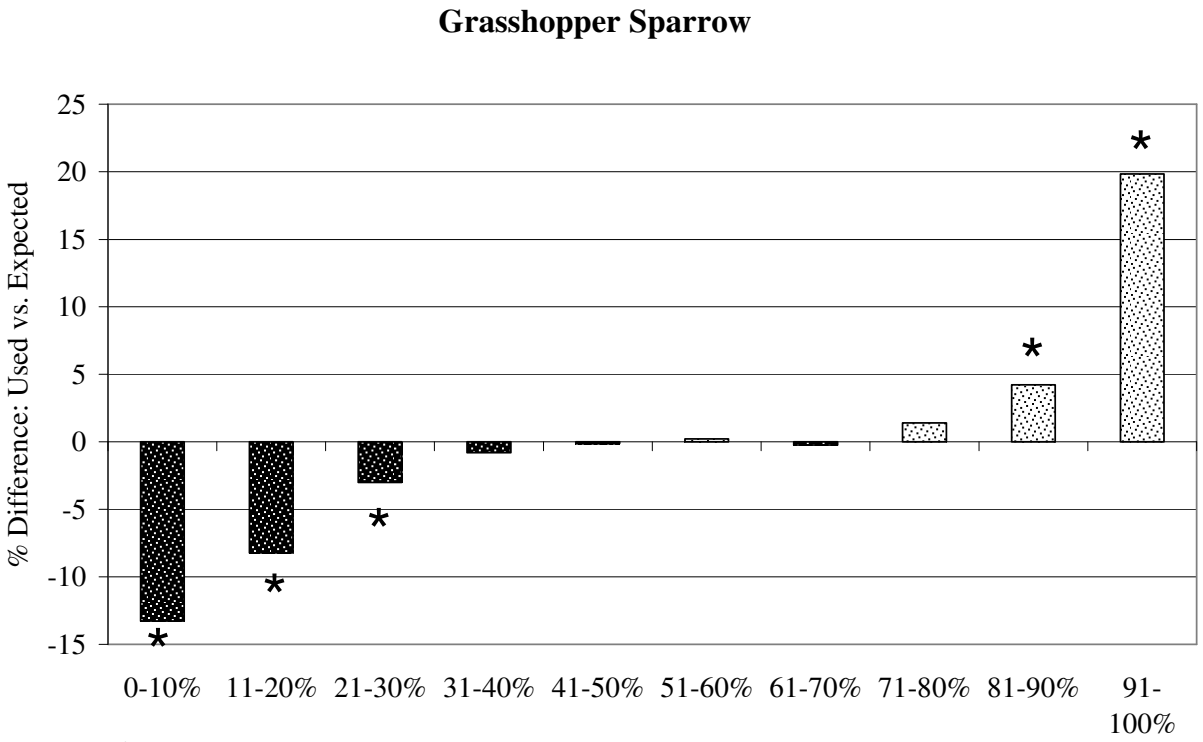

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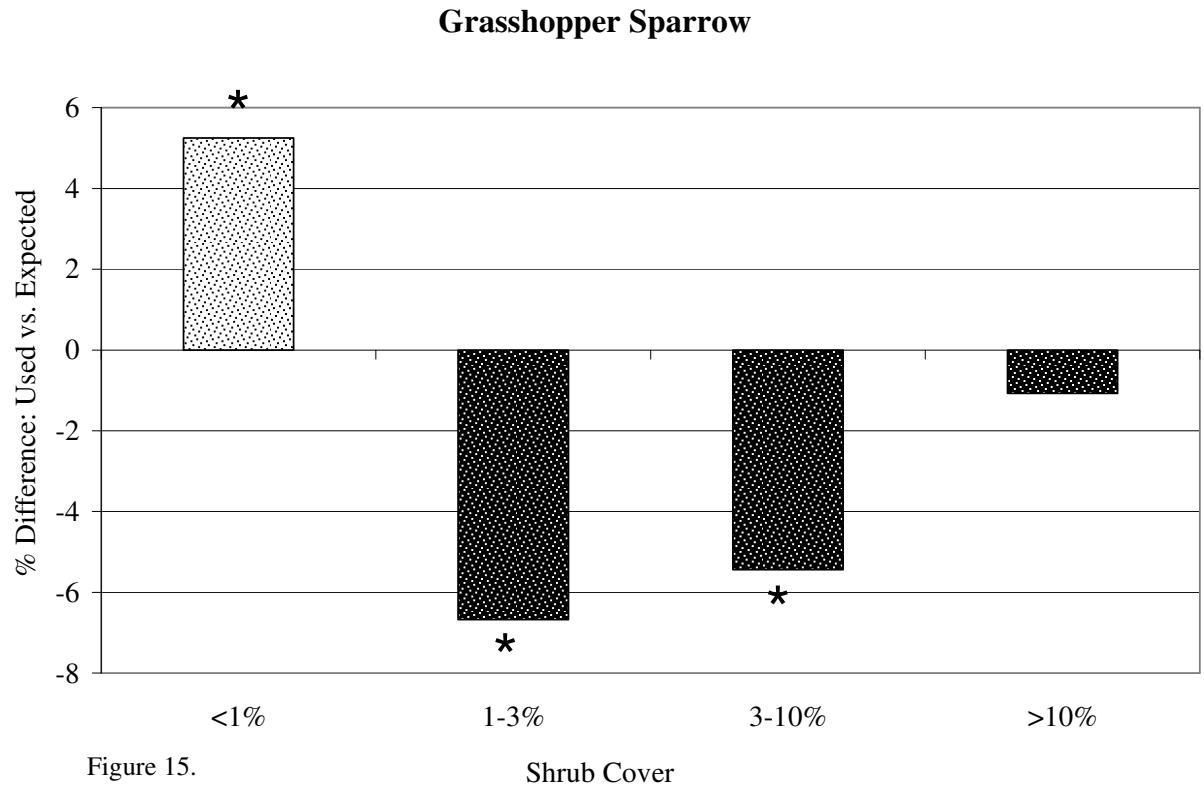

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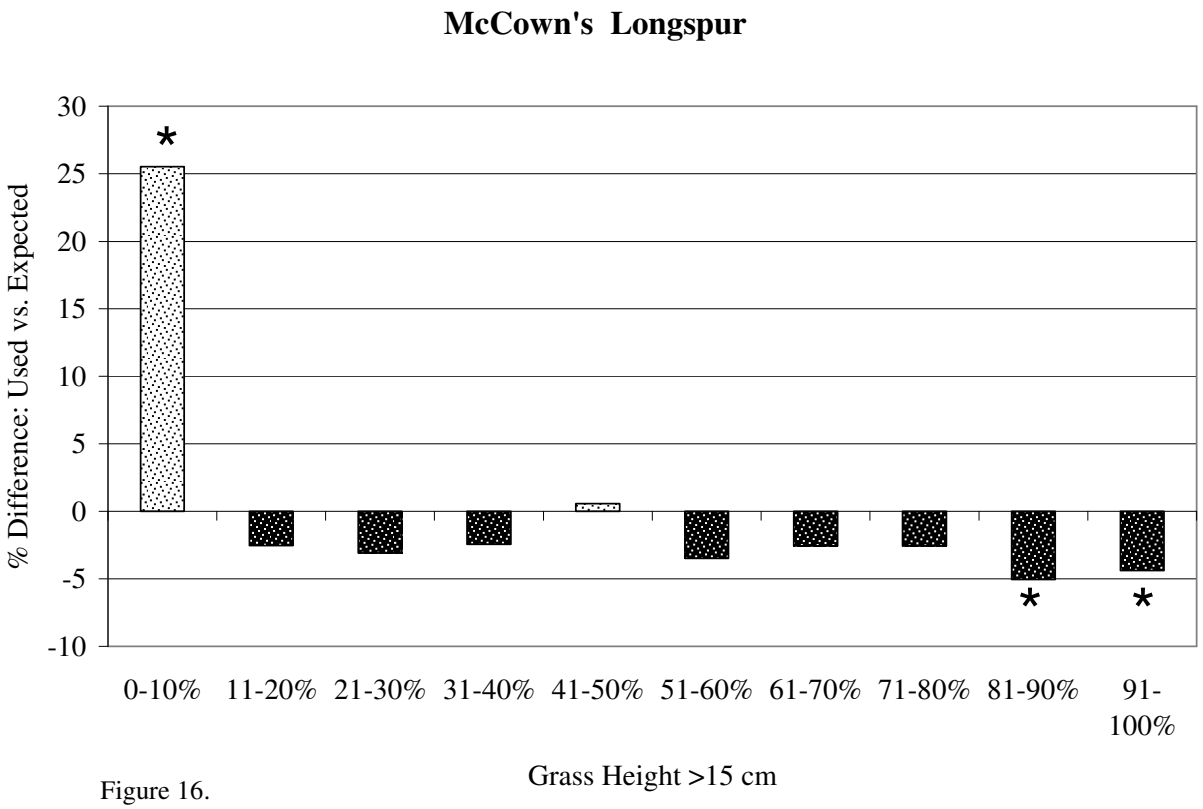

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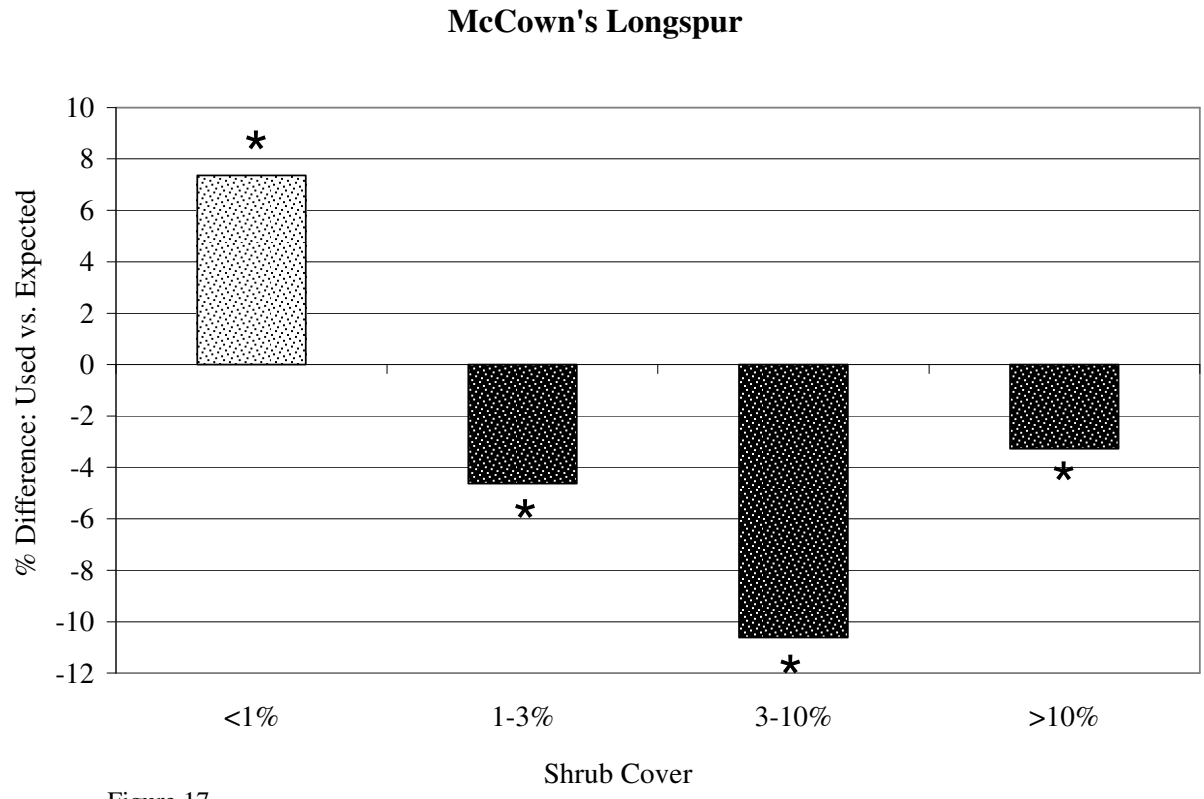

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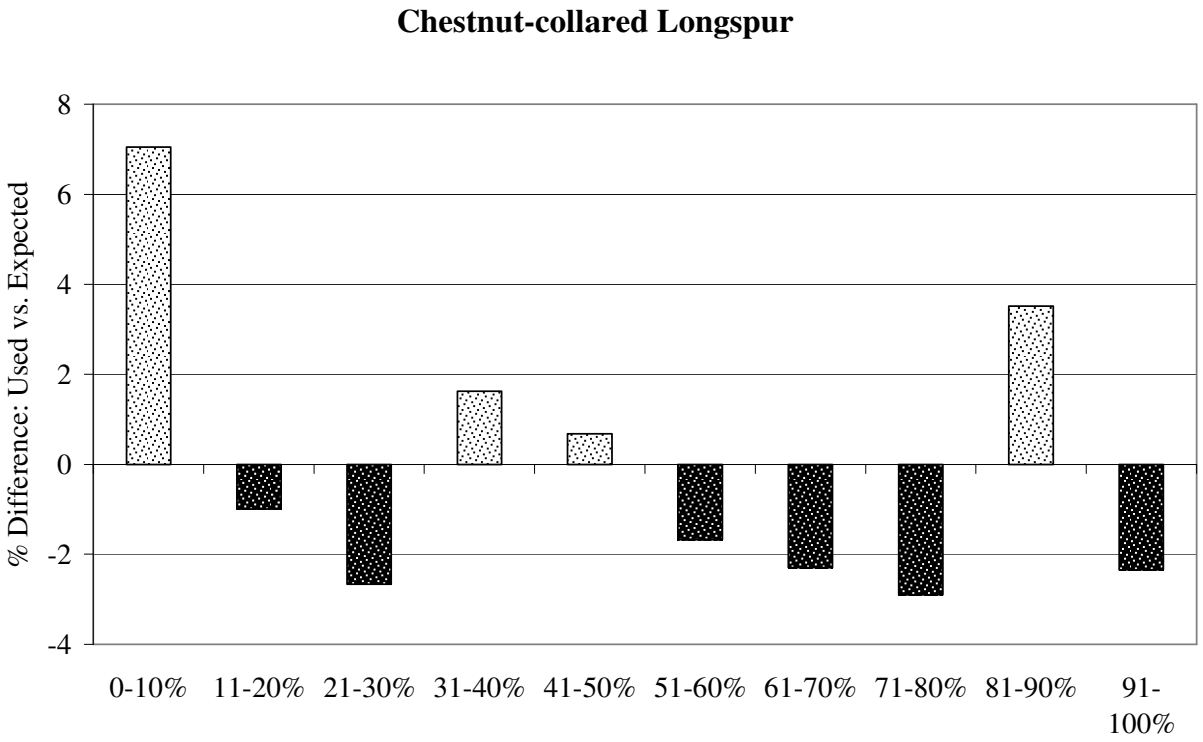

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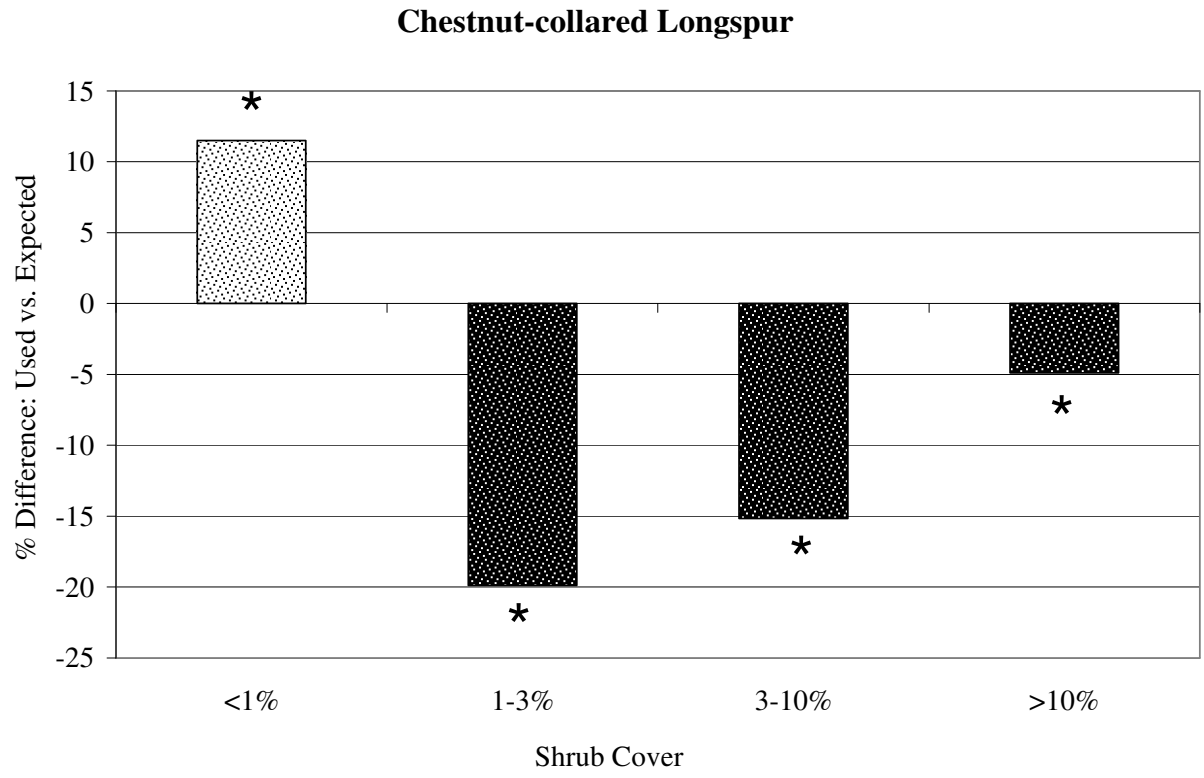

Figure 19.

Discussion

It is important that bird conservation efforts, including inventory and monitoring systems, are implemented consistently across regions that are spatially meaningful to migratory birds. The North American Bird Conservation initiative (NABCI) has developed a framework for bird conservation, and has delineated ecologically based planning, implementation, and evaluation units called Bird Conservation Regions (BCR). The goal of this effort is for states, Joint Ventures, federal agencies, and conservation groups within these regions to develop "regionally-based, biologically driven partnerships." RMBO has been instrumental in creating these partnerships for the Shortgrass Prairie BCR by gaining the cooperation and financial support of Colorado Division of Wildlife, Nebraska Game and Parks Commission, and Kansas Parks and Wildlife, United States Forest Service and the Oklahoma Department of Wildlife Conservation, in implementing a region-wide inventory and monitoring system. Sauer et al. (2003) states that unfortunately much of the information needed to implement conservation plans (estimates of abundance, population change, survival and productivity), habitat availability and change, and bird habitat interactions does not presently exist at the BCR scale.

Cooperation at this scale has allowed us to collect valuable information on bird species within BCR 18 using the section-based survey monitoring technique. This technique can potentially provide statistically significant ($\alpha = .10$) population trends for 46 upland breeding species in BCR 18 within 5 - 20 years (CV = 3%, 41% respectively), based on a power analysis using program TRENDS (Gerrodette 1987, 1991 and 1993). Included in this list are 18 species of concern according to the Partners In Flight (PIF database 2004), a comprehensive database that evaluates the biological status of North American birds and summarizes a vast amount of complex biological information into a limited set of simple scores. Eight species of concern are recognized by states and federal agencies participating in this grassland bird monitoring program. The importance of monitoring for large scale conservation planning is critical for tracking the status of habitats and species and for testing underlying management assumptions and hypotheses (Samson et al. 2003).

According to the North American Landbird Conservation Plan (Rich et al. 2004), seven species we were able to calculate density estimates for are listed as species of Continental Importance in the Prairie Avifaunal Biome. Chestnut-collared Longspur, Lark Bunting, Grasshopper Sparrow, Dickcissel, Swainson's Hawk and Scaled Quail. These species are in the Management action category, in need of on the ground conservation actions to reverse significant, long-term population declines or sustain vulnerable populations (Rich et al. 2004). Chestnut-collared Longspur, Lark Bunting and Grasshopper Sparrow are also stewardship species. Stewardship species are characteristic of their biome and are intended to represent bird characteristics and habitat within their biome. One species, McCown's Longspur, is in the Long-term Planning and Responsibility action category of the North American Landbird Conservation Plan (Rich et al. 2004). This plan was developed by Partners in Flight and serves as a blueprint for continental habitat conservation under the North American Bird Conservation Initiative (Rich et al. 2004).

Data gathered using section-based surveys could also be used to delineate areas that are important to breeding prairie birds. Using GIS, we can overlay relative abundance and distribution layers for threatened species in the Shortgrass Prairie BCR, shown in the species accounts section (Appendix D), to form maps on which we can draw polygons around areas that

have high relative abundances and species richness. We could then create maps for any species, or group of species, detected using this technique. With this information we could direct additional efforts in demographic research to these areas to determine if they support source or sink populations. With this demographic information in association with climate, precipitation, and habitat, we should be able to model breeding bird populations to determine which geographic areas consistently hold viable populations of prairie birds.

Our grassland bird monitoring program also provides detailed species accounts that compare density estimates of individual species between management units, habitat types, percent shrub cover categories and percent grass cover >15 cm categories. This information will allow us to identify variables or locations that should effectively conserve prairie bird species. Armed with this information, local and regional land managers can enhance management for breeding shortgrass prairie bird species within BCR 18.

An important aspect of bird monitoring for land managers is the ability to use monitoring data coupled with vegetation data to assess ecosystem integrity. Bird communities reflect an integration of a broad array of ecosystem conditions, including productivity, vegetation structure and composition, water quality, and landscape integrity (Adamus et al. 2001). The response by bird communities to changes in the environment can be examined at a variety of spatial scales, making them a powerful and practical tool for evaluating the broader effects of resource management, conservation and restoration activities, or other environmental changes. Moreover, because birds are generally abundant, conspicuous, and relatively easy to identify, they offer tremendous logistical and economic advantages over other taxonomic groups in aiding our ability to monitor their populations. In addition, birds are popular with the public, and there is a strong and growing interest, both nationally and internationally, to manage and conserve bird populations, many of which are exhibiting long-term population declines (Sauer et al. 2003).

The exploratory habitat analysis provides insight into habitat conditions birds are selecting. In BCR 18 percent shrub cover and percent grass cover >15 cm are major factors influencing habitat use for grassland birds. Many variables influence resource selection such as population density, competition with other species, natural selection, make up of forage elements, heredity, predation, habitat patch size and inter-patch distances (Manly et al. 2002). The difficulty in assessing whether a habitat condition is selected or avoided is not certain with availability and use data but does provide a starting point for further analysis (Manly et al. 2002). The habitat analysis will provide managers with specific baseline information on how to manage grasslands to benefit priority bird species.

HABITAT EVALUATION FOR EIGHT GRASSLAND BIRD SPECIES

Habitat utilization versus availability was analyzed for two habitat characteristics, proportion of grass height >15 cm and percent shrub cover using a categorical chi-square goodness of fit tests (Bonferroni adjusted). Below, we present summary of the results from the utilization analysis and the density estimates calculated using program DISTANCE.

Burrowing Owl prefers areas primarily with short grass and little shrub cover. The most important condition for breeding Burrowing Owls are concentrations of prairie dogs to provide nesting opportunities. This species is selecting areas where grass height >15 cm covers

approximately 10% of the area and avoiding areas where grass height >15 cm covers 21-30%, 41-50% and 61-70%. The highest densities (~0.9 birds/km^2) occur where grass height >15 cm covers 0-10% of the area with overlapping confidence intervals in 31-40% grass cover.
This species is avoiding areas where shrub cover is >10%. The highest densities (~2.4 birds/km^2) occur where shrub cover is 1-3% with overlapping confidence intervals in <1% and 3-10% shrub cover.

Loggerhead Shrike prefers areas with dense shrub structure and a low percentage of grass cover >15 cm. This species is selecting areas where grass height >15 cm covers approximately 10% of the area. The highest densities (~1.5 birds/km^2) occur where grass height >15 cm covers 61-70% of the area with overlapping confidence intervals in 0-10% and 11-20% grass cover.
This species is selecting areas where shrub cover is 3-10% to >10% and avoiding <1% shrub cover areas. The highest densities (~14.1 birds/km^2) occur where shrub cover is >10% with overlapping confidence intervals in 1-3% shrub cover.

Cassin's Sparrow is another species that selects areas with a high percent of shrub cover and a medium to higher percent of grass cover >15 cm, but avoiding the extremes (0-10% and 91-100% grass cover).
This species is selecting areas where grass height >15 cm covers approximately 41-50%, 61-70%, 71-80% and avoiding areas where grass cover >15 cm is 0-10% and 91-100%. The highest densities (~29.8 birds/km^2) occur where grass >15 cm covers 41-50% of the area with overlapping confidence intervals in 31-40%, 51-60%, 61-70%, 71-80% and 81-90% grass cover >15 cm.
This species is selecting areas where shrub cover is >1% to >10% and avoiding areas with <1% shrub cover. The highest densities (~138.8 birds/km^2) occur where shrub cover is >10%.

Brewer's Sparrow selects for areas with dense shrub structure and low grass height. This species is selecting areas where grass >15 cm covers approximately 0-10% and avoiding areas where grass height >15 cm covers 91-100% of the area. The highest densities (~0.95 birds/km^2) occur where grass height >15 cm covers 0-10% of the area with overlapping confidence intervals in 11-20% and 21-30% grass cover. This species is also selecting areas where shrub cover is >10% and avoiding areas with <1% shrub cover. The highest densities (~12.2 birds/km^2) occur where shrub cover is >10%.

Lark Bunting prefers areas exhibiting a low number of shrubs that contain areas with a high percentage of grass cover >15 cm. This species is selecting areas where grass height >15 cm covers approximately 81-100% and avoiding areas where grass height >15 cm covers 0-10%. The highest densities (~41.6 birds/km^2) occur where grass >15 cm covers 81-90% of the area with overlapping confidence intervals in 41-50%, 61-70%, 71-80% and 91-100% grass cover >15 cm.
This species is also selecting areas where shrub cover is <1% and avoiding areas with shrub cover >1% to >10%. The highest densities (~48.1 birds/km^2) occur where shrub cover is <1% with overlapping confidence intervals in 1-3%, 3-10% and >10% shrub cover.

Grasshopper Sparrow prefers areas with high percent grass cover >15 cm and low percent of shrub cover within the area.

This species is selecting areas where grass height >15 cm covers approximately 81-100% and avoiding areas where grass height >15 cm covers 0-30%. The highest densities (~70.9 birds/km^2) occur where grass height >15 cm covers 90-100% of the area.
This species is also selecting areas where shrub cover is <1% and avoiding areas with shrub cover >1-10%. The highest densities (~34.5 birds/km^2) occur where shrub cover is <1% with overlapping confidence intervals in 1-3%, 3-10% and >10% shrub cover.

McCown's Longspur prefers areas with a low percent of shrub cover and percent grass cover >15 cm is low.
This species is selecting areas where grass height >15 cm covers approximately 0-10% and avoiding areas where grass >15 cm covers 81-100%. The highest densities (~2.5 birds/km^2) occur where grass height >15 cm covers 0-10% of the area with overlapping confidence intervals in 21-30%, 31-40%, 41-50% and 71-80% grass cover.
This species is also selecting areas where shrub cover is <1% and avoiding areas with shrub cover >1% to >10%. The highest densities (~4.2 birds/km^2) occur where shrub cover is >1-3%.

Chestnut-collared Longspur prefers areas with a low number of shrubs. This species compared with the McCown's Longspur uses areas where percent grass cover >15 cm is higher.
This species displays no significant selection for categories with grass height >15 cm. The highest densities (~.62 birds/km^2) occur where grass >15 cm covers 81-90% of the area with overlapping confidence intervals in 0-10% and 31-40% grass cover.
This species is selecting areas with shrub cover <1% and avoiding areas with >1% to >10% shrub cover. The highest densities (~0.46 birds/km^2) occur where shrub cover is <1%.

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Appendix A Species detected by section-based surveys

Below is a comprehensive list of bird species detected by section-based monitoring, 15 May – 3 July 2004. The total number of species detected was 115 and the total number of detections was 43,127. For each of the management units, we have indicated the number of detections by species. We listed the species in taxonomic order.

Species	CO	KS	NE	OK	Cimarron	Comanche	Kiowa	Pawnee	Rita Blanca	BCR
Wood Duck		1								1
Mallard	22	14	6	13			1			56
Northern Pintail	2									2
Ring-necked Pheasant	56	334	60	92	24	1			5	542
Sharp-tailed Grouse			1							1
Lesser Prairie-Chicken		1								1
Wild Turkey		6	2							8
Scaled Quail	67	8		19	7	6	4		4	100
Northern Bobwhite	4	74	11	6	17					95
American White Pelican	4									4
Great Blue Heron	4	3	4	1			1			13
Turkey Vulture	38	16	11	1		12	9			75
Mississippi Kite	2	1								3
Northern Harrier	7	30	17	6	1					60
Sharp-shinned Hawk	1		1							2
Swainson's Hawk	136	53	28	13	3	14	19	1	12	261
Red-tailed Hawk	24	13	25	4	1	3			1	66
Ferruginous Hawk	12	10	5	5		7	4		7	39
Golden Eagle	2									2
American Kestrel	31	17	17	3	1	1	2	1		70
Prairie Falcon	5		1			1				6
Virginia Rail	1									1
Sandhill Crane			1							1
Killdeer	119	124	40	22	2			3	1	306
Mountain Plover	8	3				3	1			12
American Avocet	4	3								7
Willet			2							2
Upland Sandpiper	4	6	31							41
Long-billed Curlew	52	2	79	35		23	10		35	198
Ring-billed Gull	4									4
Black Tern				1						1
Rock Pigeon	35	11	24				2			72
Eurasian Collared-Dove	1									1
Mourning Dove	1824	1246	628	373	100	160	36	22	31	4119
Yellow-billed Cuckoo		1								1
Barn Owl				2						2

Species	CO	KS	NE	OK	Cimarron	Comanche	Kiowa	Pawnee	Rita Blanca	BCR
Great Horned Owl	1	4								5
Burrowing Owl	107	28	28	42	1	25	19	3	23	236
Short-eared Owl			3	4						7
Common Nighthawk	140	102	53	13	18	18	1		3	312
Chimney Swift		5	2							7
White-throated Swift	2					2				2
Broad-tailed Hummingbird	2									2
Red-headed Woodpecker	1	17	3	1	1					22
Northern Flicker	2	5	3							10
Eastern Phoebe		3					1			4
Say's Phoebe	45	23	17	2		7	7			94
Ash-throated Flycatcher	7					4	1			8
Great Crested Flycatcher		1								1
Cassin's Kingbird	14		3	1		1				18
Western Kingbird	638	299	185	128	20	58	26	11	24	1287
Eastern Kingbird	36	34	49	1	1	3				120
Scissor-tailed Flycatcher		6		5						11
Loggerhead Shrike	56	5	24			6	4			89
Warbling Vireo		3								3
Blue Jay		3	3							6
Black-billed Magpie	4	1	1							6
American Crow			4							4
Chihuahuan Raven	63	3		7	1	31	4		4	78
Common Raven	14		1				10			25
Horned Lark	5596	3295	1439	366	70	290	237	208	121	11012
Tree Swallow	2									2
Violet-green Swallow	4									4
Northern Rough-winged Swallow	9	21	16			3				46
Bank Swallow	9		15	8						32
Cliff Swallow	236	72	71	17		13	12	5		408
Barn Swallow	102	133	68	59	3	1	26	2	9	391
Cactus Wren	1									1
Rock Wren	2	8	12				1			23
Bewick's Wren				1					1	1
House Wren	1	4								5
Eastern Bluebird		2								2
Western Bluebird	3	3				1				6
Mountain Bluebird			1				1			2
Wood Thrush	1					1				1
American Robin	25	30	30							85
Northern Mockingbird	191	23	4	14	2	37	15		6	251
Sage Thrasher	2									2
Brown Thrasher	2	29	6							37

Species	CO	KS	NE	OK	Cimarron	Comanche	Kiowa	Pawnee	Rita Blanca	BCR
Curve-billed Thrasher							1			1
European Starling	79	40	48		1		1			168
Yellow Warbler	3	2	1							6
Palm Warbler	1							1		1
Yellow-breasted Chat		1	1							2
Cassin's Sparrow	934	225	1	164	78	192	70		73	1452
Chipping Sparrow	4	1				2				5
Brewer's Sparrow	36	1	10	7				13	3	54
Field Sparrow		3	2							5
Vesper Sparrow	26	1	15	4					3	46
Lark Sparrow	480	145	401	60	14	49	51	7	25	1155
Lark Bunting	3928	980	1284	243	6	118	37	242	55	6472
Savannah Sparrow	2									2
Grasshopper Sparrow	321	400	344	300	24	15	5	5	24	1381
Lincoln's Sparrow	2									2
McCown's Longspur	148		73					74		221
Chestnut-collared Longspur	5		173					5		178
Blue Grosbeak	2	17	10	10	7		1		2	40
Lazuli Bunting	1	1			1	1				2
Indigo Bunting		1								1
Dickcissel	3	71	15	1	7					90
Bobolink			11							11
Red-winged Blackbird	253	868	92	153	17	1		1	5	1369
Eastern Meadowlark	1	5		2			9		1	18
Western Meadowlark	3304	2069	1899	661	139	288	126	40	153	8148
Yellow-headed Blackbird	1	1		1						3
Brewer's Blackbird	78		27							105
Common Grackle	93	285	151	33	2	5	1		12	563
Great-tailed Grackle	5	16		2			3			26
Brown-headed Cowbird	122	129	76	9	6	2	2		5	343
Orchard Oriole	4	33	17							54
Bullock's Oriole	83	24	7	7	13	2	4	1		125
Baltimore Oriole		6								6
House Finch	6	13	1	2						22
American Goldfinch		1	14		1					15
House Sparrow	47	108	5	7	1					167

Appendix B Species of concern detected by section-based surveys

Below is a comprehensive list of species of concern detected by section-based monitoring, 15 May – 3 July 2004. We have indicated species designated as a conservation concern by each of the management units and species in the Partners in Flight database (PIF) by an X. We listed the species in taxonomic order. See corresponding *Species Accounts* for detailed information on species status in each management unit.

Common Name	Scientific Name	NE	CO	KS	OK	USFS R2	PIF
Lesser Prairie-Chicken	*Tympanuchus pallidicinctus*		X			X	X
Northern Bobwhite	*Colinus virginianus*	X					
Mississippi Kite	*Ictinia mississippiensis*	X					X
Northern Harrier	*Circus cyaneus*	X				X	X
Swainson's Hawk	*Buteo swainsoni*	X			X		X
Ferruginous Hawk	*Buteo regalis*	X	X	X	X	X	X
Golden Eagle	*Aquila chrysaetos*			X	X		
Prairie Falcon	*Falco mexicanus*				X		X
Mountain Plover	*Charadrius montanus*	X	X	X	X	X	X
American Avocet	*Recurvirostra americana*	X					X
Upland Sandpiper	*Bartramia longicauda*	X				X	X
Long-billed Curlew	*Numenius americanus*	X	X	X	X	X	X
Yellow-billed Cuckoo	*Coccyzus americanus*	X	X			X	
Burrowing Owl	*Athene cunicularia*	X	X		X	X	
Short-eared Owl	*Asio flammeus*						X
Chimney Swift	*Chaetura pelagica*	X					
Red-headed Woodpecker	*Melanerpes erythrocephalus*	X					X
Say's Phoebe	*Sayornis saya*						X
Great Crested Flycatcher	*Myiarchus crinitus*	X					
Cassin's Kingbird	*Tyrannus vociferans*	X					
Western Kingbird	*Tyrannus verticalis*						X
Scissor-tailed Flycatcher	*Tyrannus forficatus*	X					
Loggerhead Shrike	*Lanius ludovicianus*	X			X	X	
Chihuahuan Raven	*Corvus cryptoleucus*			X			
Horned Lark	*Eremophila alpestris*						X
Cassin's Sparrow	*Aimophila cassinii*						X
Brewer's Sparrow	*Spizella breweri*	X				X	X
Lark Sparrow	*Chondestes grammacus*	X					X
Lark Bunting	*Calamospiza melanocorys*	X					X
Grasshopper Sparrow	*Ammodramus savannarum*	X				X	X
McCown's Longspur	*Calcarius mccownii*	X				X	X
Chestnut-collared Longspur	*Calcarius ornatus*	X				X	X
Dickcissel	*Spiza americana*	X					X
Bobolink	*Dolichonyx oryzivorus*	X		X			X
Eastern Meadowlark	*Sturnella magna*	X					
Western Meadowlark	*Sturnella neglecta*						X
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*						X
Bullock's Oriole	*Icterus bullockii*	X					

Appendix C Partners in Flight priority upland bird species list

Below is a list of priority upland species complied by RMBO from the Partners in Flight database within BCR 18. RMBO identified the number of piority upland species by selecting species that use shortgrass prairie and shrubland habitats during the breeding season, and greater than 1% of the population breeds within BCR 18. The list includes the common name, the PIF priority level, % of the breeding population estimated to occur in BCR 18, the population trend (based on BBS data within BCR 18 1966-1999), and the associated P-value.

Species	PIF priority level*	% of population in BCR	BCR Trend	P-value
Northern Harrier	II.	4.37	-2.8	0.25
Swainson's Hawk	I.	20.94	-0.7	0.69
Ferruginous Hawk	I.	21.11	1.46	0.37
Prairie Falcon	I.	10.17	5.72	0.08
Greater Prairie-Chicken	I.	7.58	54.96	0.16
Lesser Prairie-Chicken	I.	No Data	No Data	
Scaled Quail	I.	8.37	-2.95	0.05
Mountain Plover	I.	73.6	-1.06	0.78
Upland Sandpiper	II.	1.37	-5.46	0.22
Long-billed Curlew	I.	14.08	-3.32	0.15
Burrowing Owl	I.	34.95	-3.37	0.36
Say's Phoebe	II.	10.44	0.79	0.63
Chihuahuan Raven	II.	24.42	-1.33	0.26
Loggerhead Shrike		7.82	-0.18	0.93
Horned Lark	III.	21.49	-1.89	<0.01
Cassin's Sparrow	I.	38.55	-1.68	0.01
Brewer's Sparrow	III.	1.09	-5.99	0.12
Lark Sparrow	II.	17.73	-1.48	0.06
Lark Bunting	I.	36.44	-1.97	0.01
Grasshopper Sparrow	II.	19.65	-1.53	0.17
McCown's Longspur	I.	18.42	2.5	0.69
Chestnut-collared Longspur	I.	2.66	9.4	0.26
Dickcissel	II.	1.85	4.26	0.11
Western Meadowlark	III.	18.44	-0.64	0.06

* Tier I. High Overall Priority. This tier includes species that are typically of conservation concern throughout their range.
Tier II. High Regional Priority. This tier includes species that are of moderate overall priority, but are important to consider for conservation within a region.
Tier III. Additional Watch List Species. This tier includes species that are on the U.S. Watch List (see Pashley et al. 2000), but are not included in the above tiers.

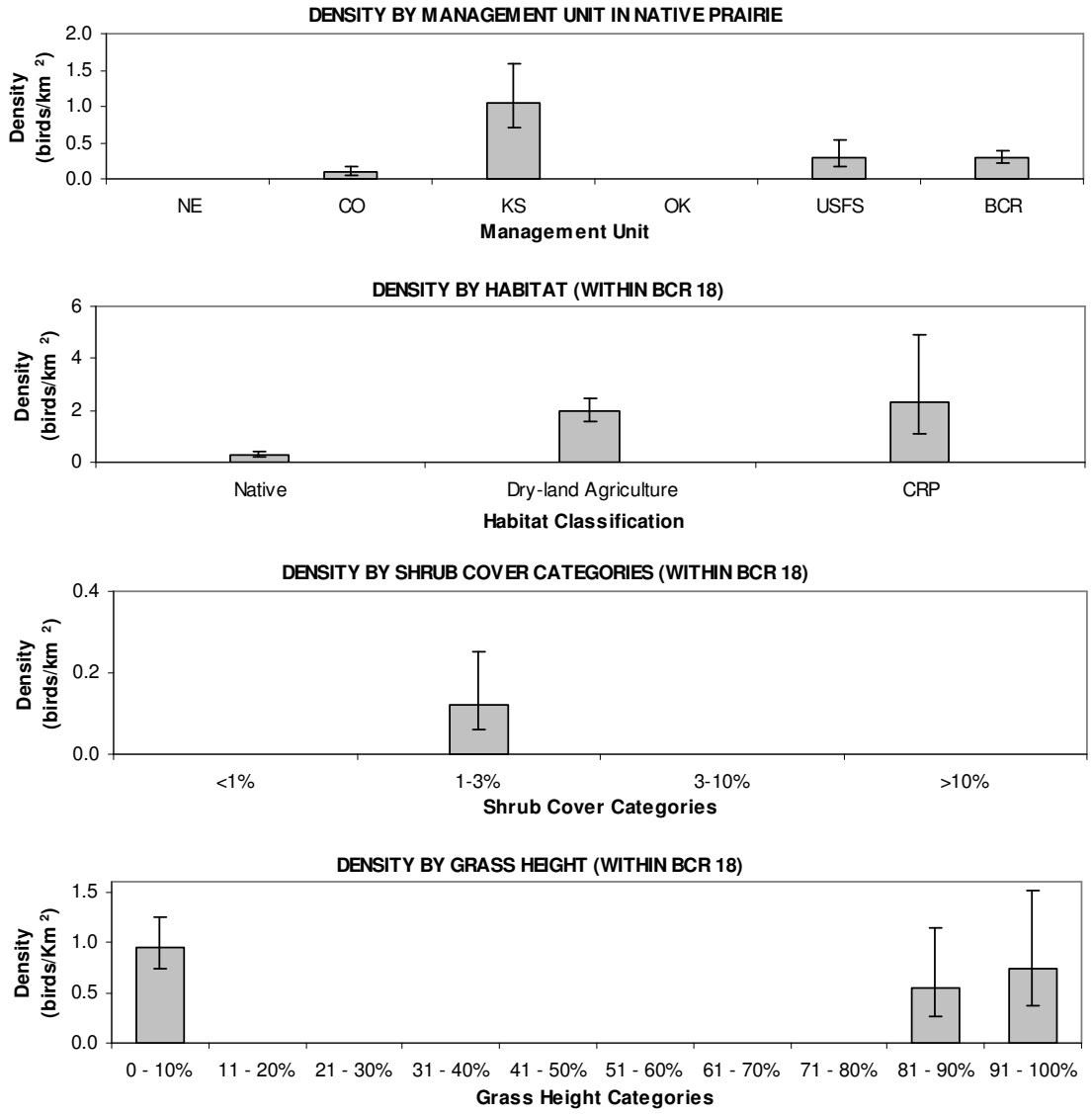
Appendix D Species Accounts

The following species accounts include species distribution maps and density estimates. Species distribution maps show observation locations and index of abundance at the section level. All bird locations do not necessarily represent local breeding for the individual species. Index of abundance, represented by graded dots, is defined as the total number of a species detected on the section divided by the number of point counts conducted on that section. The density estimates by shrub cover and percent grass height >15 cm categories were obtained by pooling data from 2002-2004.

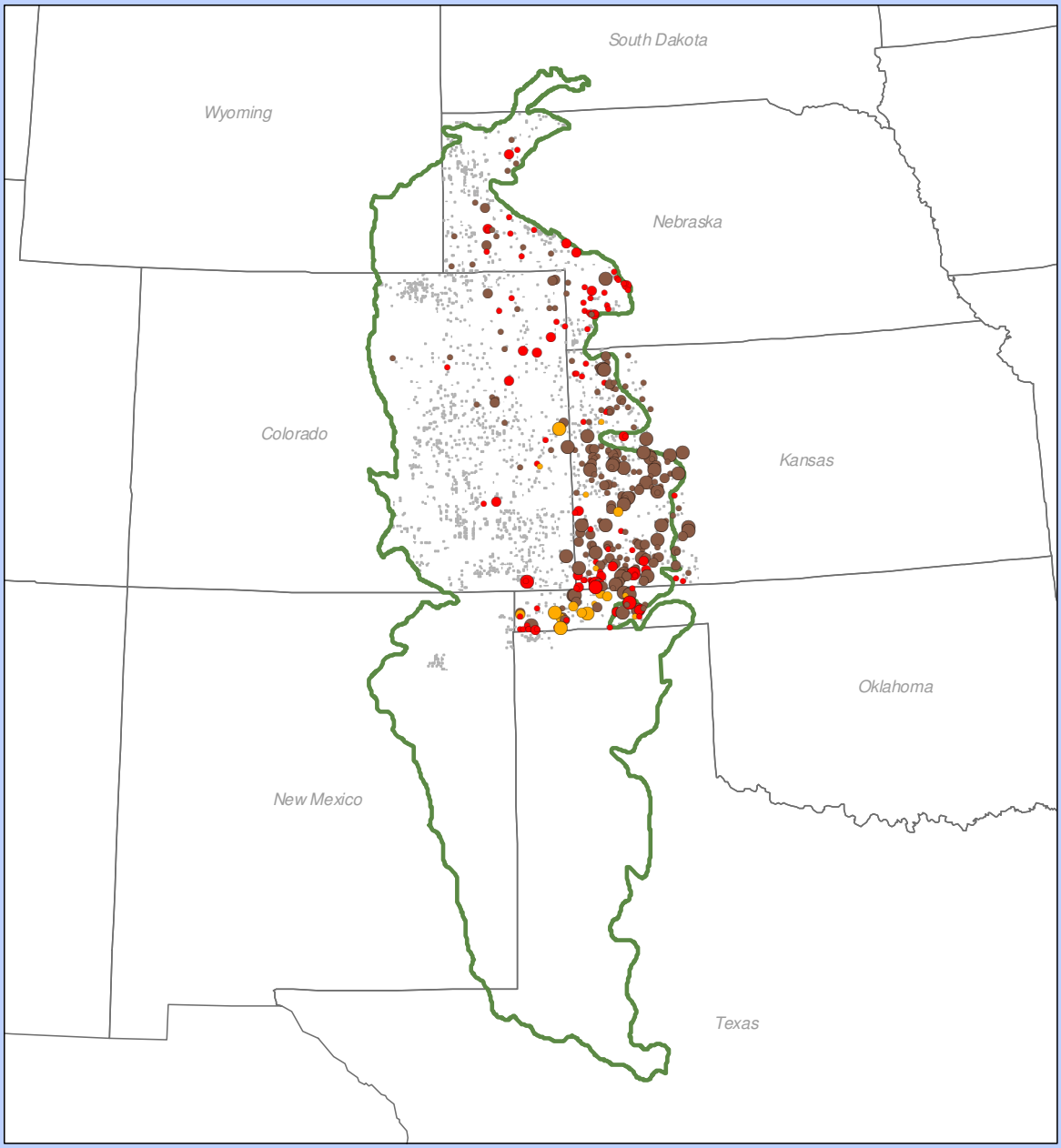
Ring-necked Pheasant

(Phasianus colchicus)

During the 2004 field season, we detected 542 Ring-necked Pheasants on 333 (13.8%) of the surveyed sections. Ring-necked Pheasants were distributed in greater abundance in the southeastern part of the study area. Density was higher in CRP habitat (D = 2.33 birds/km^2, CV = 39%, *n* = 21) than in native prairie habitat (D = 0.30 birds/km^2, CV = 15%, *n* = 112) and dry-land agriculture (D = 1.97 birds/km^2, CV = 11%, *n* = 239) at the BCR level. Within native prairie habitat, highest density occurred in Kansas (D = 1.05 birds/km^2, CV = 21%, n = 43). This species had a density estimate of 1.05 birds/km^2 (CV = 21%, n = 43) in 1-3% shrub cover. In grass height this species exhibited irregular density patterns with higher density estimates in the 0-10% category (D = .96 birds/km^2, CV = 13%, *n* = 221). Management of this introduced upland game bird should be focused in areas of agricultural and CRP habitat.



Ring-necked Pheasant



Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Lesser Prairie Chicken

(Tympanuchus pallidicinctus)

In 2004, we detected one Lesser Prairie Chicken in Meade county, Kansas and one detection in 2003 in Stevens County, Kansas. This species is of concern as follows:

- Partners In Flight – Tier I (high overall priority)
- US Fish and Wildlife Service – candidate species
- Colorado – state threatened
- USFS R2 – sensitive species.

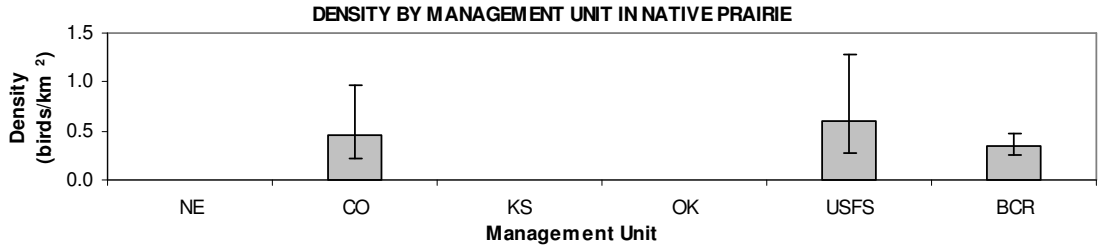
Lesser Prairie Chicken

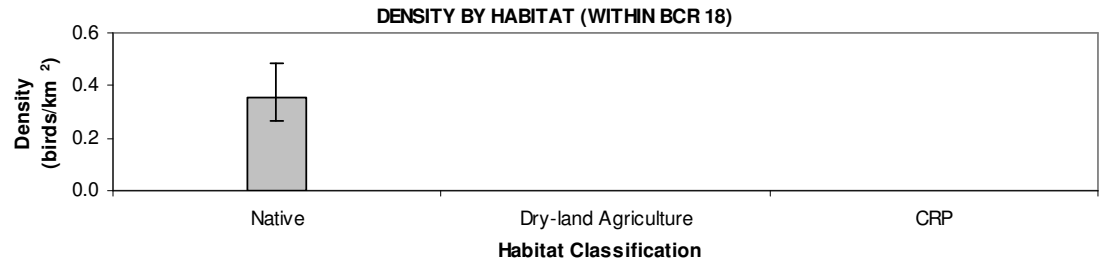
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

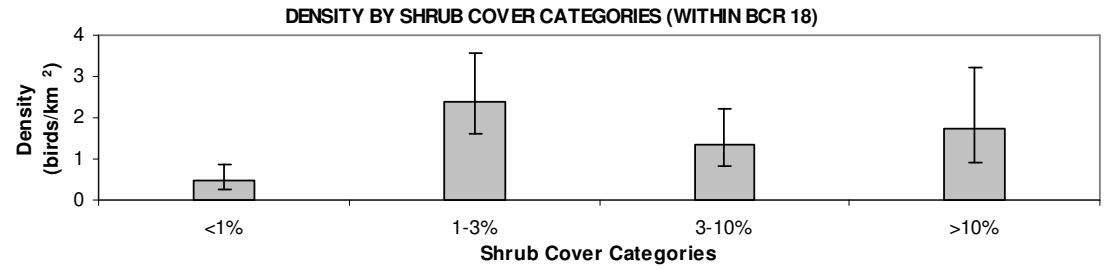
Scaled Quail

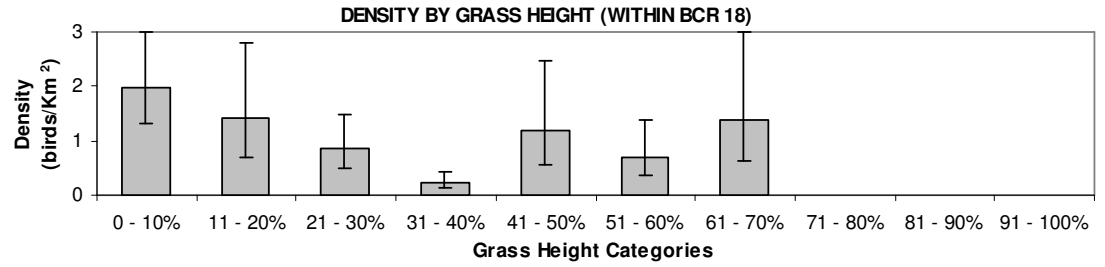
(Callipepla squamata)

In 2004, we documented 100 Scaled Quail on 71 (2.9%) of the surveyed sections. Higher density estimates were obtained in USFS grasslands (D = .60 birds/km^2, CV = 40%, *n* = 18). Within percent shrub cover types, density was highest in areas of 1-3% shrub cover (D = 2.39 birds/km^2, CV = 20%, *n* = 95). In grass height, this species had a generalist behavior up to 70%. Scaled Quail is a Tier I (high overall priority) species according to Partners In Flight (2004).

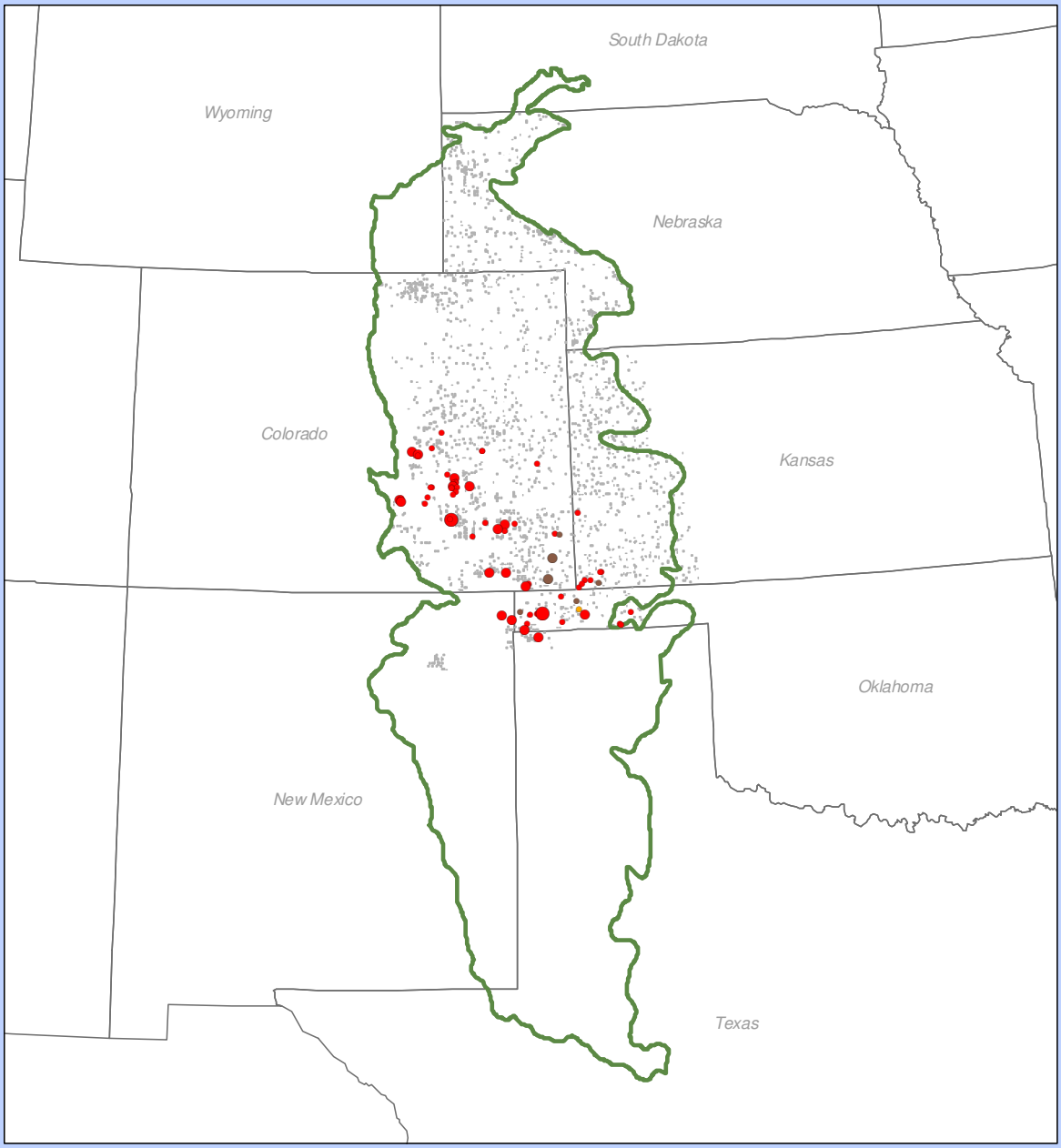








Scailed Quail

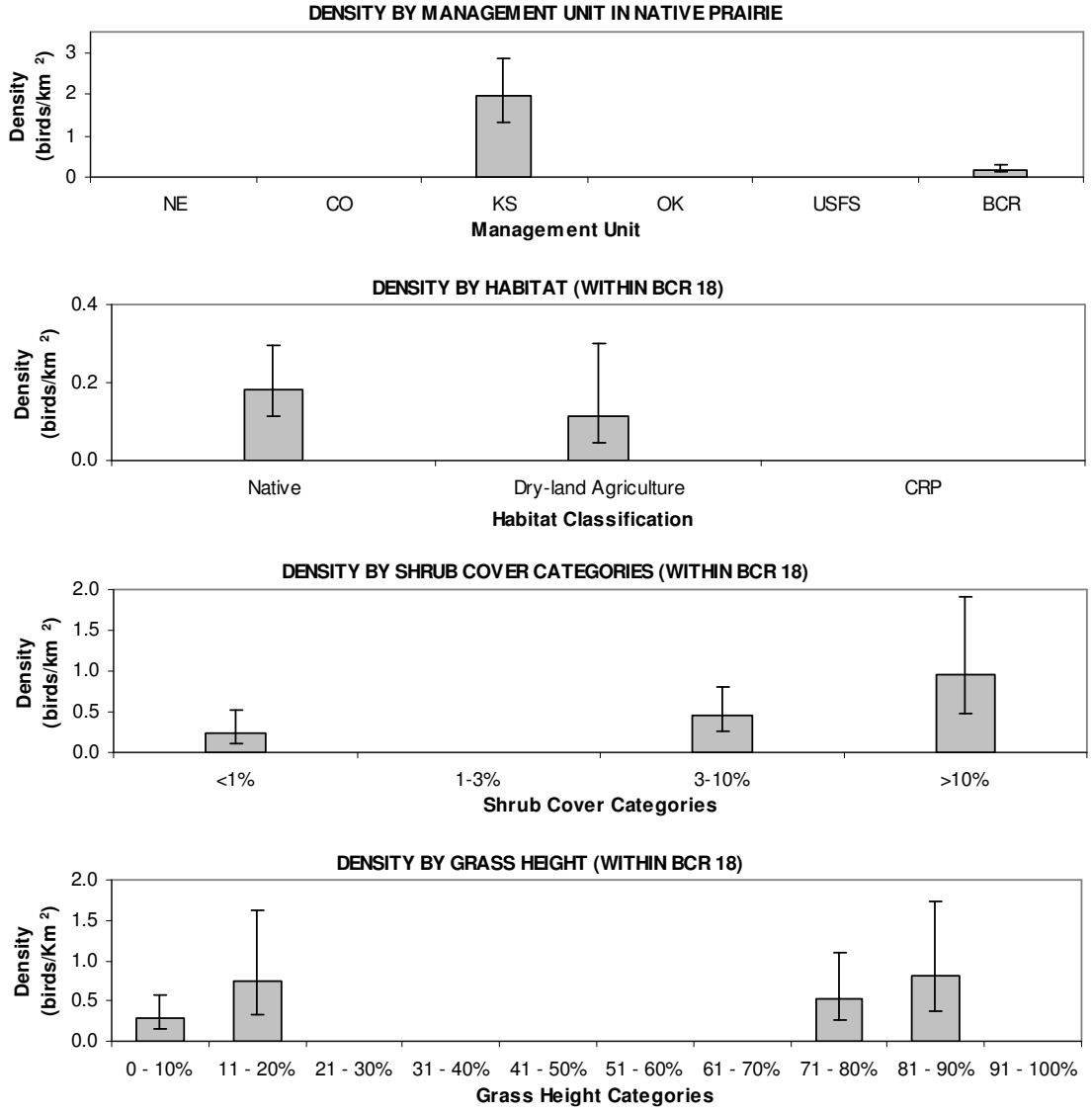


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

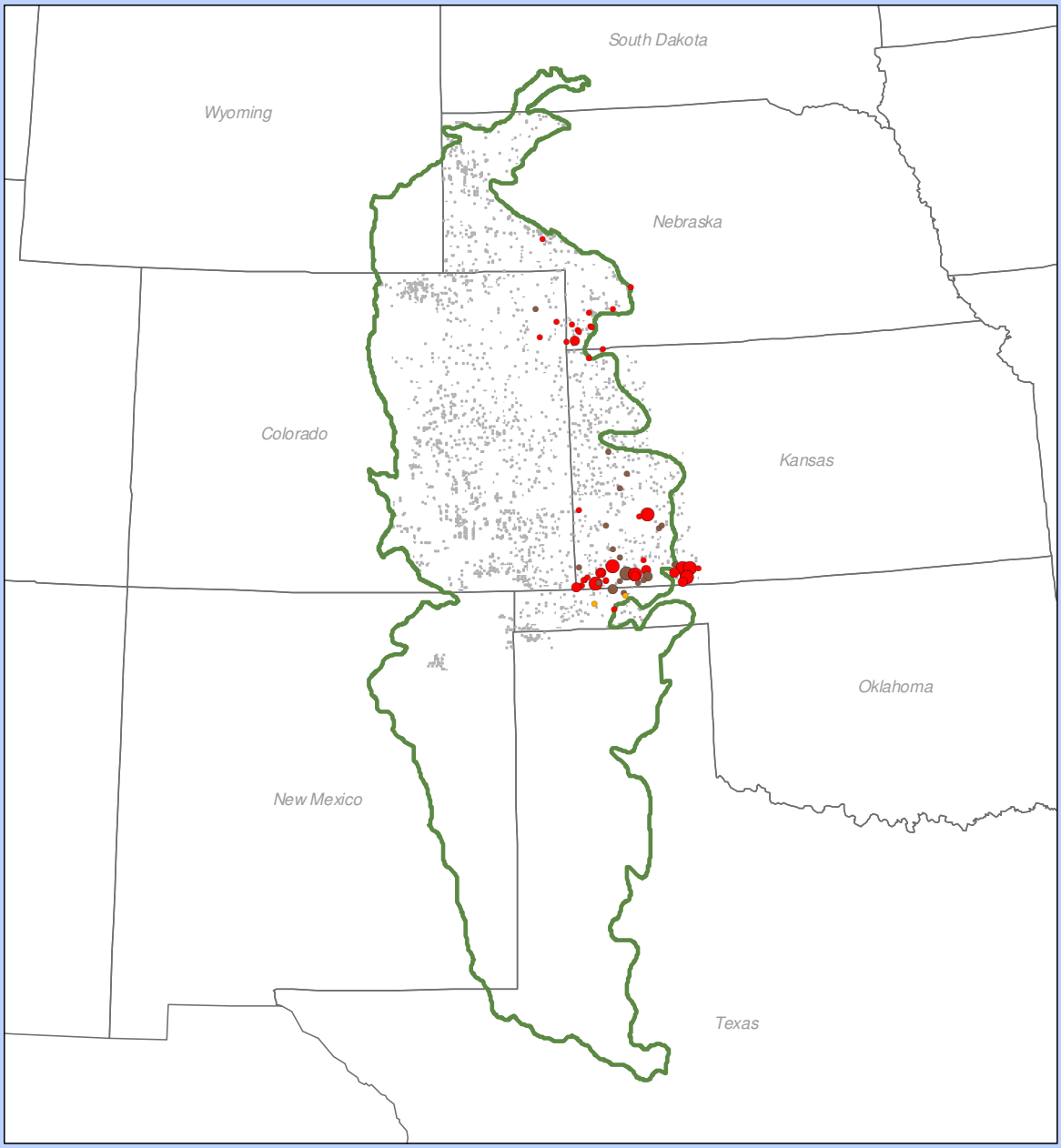
Northern Bobwhite

(Colinus virginianus)

In 2004, we detected 95 Northern Bobwhites on 67 (2.8%) of the surveyed sections. This species was detected in all four states of the study area with high concentrations in southwest Kansas. Density in native prairie habitat (D = 0.18 birds/km^2, CV = 25%, *n* = 62) similar to dry-land agriculture (D = 0.11 birds/km^2, CV = 50%, *n* = 16). Northern Bobwhite is a species of moderate concern in Nebraska.



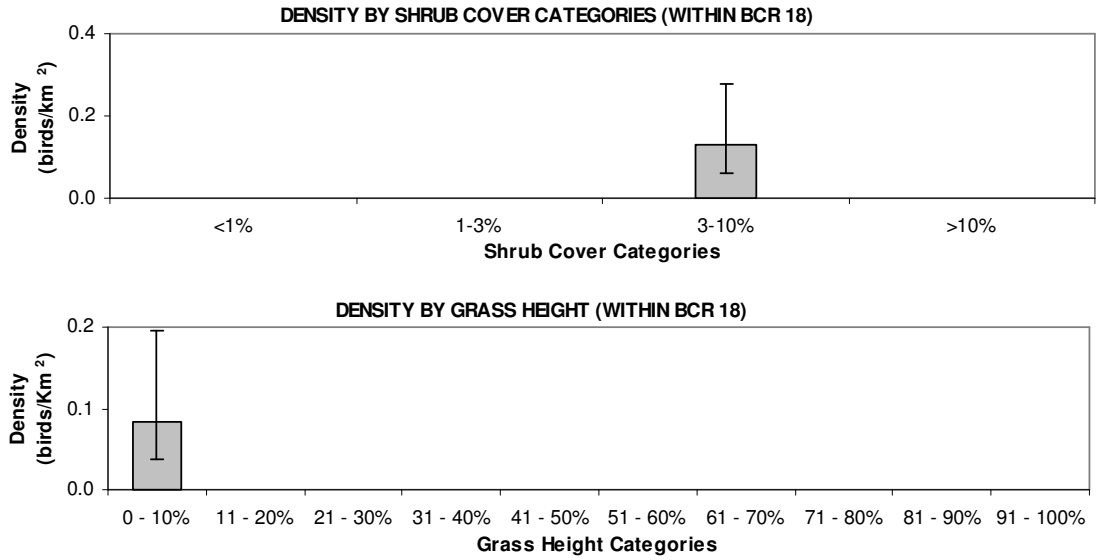
Northern Bobwhite



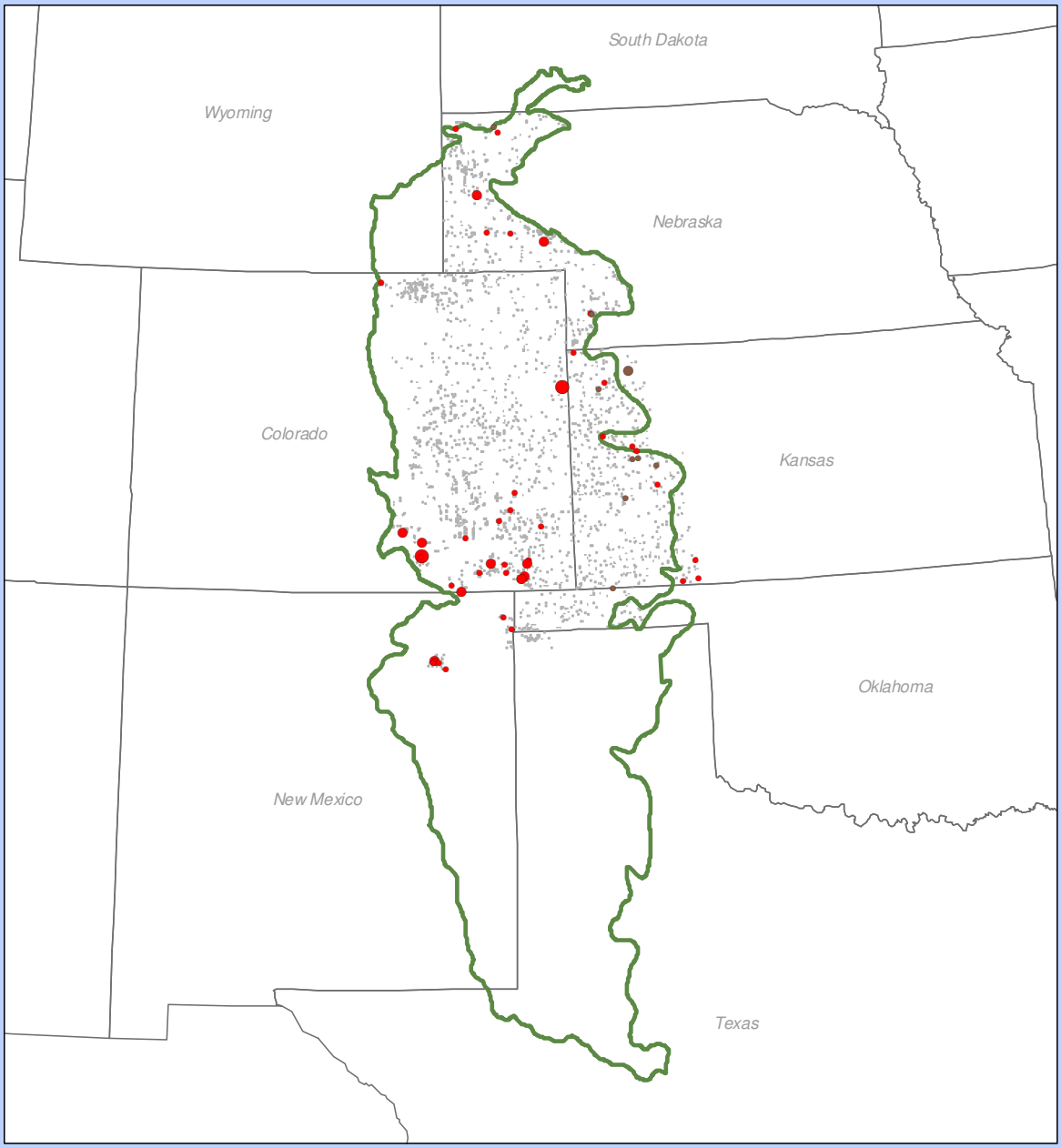
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Turkey Vulture
(Cathartes aura)

In 2004, we observed 75 Turkey Vultures on 53 (2.2%) of the surveyed sections. Turkey Vultures were observed throughout the study area with slight concentrations in southeast Colorado.



Turkey Vulture



Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Mississippi Kite

(Ictinia mississippiensis)

In 2004, we detected three Mississippi Kites in three counties, Haskell (KS), Bent (CO) and Cheyenne (CO). Mississippi Kite is a species of concern as follows:

- Nebraska – species of concern

Mississippi Kite

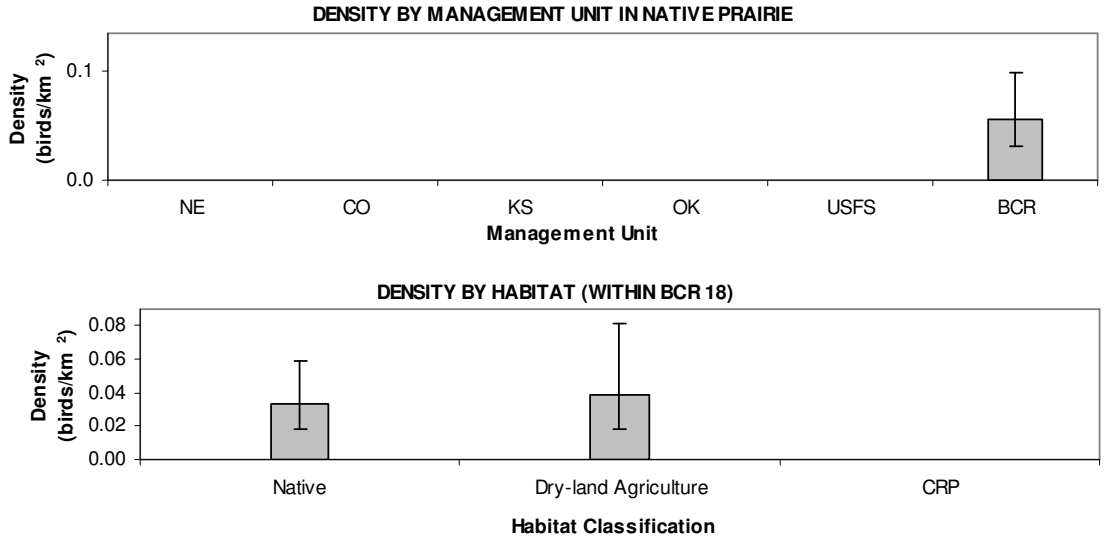
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Northern Harrier

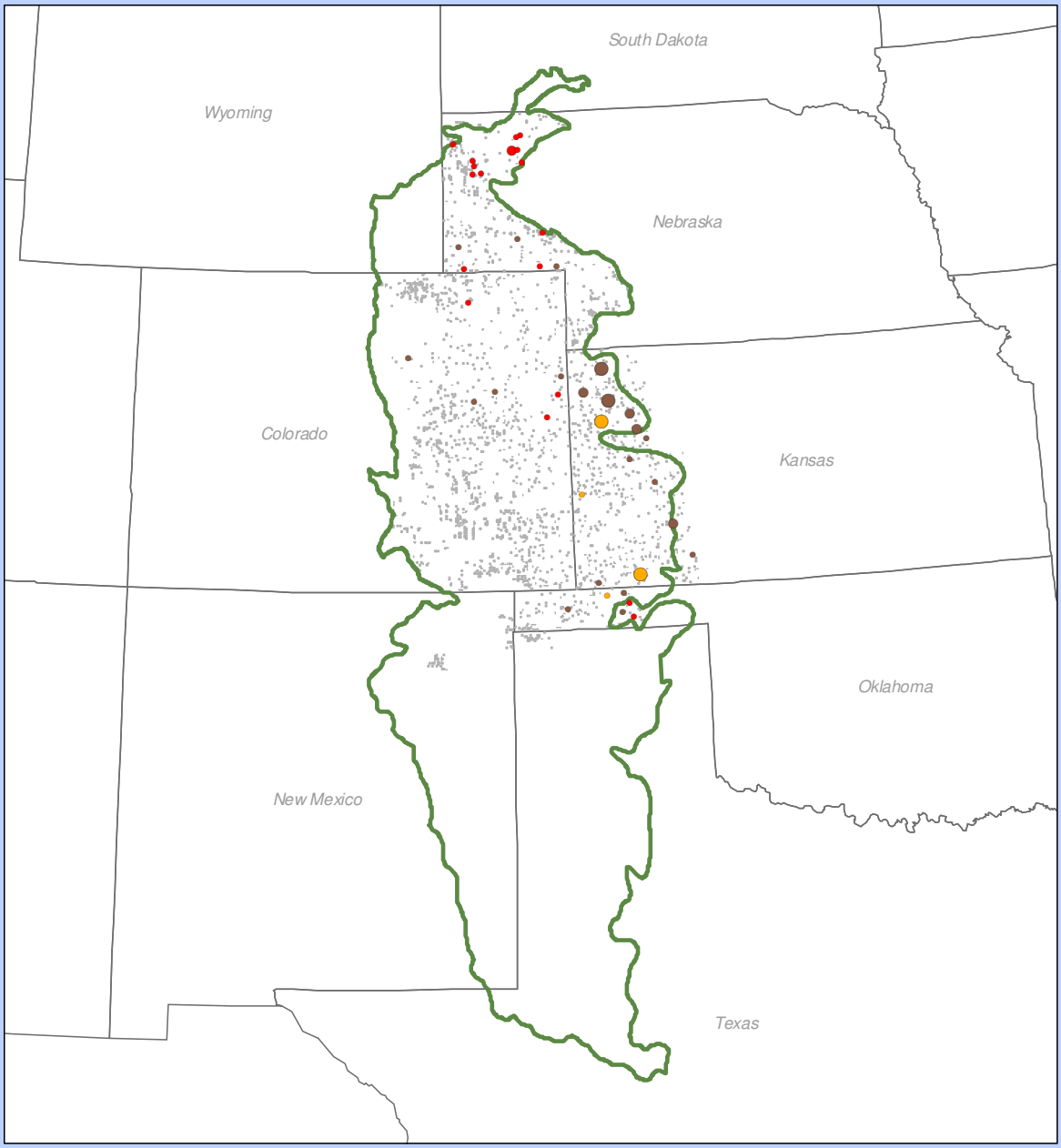
(Circus cyaneus)

In 2004, we detected 60 Northern Harriers on 45 (1.9%) of the surveyed sections. This species was distributed along the western edge of Kansas and northern Nebraska. Density estimates were obtained in native habitat (D = 0.03 birds/km^2, CV = 30%, *n* = 18) and dry-land agriculture (D = 0.04 birds/km^2, CV = 38%, *n* = 15). Dense populations of this species are associated with large undisturbed tracks of land (R. B. Macwhirte and K.L. Bildstein 1996 No. 210). Northern Harriers are year round residents of the northern and central regions of BCR 18, only wintering in its southern most region. Northern Harrier is a species of concern as follows:

- Partners In Flight – Tier II (high regional priority)
- Nebraska – species of moderate concern
- USFS R2 – species of concern.



Northern Harrier

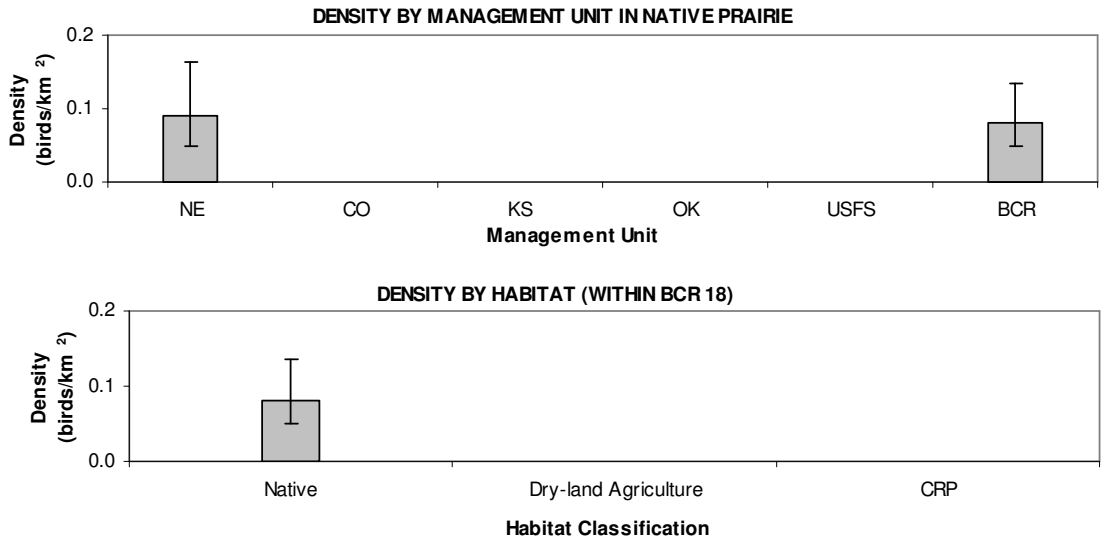


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

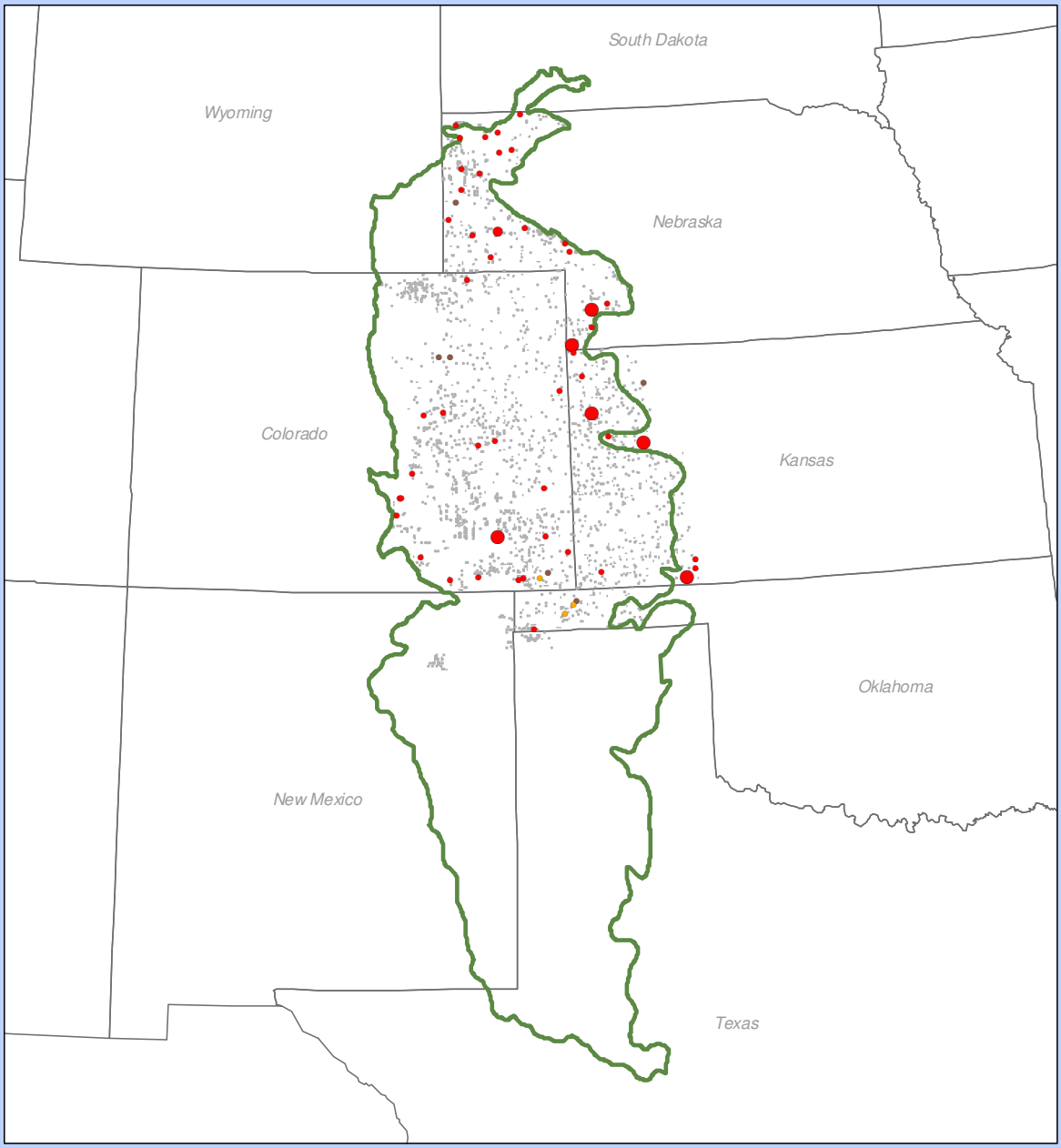
Red-tailed Hawk

(Buteo jamaicensis)

In 2004, we detected 66 Red-tailed Hawks on 60 (2.5%) of the surveyed sections. The species was distributed along the eastern edge of the study area. Density estimates provided 0.08 birds/km2 (CV = 26%, *n* = 38) throughout native prairie habitat in BCR 18.



Red-tailed Hawk



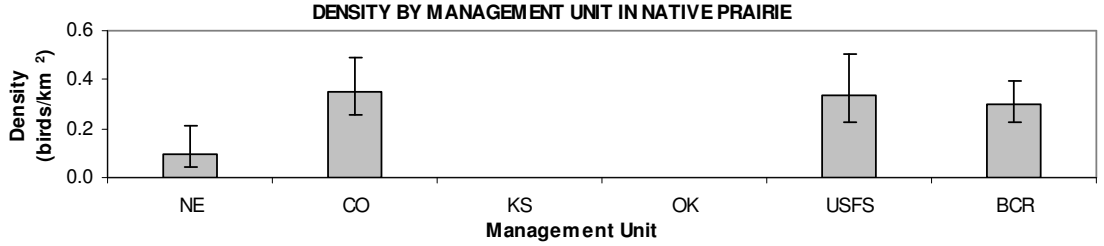
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

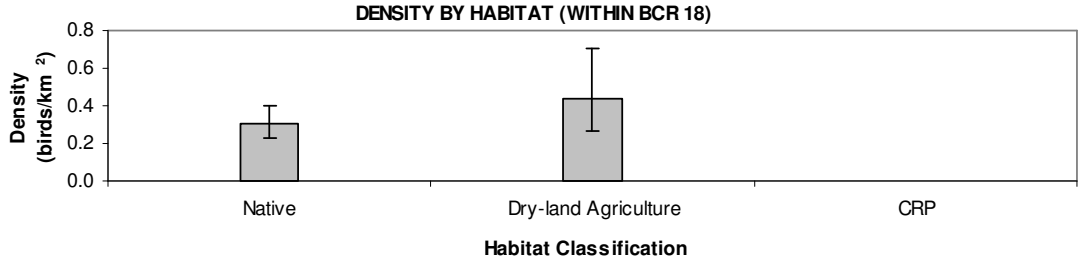
Swainson's Hawk

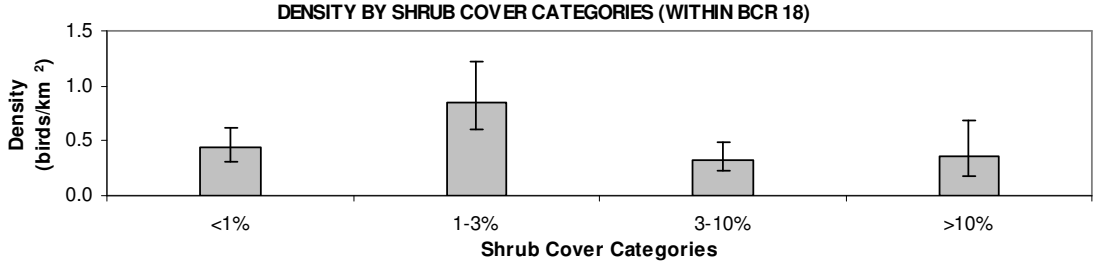
(Buteo jamaicensis)

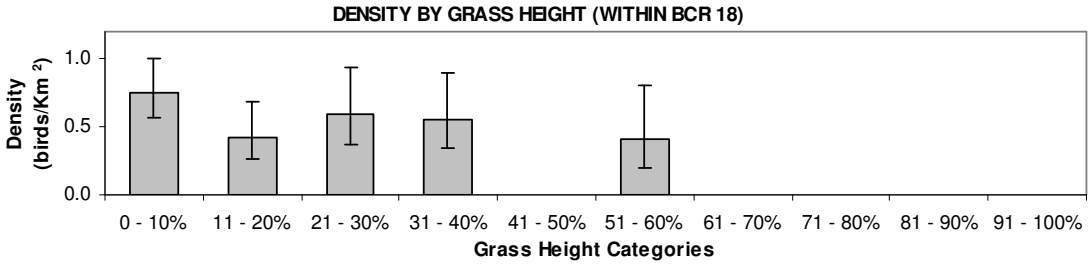
In 2004, we detected 261 Swainson's Hawks on 215 (8.9%) of the surveyed sections. The species was widely distributed across the study area. In BCR 18 density was higher in dry-land agriculture (D = 0.43 birds/km^2, CV = 25%, *n* = 48) than in native habitats (D = 0.30 birds/km^2, CV = 14%, *n* = 147). Within native prairie habitat, densities were highest in Colorado (D = 0.35 birds/km^2, CV = 17%, *n* = 87) and areas of 1-3% shrub cover (D = 0.86 birds/km^2, CV = 18%, *n* = 117). Swainson's Hawk is a species of concern as follows:

- Partners In Flight – Tier I (high overall priority)
- Nebraska – species of moderate concern
- New Mexico – wildlife of concern
- Oklahoma – species of special concern (Category II).

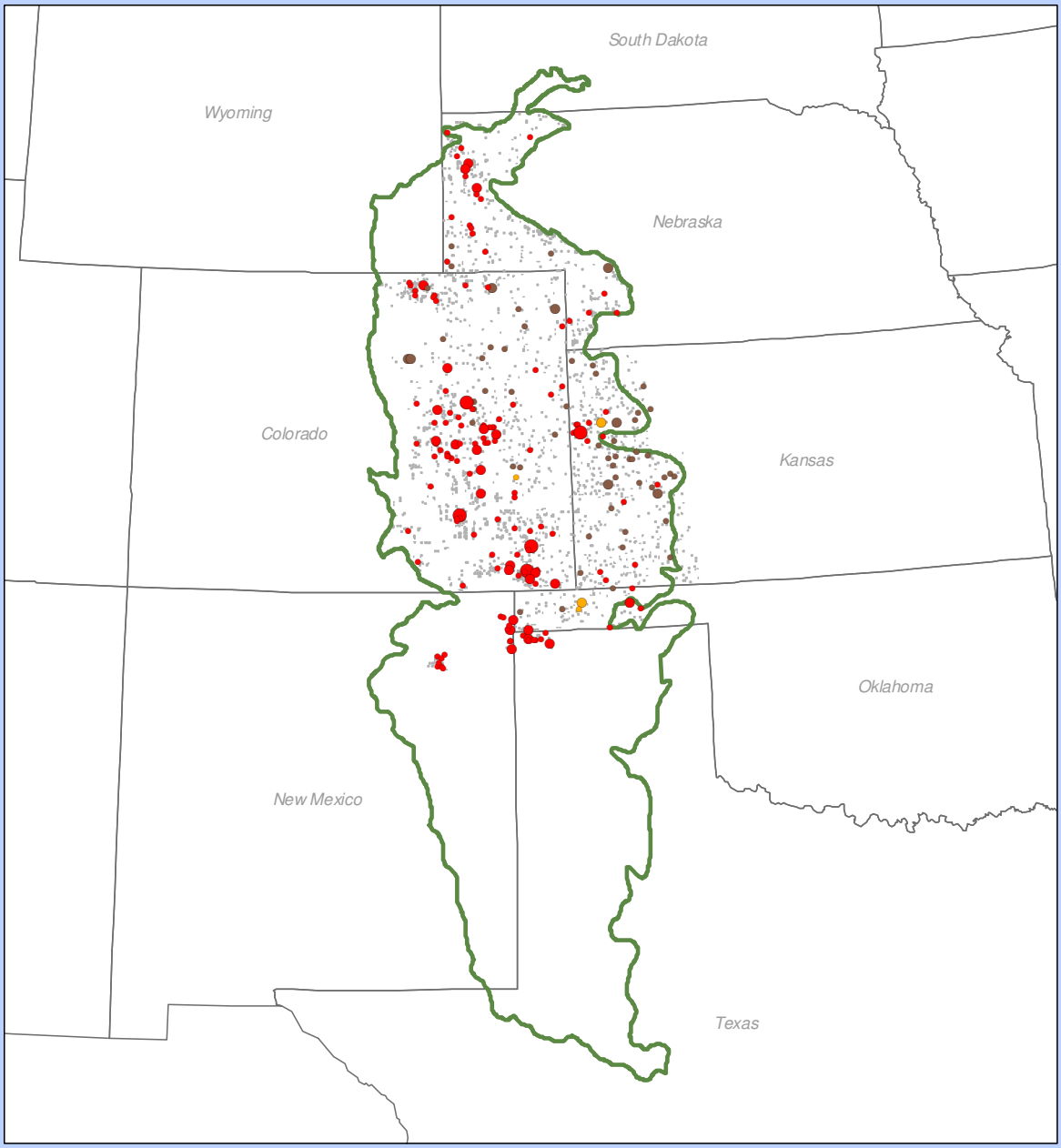








Swainson's Hawk



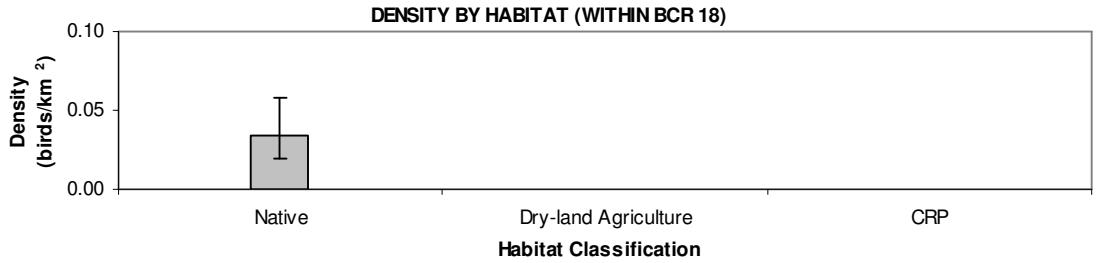
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

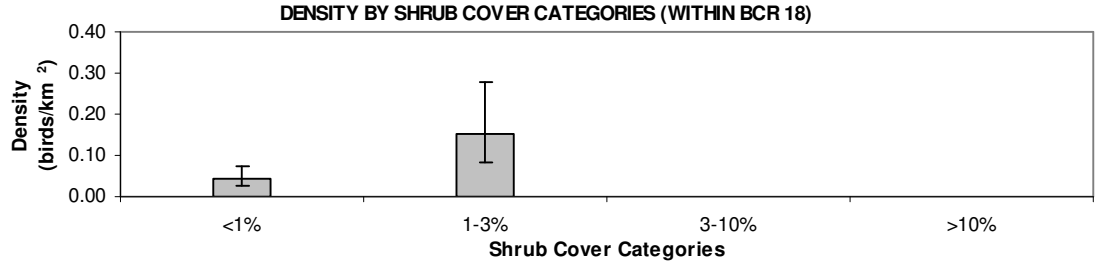
Ferruginous Hawk

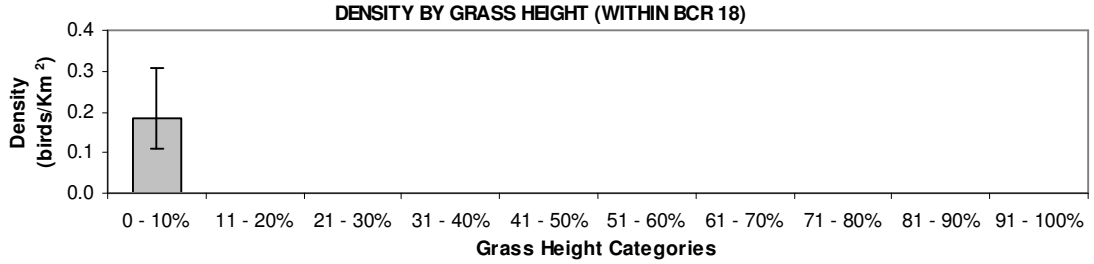
(Buteo regalis)

In 2004, we observed 39 Ferruginous Hawks on 34 (1.4%) of the surveyed sections. Observations were scattered throughout the study area. Density of Ferruginous Hawks in native prairie habitat was 0.03 birds/km^2 (CV = 28%, n = 26). Higher densities were observed for areas of 1-3% shrub cover (D = 0.15 birds/km^2, CV = 32%, n = 27). In areas of grass height 0-10% Ferruginous Hawk had a density of (D = 0.19 birds/km^2, CV = 26%, n = 38). Ferruginous Hawk is a species of concern as follows:

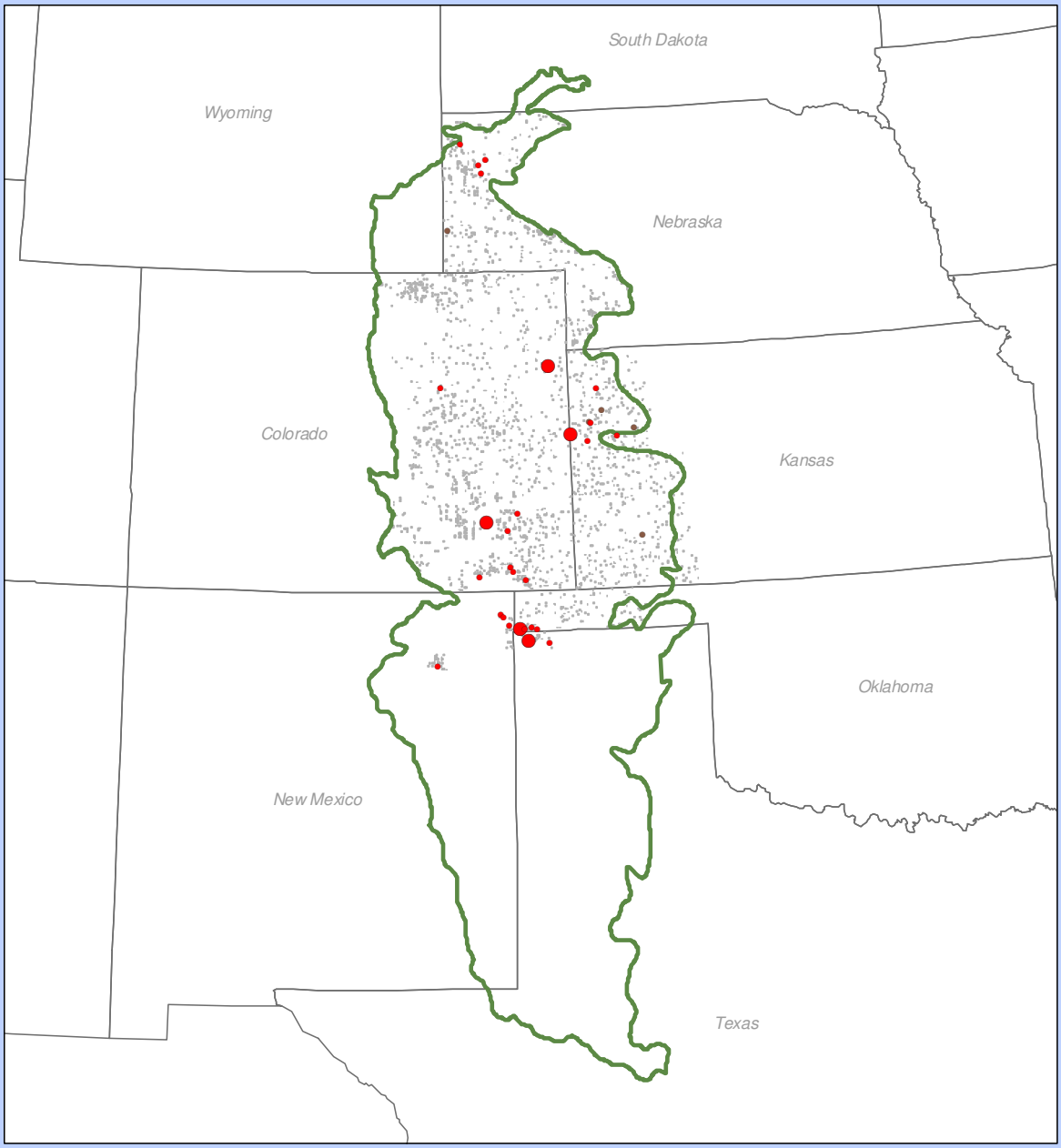
- Partners In Flight – Tier I (high overall priority)
- Nebraska – species of high concern
- Colorado – state species of special concern
- Kansas – species in need of conservation (SINC)
- Oklahoma – species of special concern
- USFS R2 – sensitive species.







Ferruginous Hawk



Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Golden Eagle

(Aquila chrysaetos)

In 2004, we two four Golden Eagles –one in each Morgan County and Weld County, Colorado. Golden Eagle is a species of concern as follows:

- Kansas – species in need of conservation (SINC)
- Oklahoma – species of special concern.

Golden Eagle

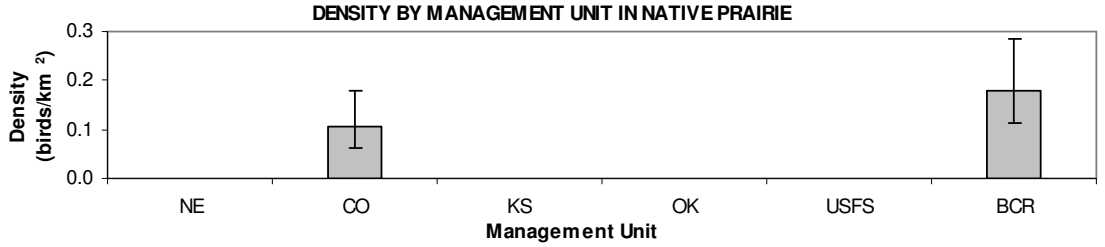
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

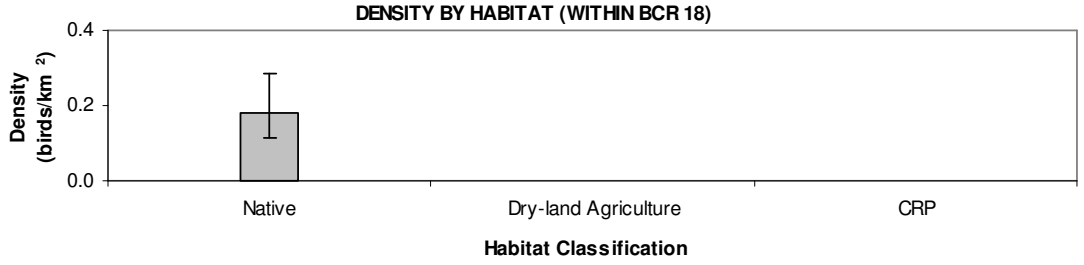
American Kestrel

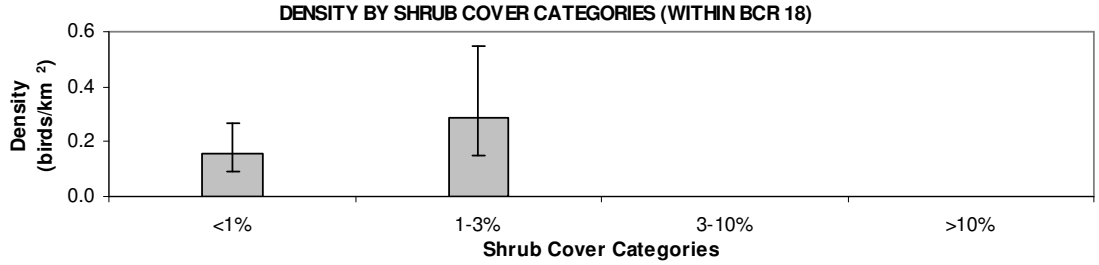
(Falco sparverius)

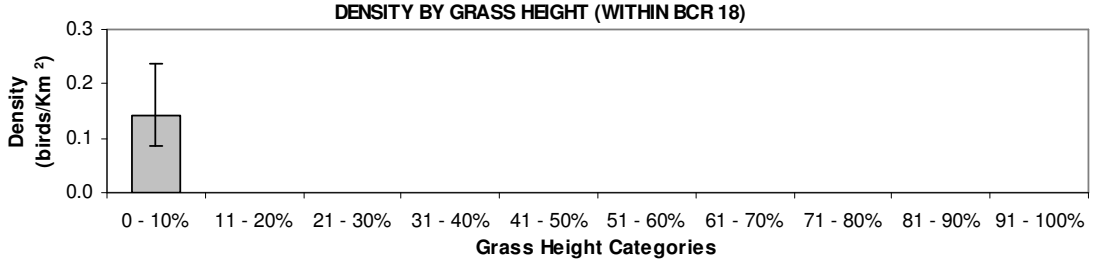
In 2004, we detected 70 American Kestrels on 59 (2.5%) of the surveyed sections. The species was widely distributed throughout the study area. In BCR 18 estimated density in native prairie habitat was 0.18 birds/km^2 (CV = 24%, *n* = 47). Higher densities were observed for areas of 1-3% shrub cover (D = 0.29 birds/km^2, CV = 33%, *n* = 24). In areas of grass height 0-10% American Kestrel had a density of (D = 0.14 birds/km^2, CV = 27%, *n* = 28). American Kestrel is a species of concern as follows:

- Partners in Flight – Tier I (high overall priority)
- Oklahoma – species of special concern (Category I).

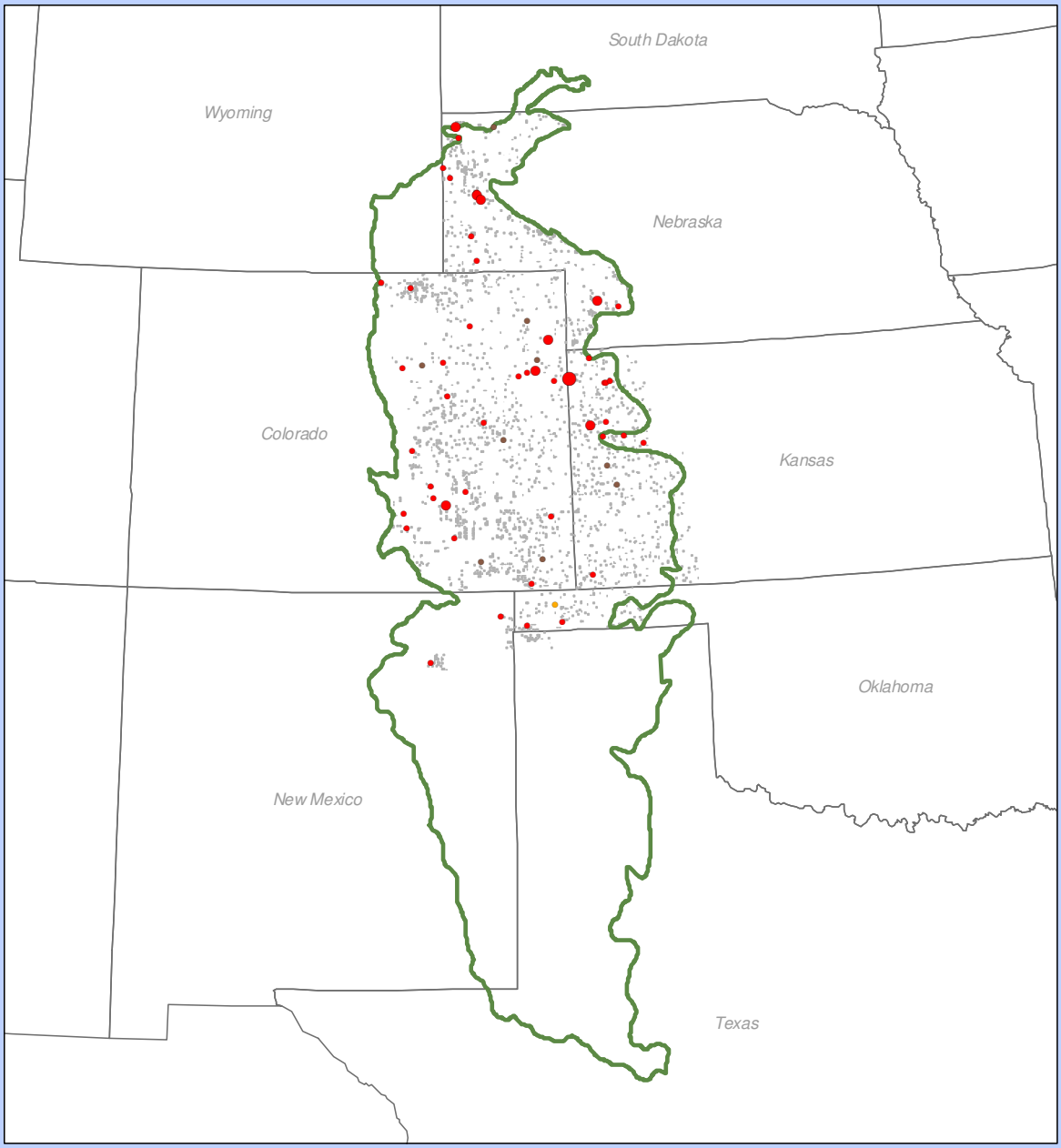








American Kestrel



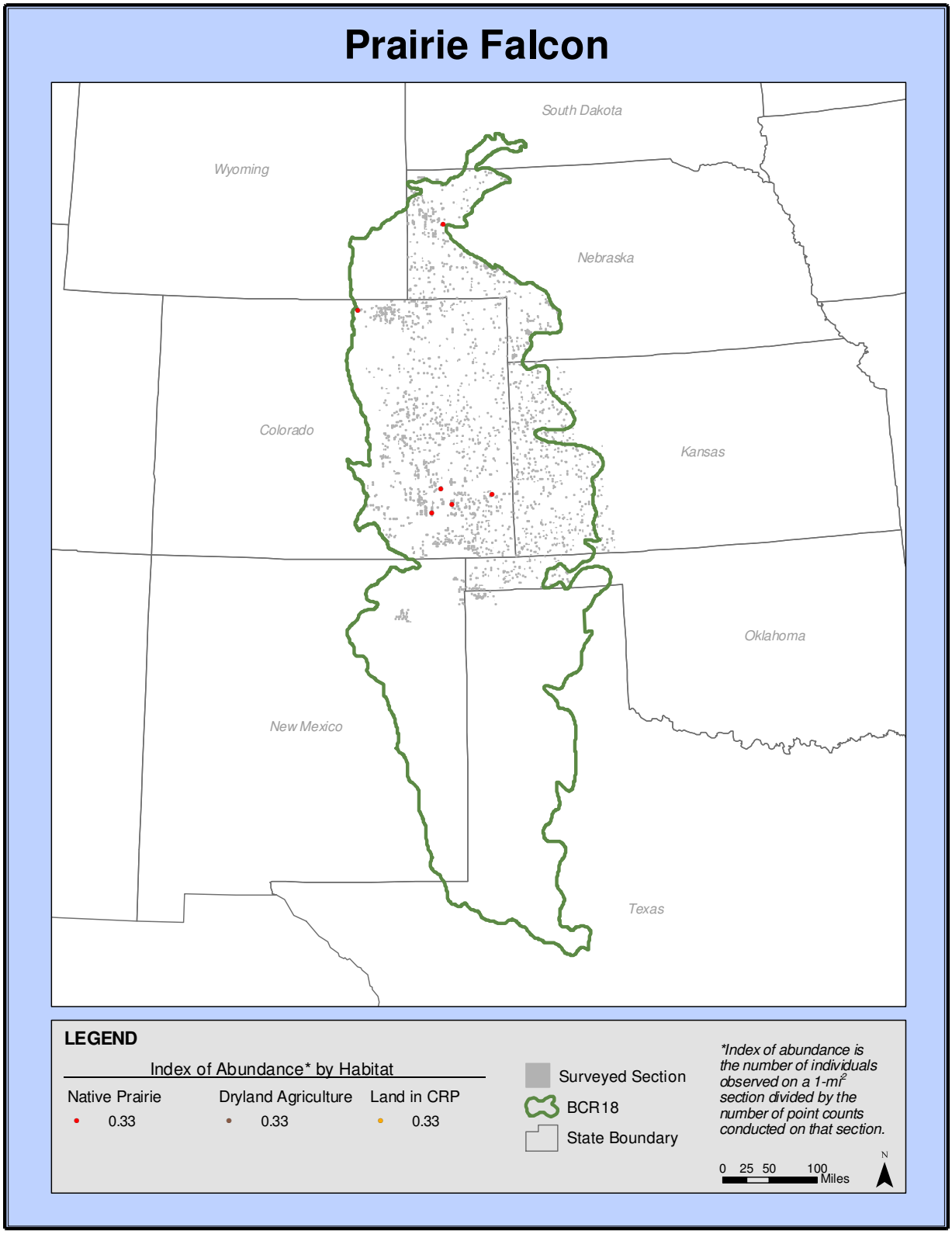
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Prairie Falcon

(Falco mexicanus)

In 2004, we detected six Prairie Falcons on six (.25%) of the surveyed sections. The species had five observations in Colorado and one in Nebraska.
Prairie Falcon is a species of concern as follows:

- Partners in Flight – Tier I (high overall priority)
- Oklahoma – species of special concern.

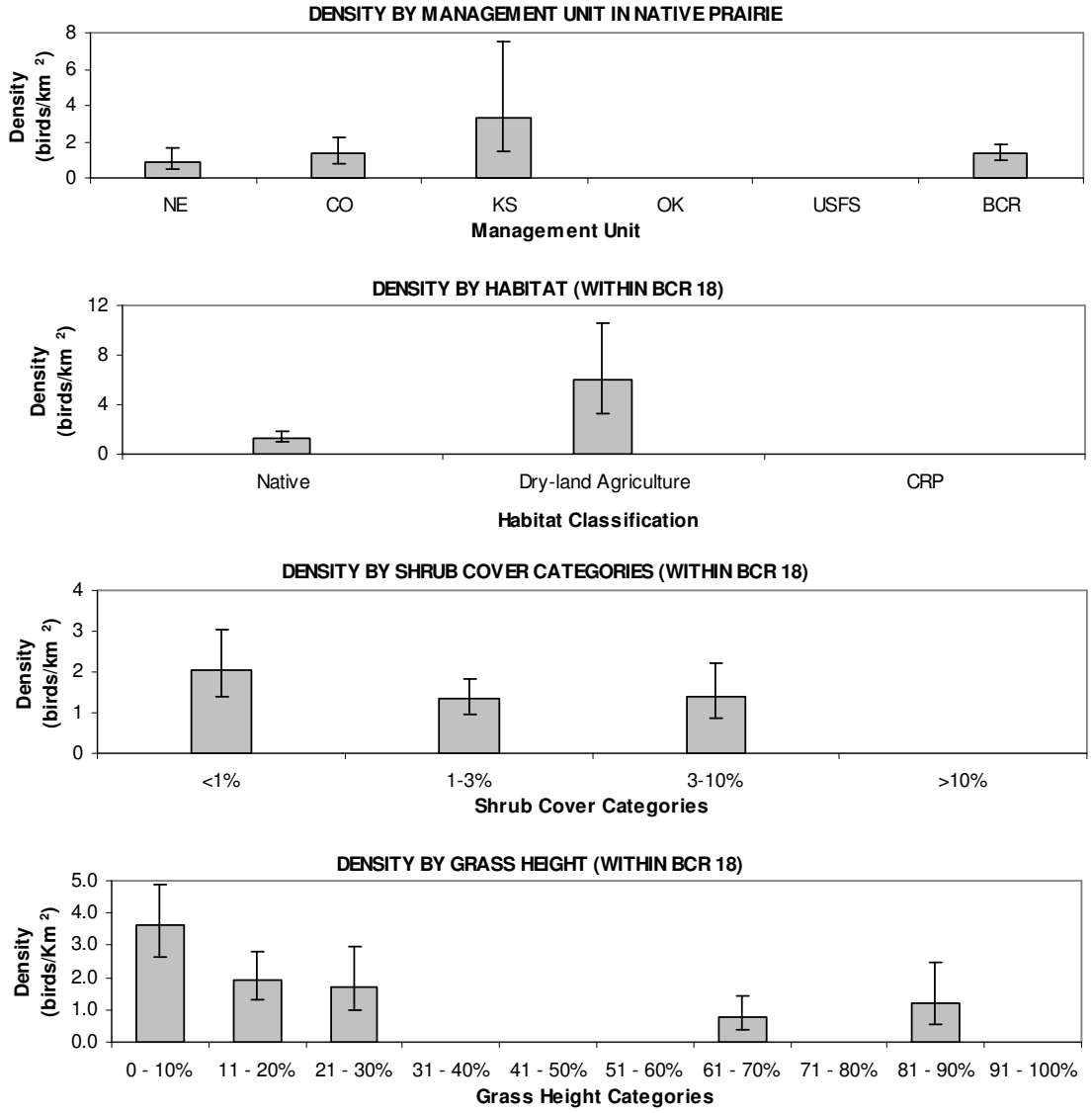


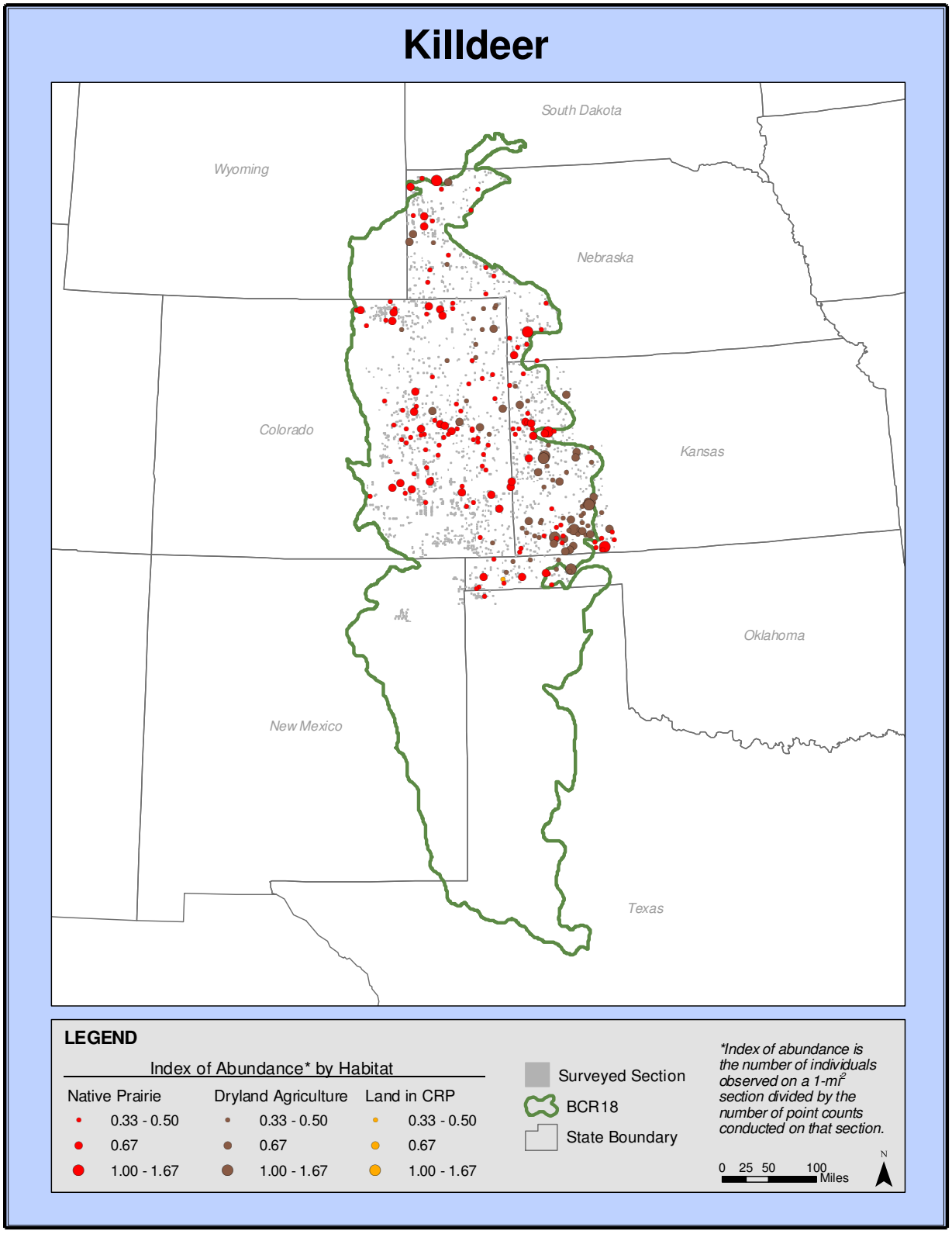
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Killdeer

(Charadrius vociferus)

In 2004, we detected 423 Killdeer on 223 (9.2%) of the surveyed sections. This species was widely distributed throughout the study area. In BCR 18 density was higher in dry-land agriculture (D = 5.94 birds/km^2, CV = 30%, *n* = 24) than in native prairie habitat (D = 1.33 birds/km^2, CV = 17%, n = 102). Within native prairie habitat, density was highest in areas of <1% shrub cover (D = 2.05 birds/km^2, CV = 20%, *n* = 66). Highest density estimates occurred in areas of grass height 0-10% (D = 3.60 birds/km^2, CV = 16%, *n* = 183).





Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

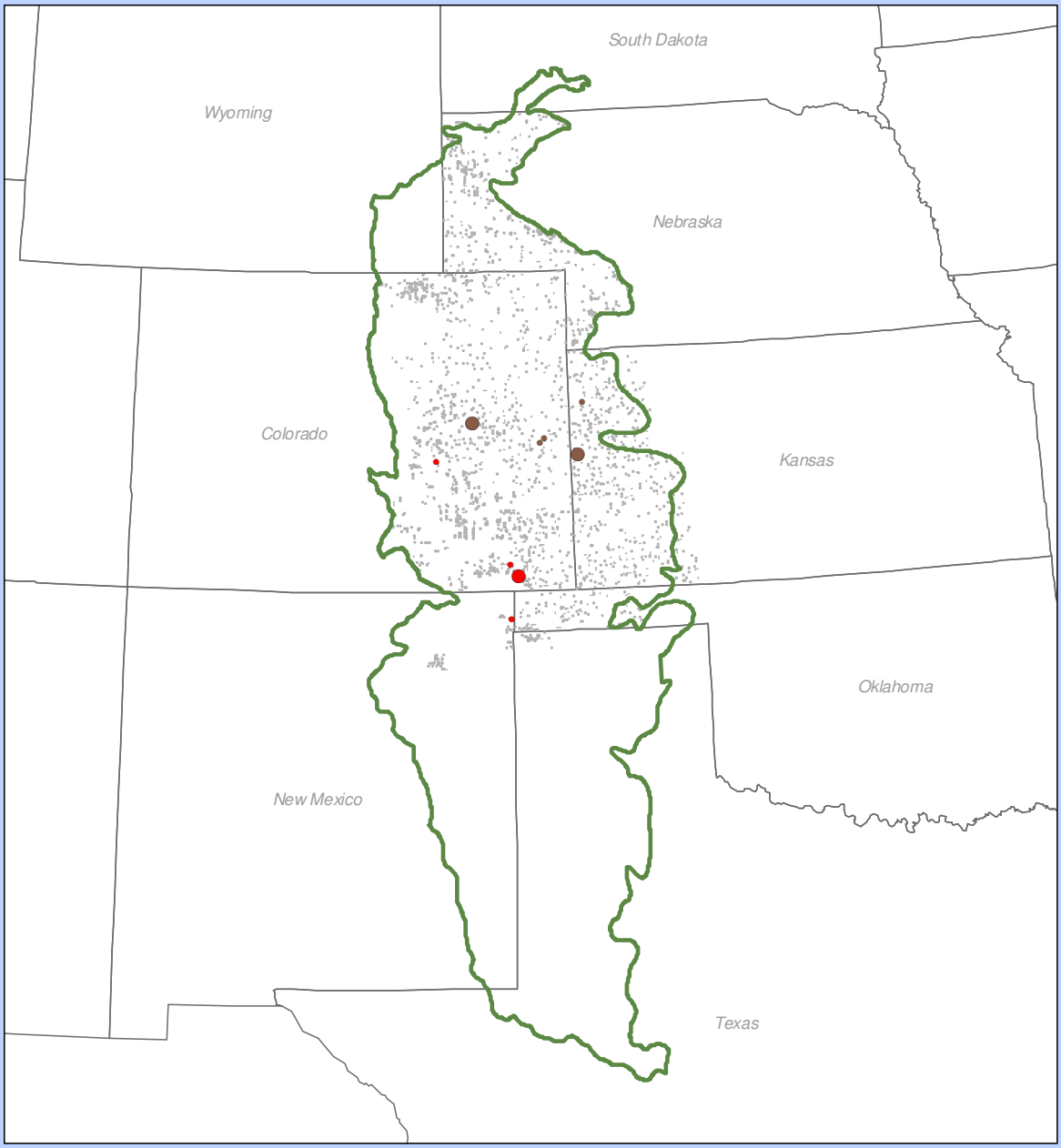
Mountain Plover

(Charadrius montanus)

In 2004, we detected twelve Mountain Plovers on nine (.37%) of the surveyed sections. Two observations occurred on Comanche National Grassland, one observation was on Kiowa National Grassland where black-tailed prairie dogs were present. Six observations occured in Colorado and three in Kansas. Mountain Plover is a species of concern as follows:

- Partners In Flight – Tier I (high overall priority)
- Nebraska – state listed species (threatened or endangered)
- Colorado – state species of special concern
- Kansas – species in need of conservation (SINC)
- New Mexico – wildlife of concern.

Mountain Plover



LEGEND

Index of Abundance* by Habitat

Native Prairie	Dryland Agriculture	Land in CRP
0.33	0.33	0.33
0.67	0.67	0.67

Surveyed Section
BCR18
State Boundary

**Index of abundance is the number of individuals observed on a 1-mi² section divided by the number of point counts conducted on that section.*

0 25 50 100 Miles

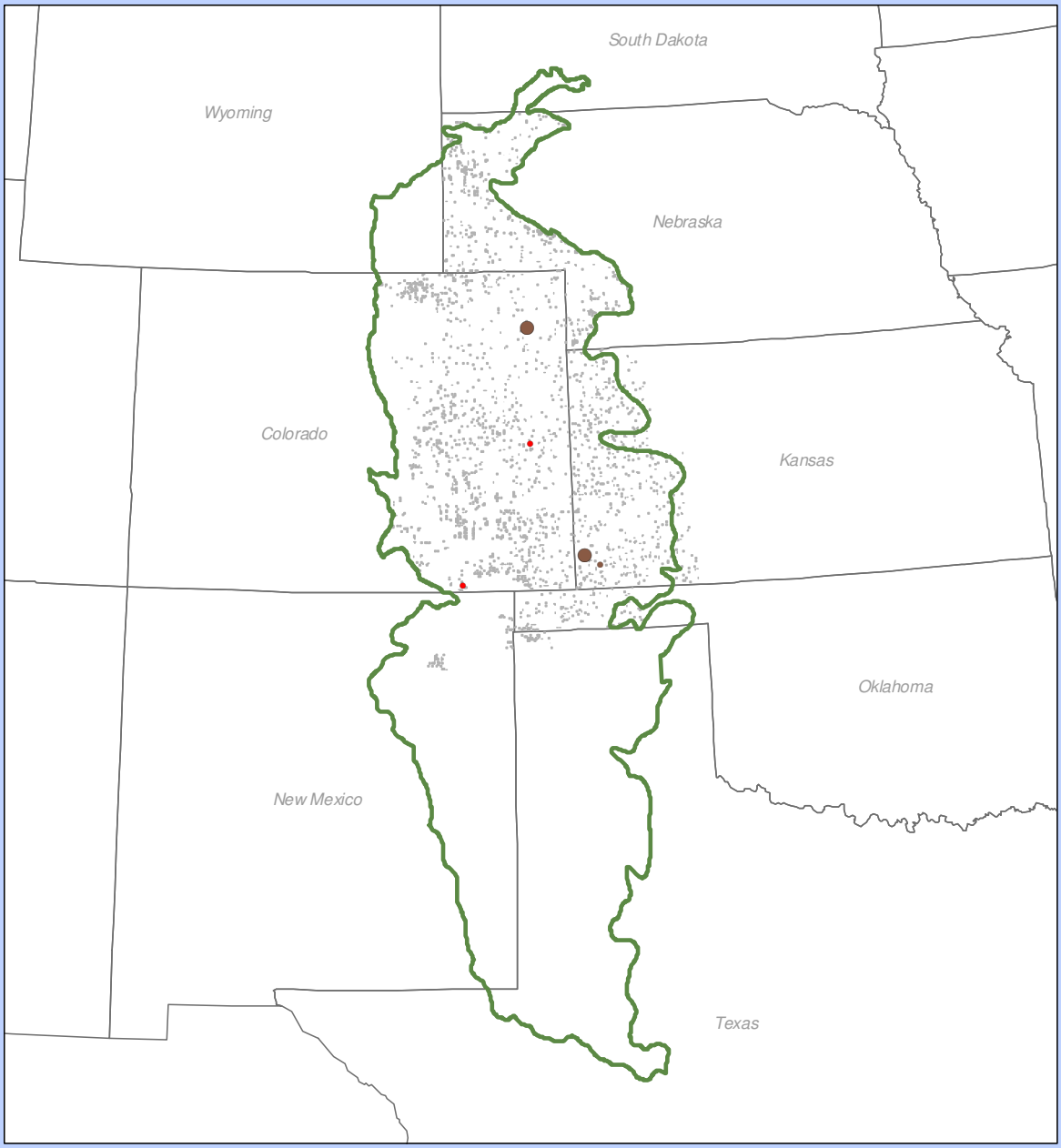
N

American Avocet

(Recurvirostra americana)

In 2004, we detected seven American Avocets on five (.2%) of the surveyed sections. The species was found in Colorado and Kansas. American Avocet is a species of moderate concern in Nebraska.

American Avocet



LEGEND

Index of Abundance* by Habitat

Native Prairie	Dryland Agriculture	Land in CRP
0.33	0.33	0.33
0.67	0.67	0.67

Surveyed Section
BCR18
State Boundary

**Index of abundance is the number of individuals observed on a 1-mi² section divided by the number of point counts conducted on that section.*

0 25 50 100 Miles

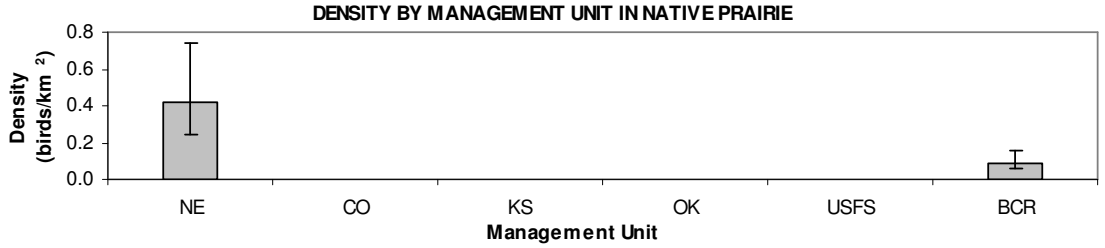
N

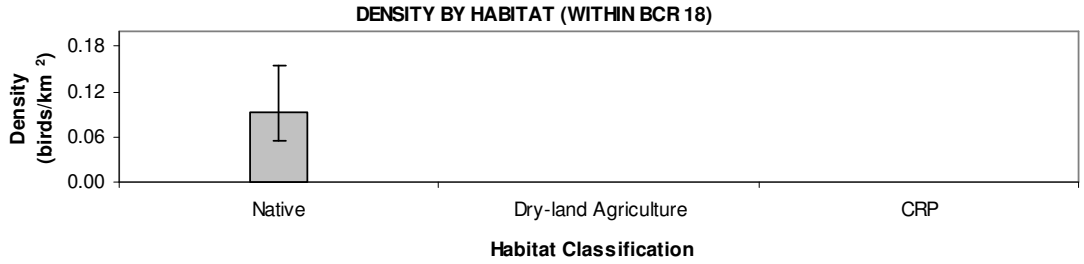
Upland Sandpiper

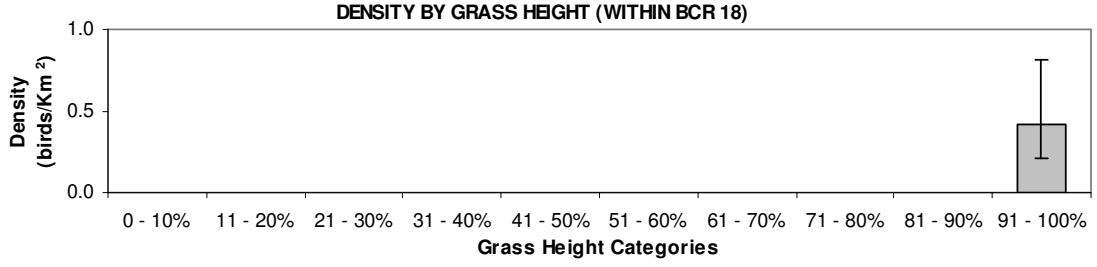
(Bartramia longicauda)

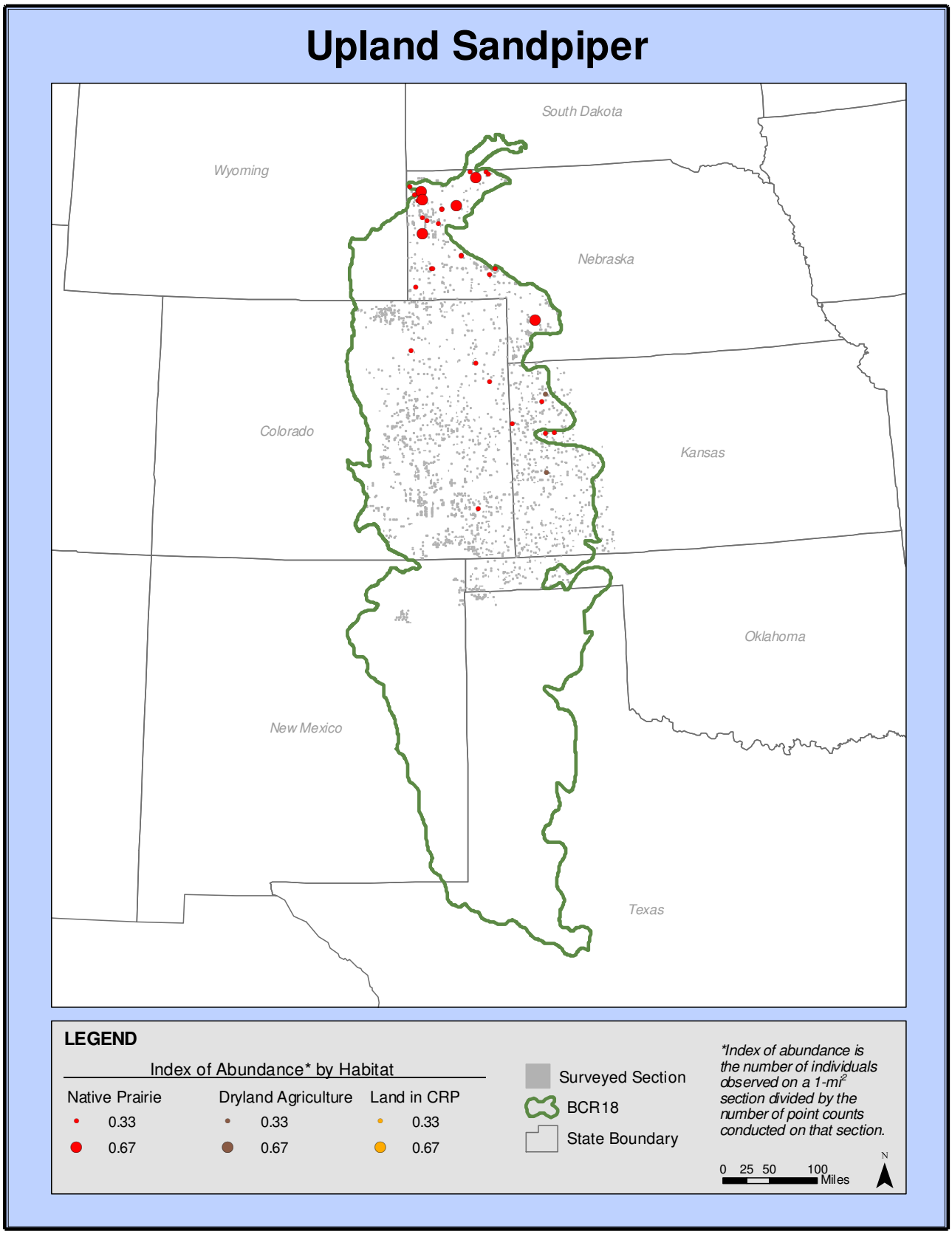
In 2004, we detected 41 Upland Sandpipers on 35 (1.5%) of the surveyed sections. This species' distribution was restricted to the northern region of the shortgrass prairie BCR with most observations occurring in western Nebraska. In BCR 18 estimated density in native prairie habitat was 0.09 birds/km^2 (CV = 27%, *n* = 28). Nebraska had a density estimate of 0.42 birds/km^2 (CV = 29%, *n* = 19). In areas of grass height 91-100% Upland Sandpiper had a density of (D = 0.41 birds/km^2, CV = 35%, *n* = 20). Upland Sandpiper is a species of concern as follows:

- Partners In Flight – Tier II (high regional priority)
- Nebraska – species of moderate concern
- USFS R2 – sensitive species.









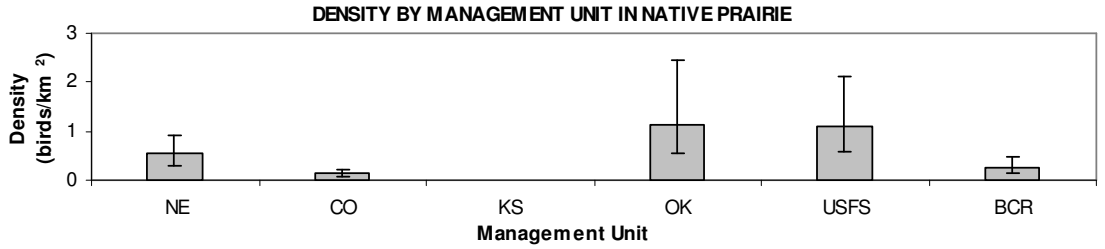
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

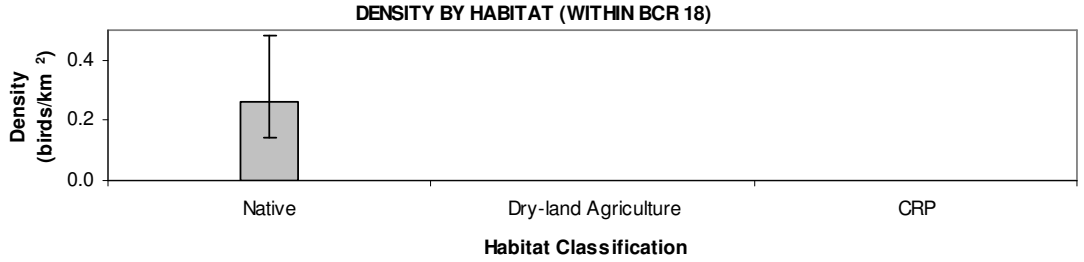
Long-billed Curlew

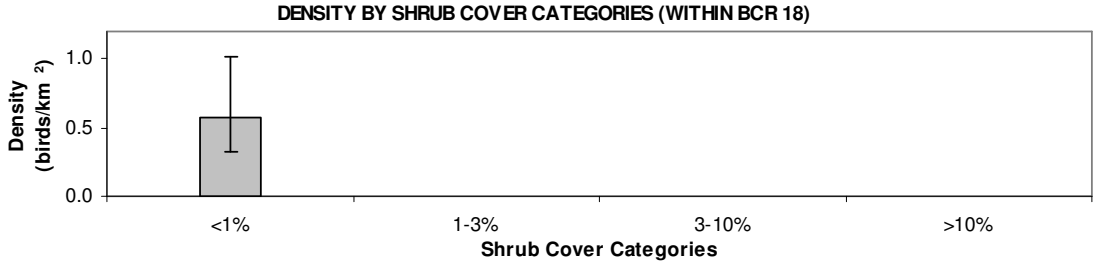
(Numenius americanus)

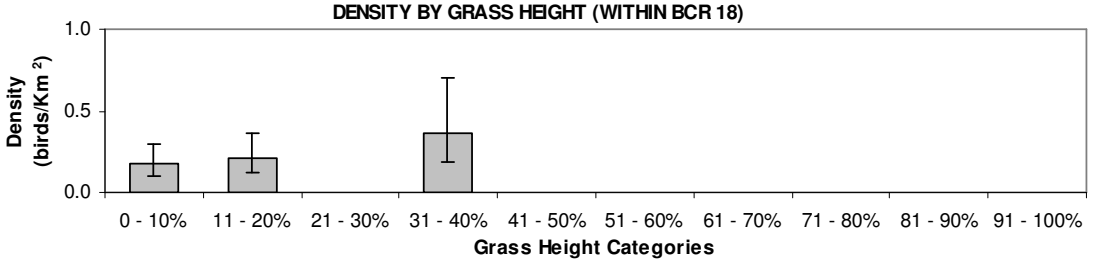
In 2004, we observed 198 Long-billed Curlews on 95 (3.9%) of the surveyed sections. This species was concentrated in the northern and southern parts of the study area with highest abundances occurring in western Oklahoma and western Nebraska. Density estimates in BCR 18 in native habitat were D = .26 birds/km^2 (CV = 32%, *n* = 77). Higher density estimates were obtained in Oklahoma (D = 1.15 birds/km^2, CV = 39%, *n* = 17). Within shrub cover types, density was highest in areas of <1% shrub cover (D = .57 birds/km^2, CV = 30%, *n* = 46). Highest densities in grass height were found in 31-40% (D = 0.37 birds/km^2, CV = 34%, *n* = 22). Long-billed Curlew is a species of concern as follows:

- Nebraska – species of high concern
- Colorado – state species of special concern
- Kansas – species in need of conservation (SINC)
- Oklahoma – species of special concern (Category I)
- USFS R2 - sensitive species.

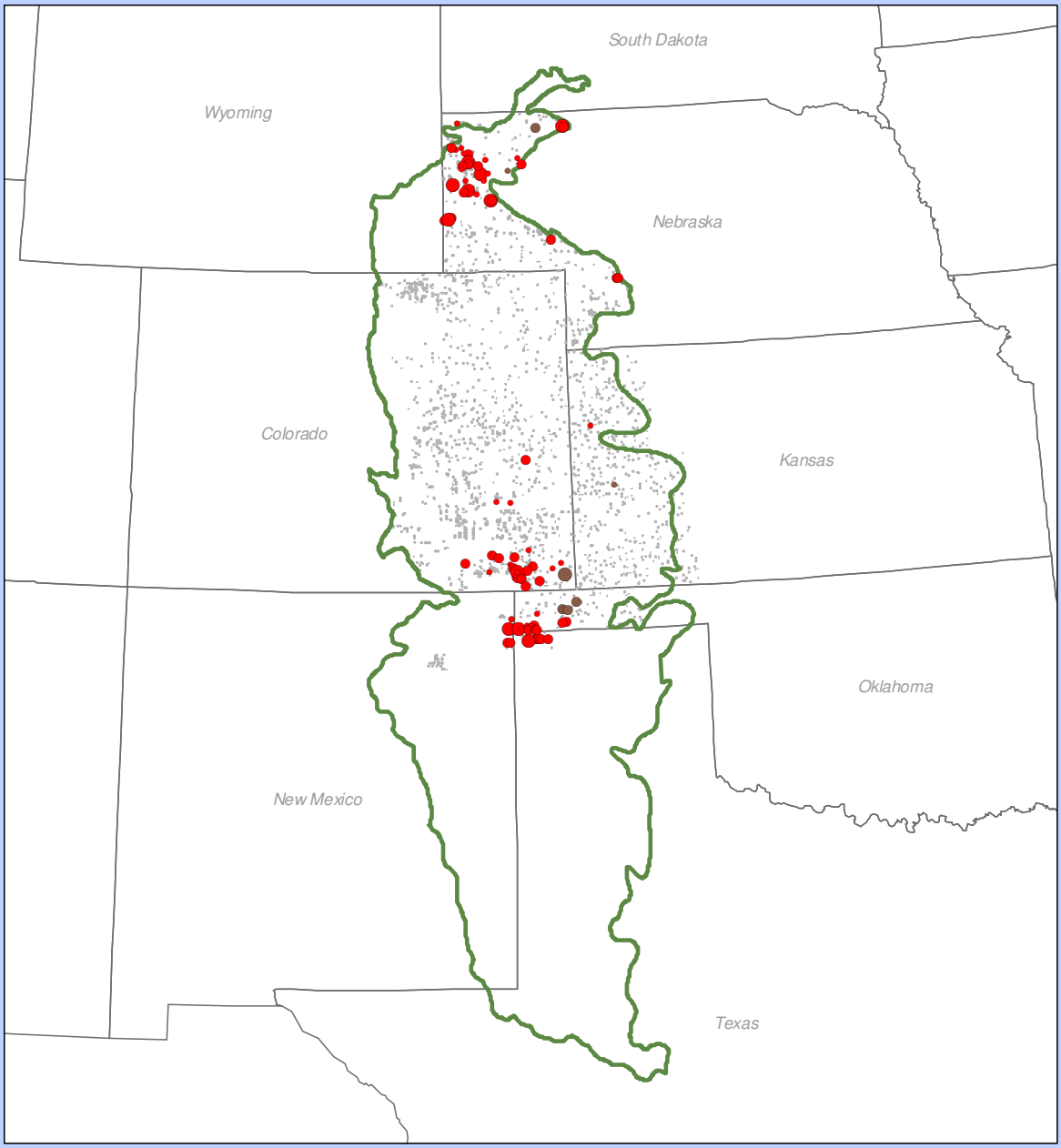








Long-billed Curlew

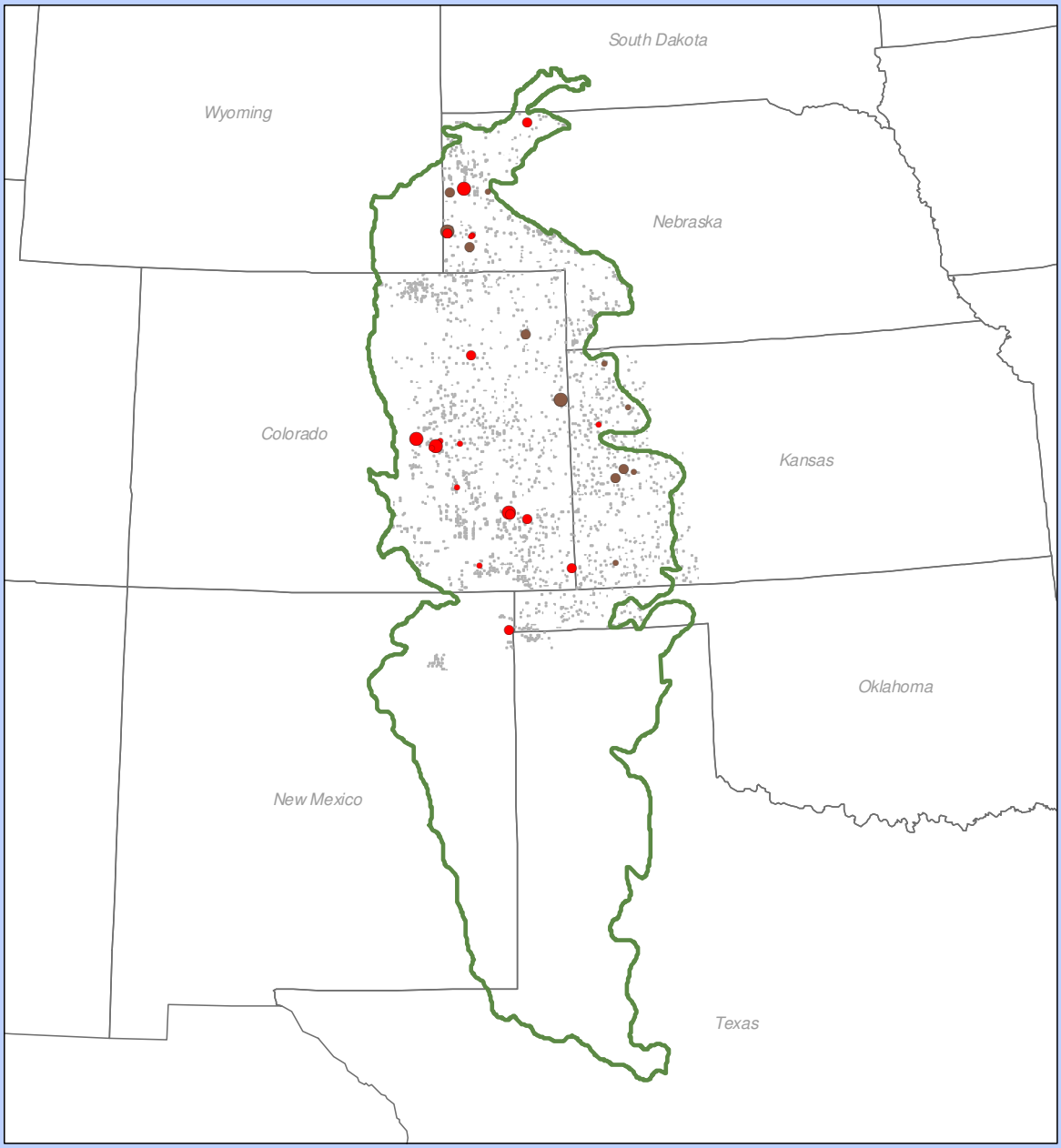


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Rock Pigeon
(Columbia livia)

In 2004, we detected 72 individuals on 31 (1.3%) of the sections surveyed. This species was generally distributed throughout the Shortgrass Prairie BCR mainly nesting in crevices in both natural and anthropogenic habitats. This species was formerly known as Rock Dove.

Rock Pigeon

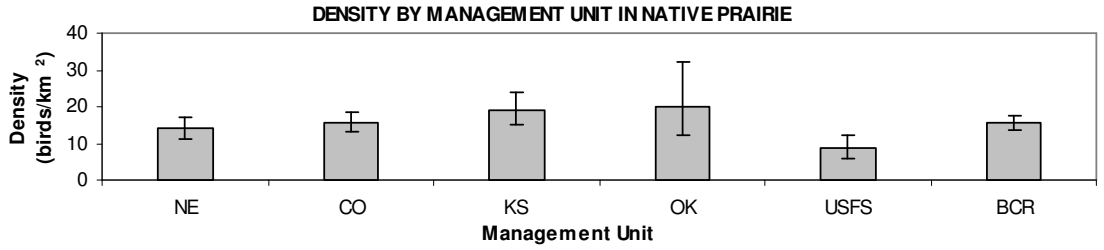


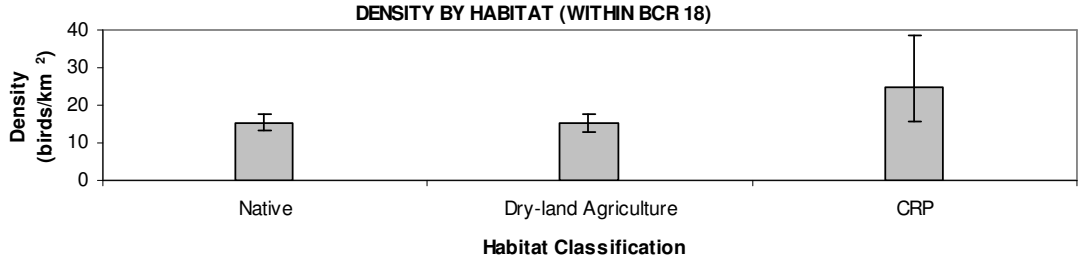
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

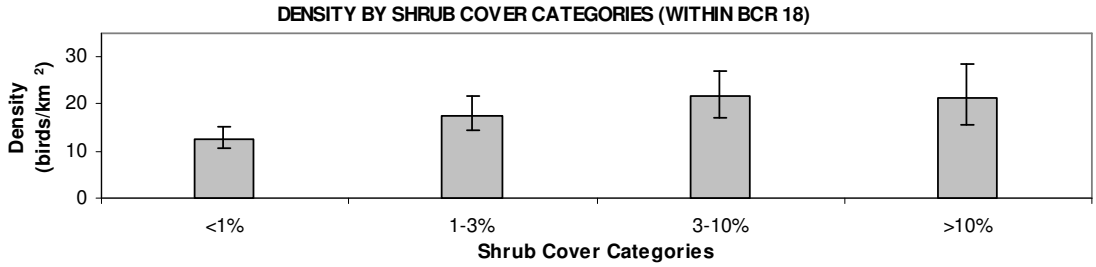
Mourning Dove

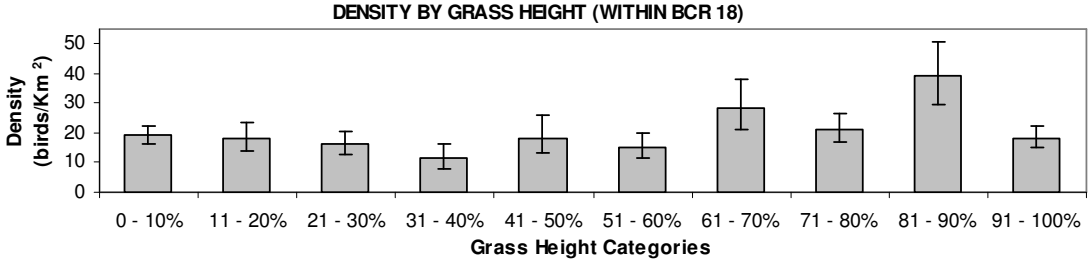
(Zenaida macroura)

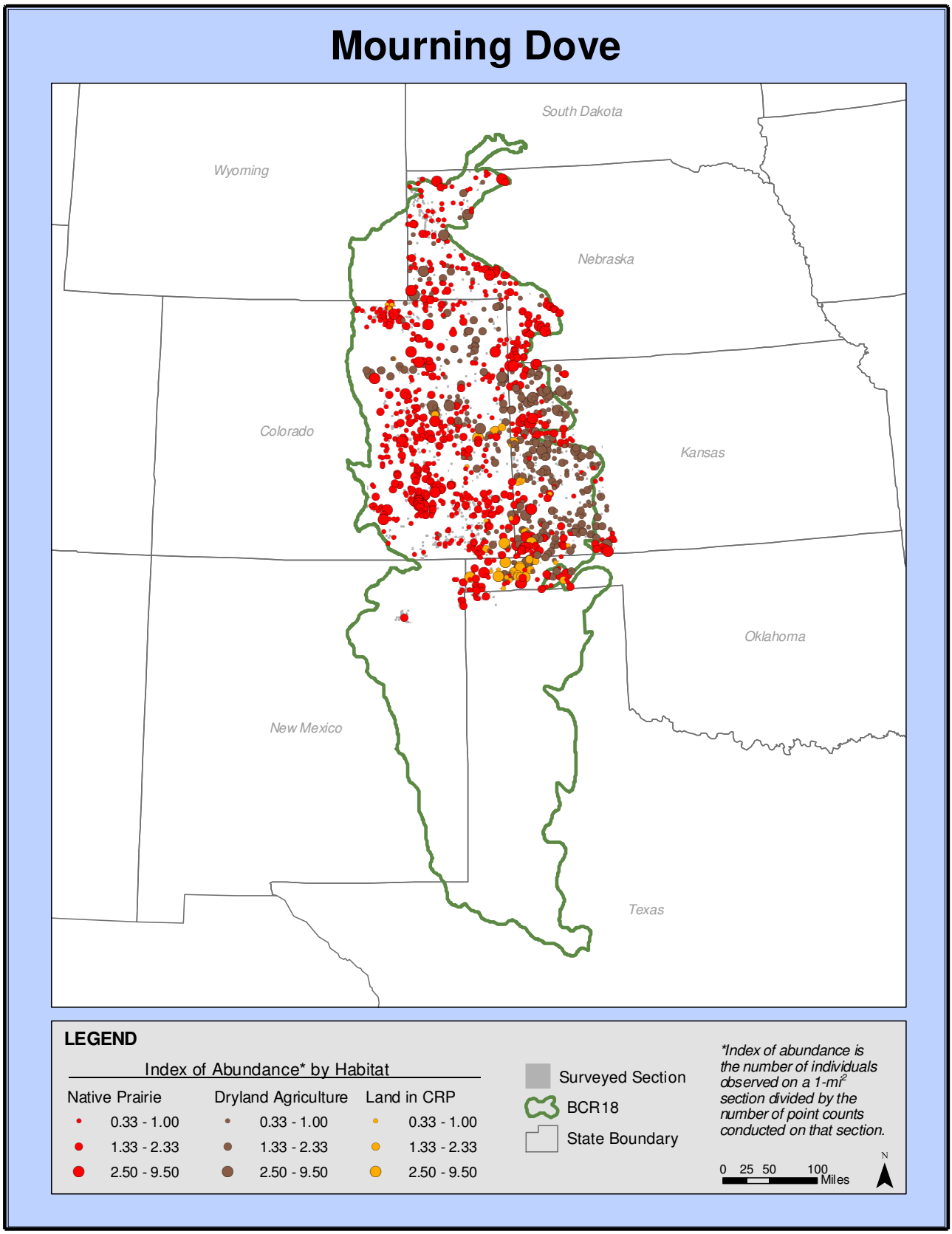
In 2004, we detected 4119 individuals on 1392 (57.7%) of the sections surveyed. The Mourning Dove commonly occurs throughout the Shortgrass Prairie BCR. The highest density of this species occurred in CRP habitat within BCR 18 (D = 24.76 birds/km^2, CV = 23%, *n* = 99). Densities of the Mourning dove in dry-land agricultural habitat within BCR 18 is also large (D = 15.13 birds/km^2, CV = 8%, *n* = 561). Generally, this species does not prefer shrub cover as it occurred in all categories at similar densities. This species had higher densities in the 81-90% grass height category (D = 39.04 birds/km^2, CV = 14%, *n* = 246).











Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Yellow-billed Cuckoo

(Coccyzus americanus)

In 2004, we detected one individual bordering the Shortgrass Prairie BCR boundary in Meade County, Kansas compared to 2003 this species occurred in the same county. Yellow-billed Cuckoo is a species of concern as follows:

- Nebraska – species of high concern
- Colorado – state species of special concern
- New Mexico – wildlife of concern
- USFS R2 – sensitive species.

Yellow-billed Cuckoo

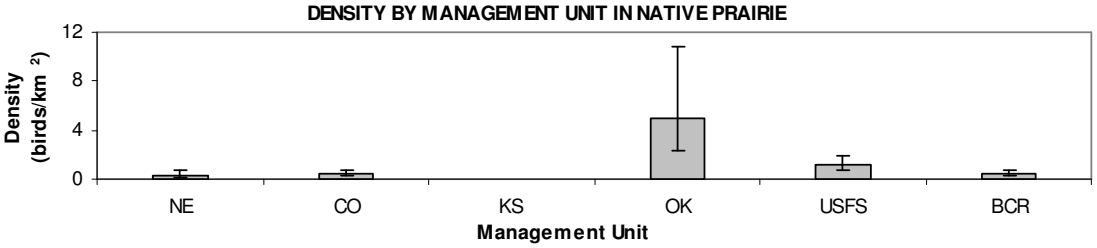
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

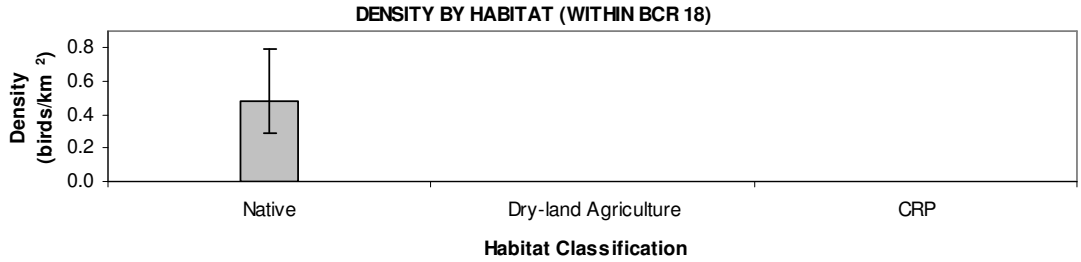
Burrowing Owl

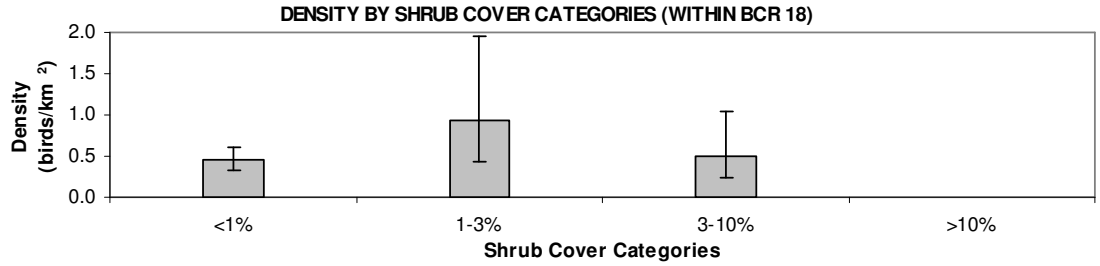
(Athene cunicularia)

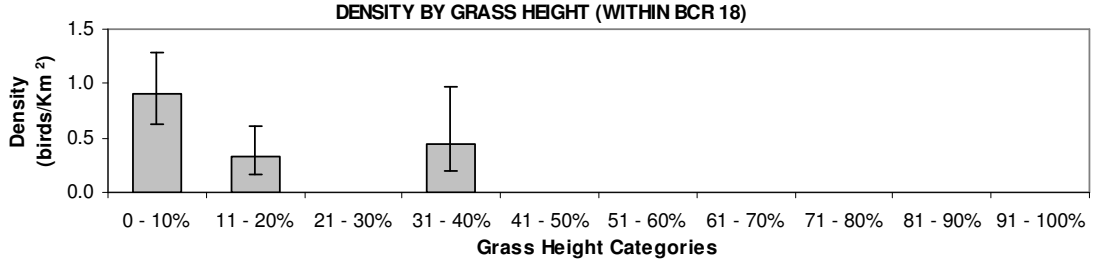
In 2004, we detected 236 Burrowing Owls on 124 (5.1%) of the surveyed sections. This species was widely distributed throughout the study area with observations occurring in every state. The highest densities (D = 5.05 birds/km^2, CV = 39%, *n* = 24) of Burrowing Owls occurred in Oklahoma. Density within native prairie habitat across the study area was .48 birds/km^2 (CV = 26%, *n* = 156). Density within native prairie habitat was highest in areas of 1-3% shrub cover (D = .93 birds/km^2, CV = 39%, *n* = 39). This species had higher densities in the 0-10% grass height category (D = .90 birds/km^2, CV = 19%, *n* = 171). Sixty-nine Burrowing Owl observations occurred on sections with Black-tailed Prairie Dog colonies. Burrowing Owl is a species of concern as follows:

- Partners In Flight – Tier I (high overall priority)
- Nebraska – species of high concern
- Colorado – state threatened
- Oklahoma – species of special concern
- USFS R2 – sensitive species.

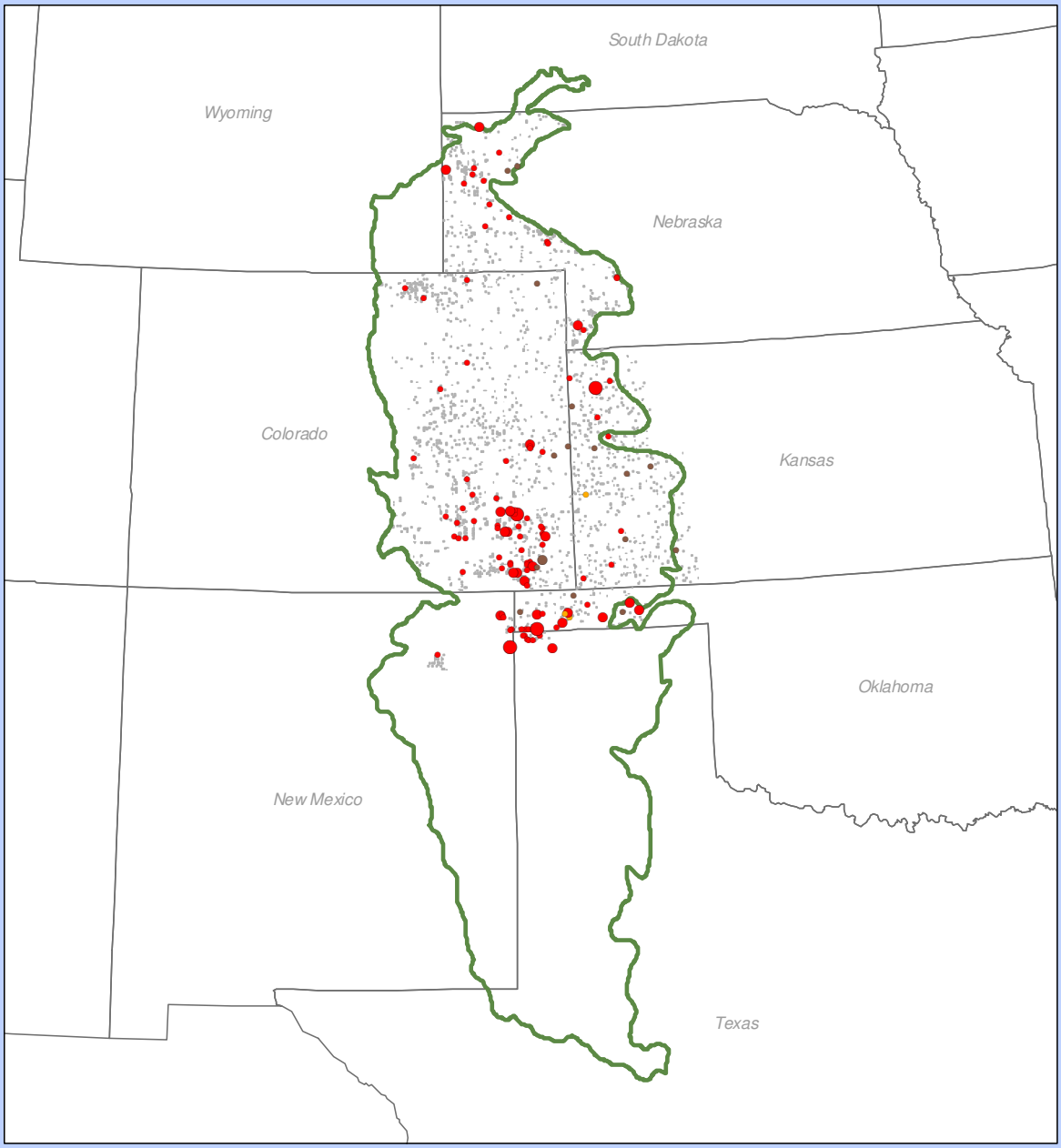








Burrowing Owl

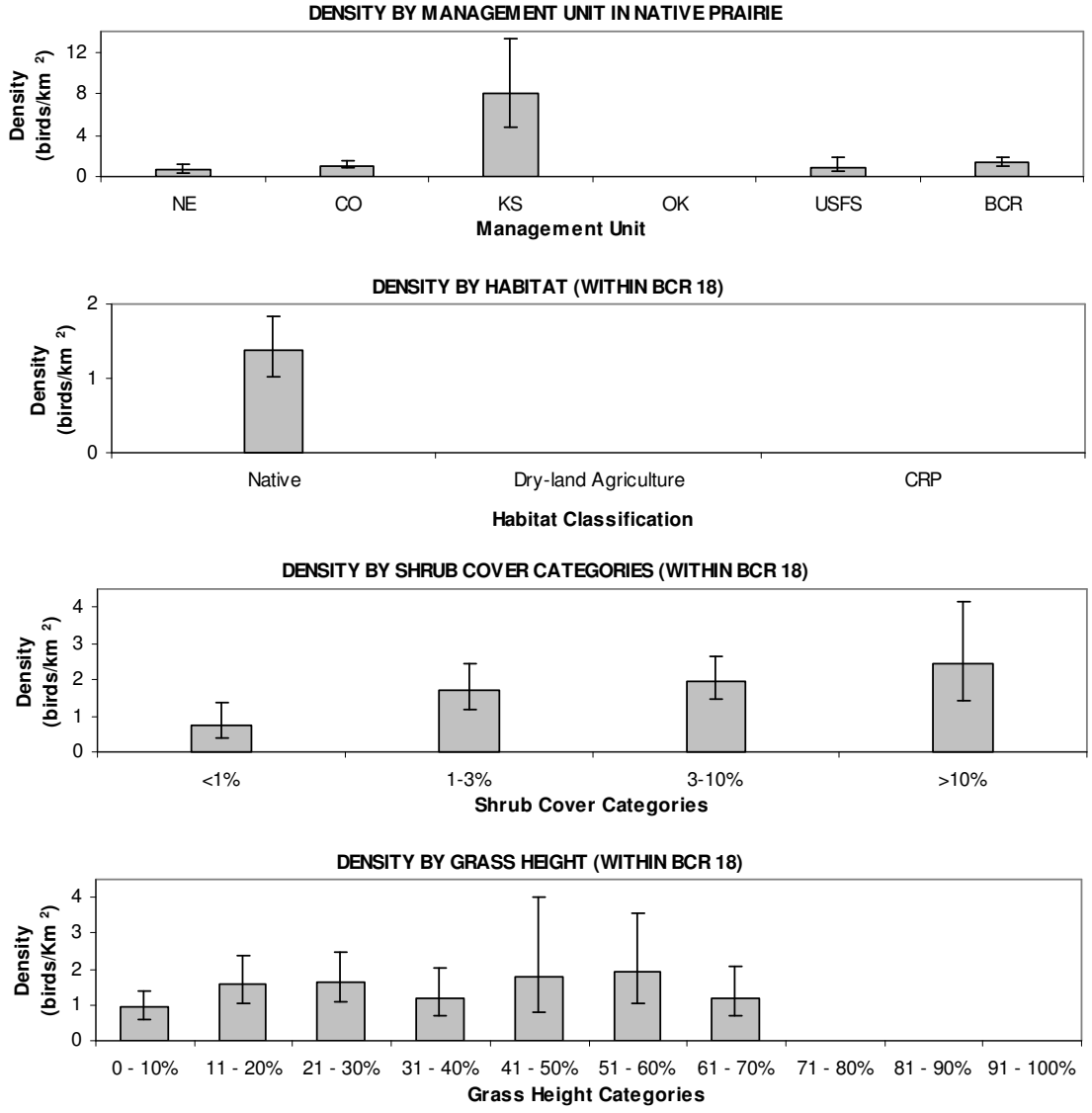


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

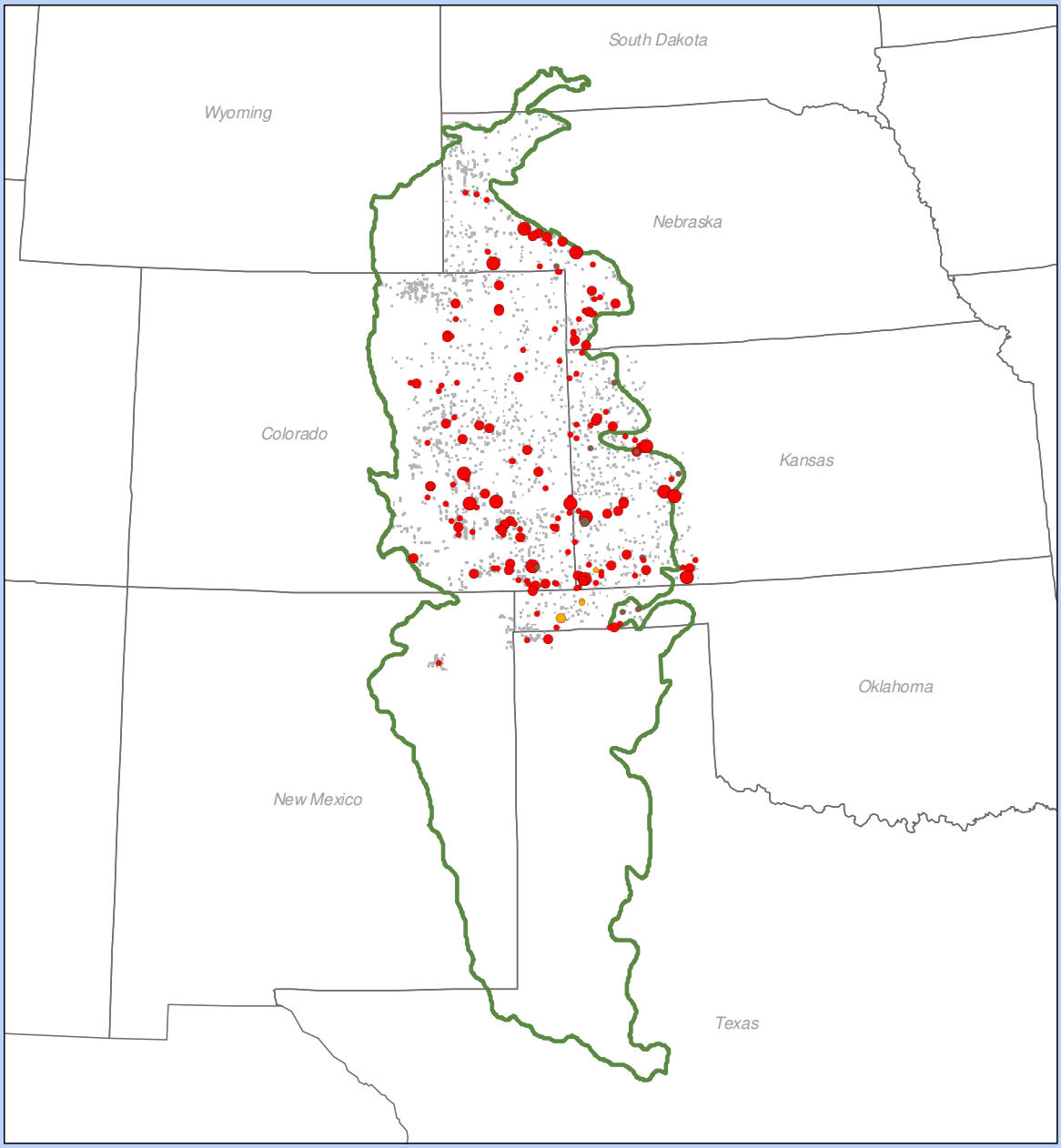
Common Nighthawk

(Chordeilis minor)

In 2004, we detected 312 individuals on 189 (7.8%) of the sections surveyed. The Common Nighthawk was distributed throughout the shortgrass prairie BCR. Largest densities occurred in Kansas (D = 8.00 birds/km^2, CV = 26%, *n* = 58). Within shrub cover types, density was highest in areas of >10% shrub cover (D = 2.44 birds/km^2, CV = 28%, *n* = 32). The Common Nighthawk exhibits no preference for grass height categories.



Common Nighthawk

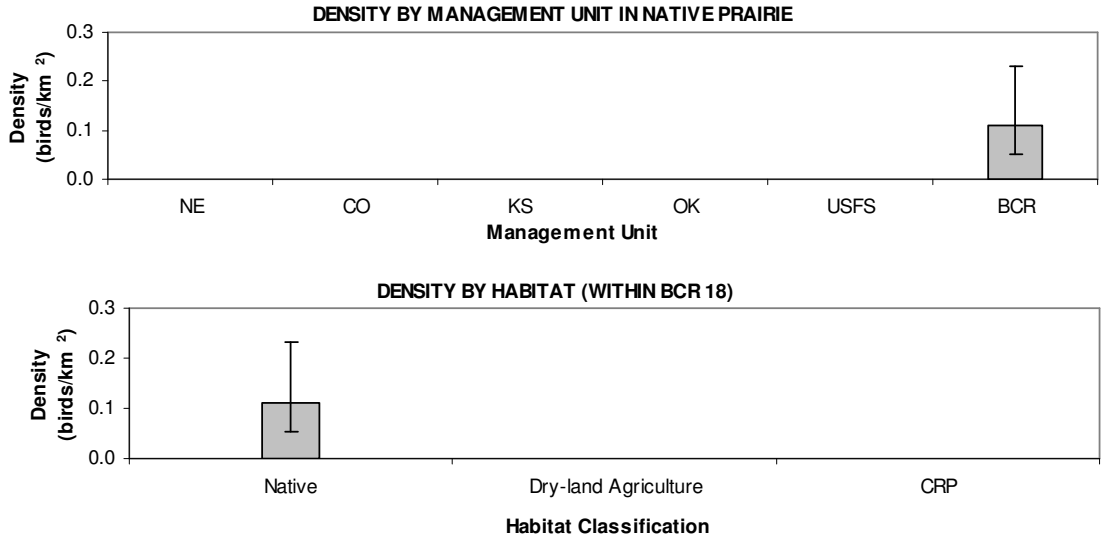


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

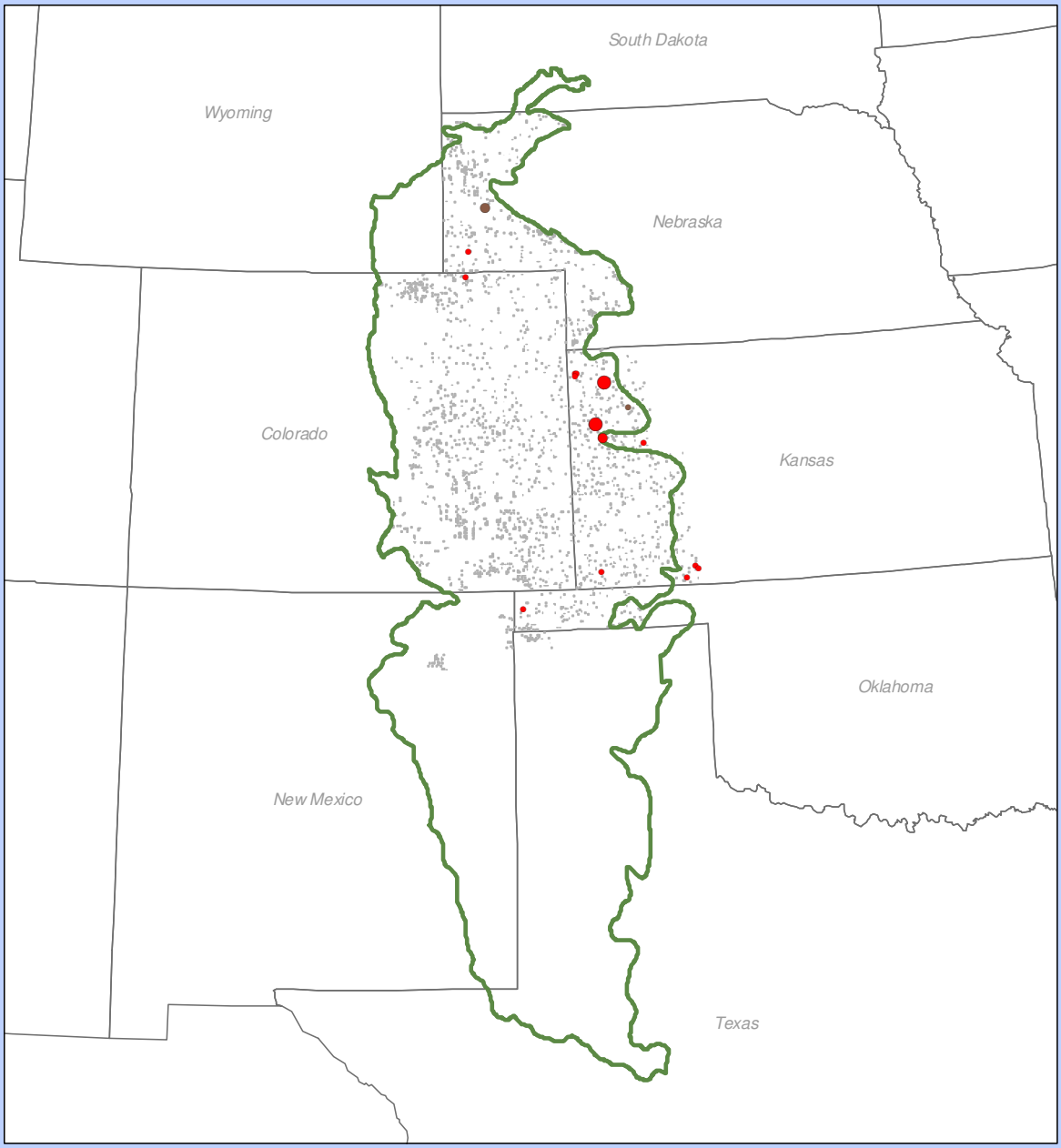
Red-headed Woodpecker

(Melanerpes erythrocephalus)

In 2004, we detected 22 individuals on 16 (.7%) of the sections surveyed. This species was distributed intermittently throughout the northern portion of the Shortgrass Prairie BCR, mainly in scattered woodlands (i.e. shelter belts). In BCR 18 density estimates for native habitat were 0.11 birds/km^2 (CV = 39%, n = 17). Red-headed Woodpecker is a species of high concern in Nebraska.



Red-headed Woodpecker



Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Northern Flicker

(Colaptes auratus)

In 2004, we detected ten individuals on nine (.8%) of the sections surveyed. This species was distributed throughout the Shortgrass Prairie BCR. All detections for this species were in native habitat. This species prefers wooded areas and forages on the ground.

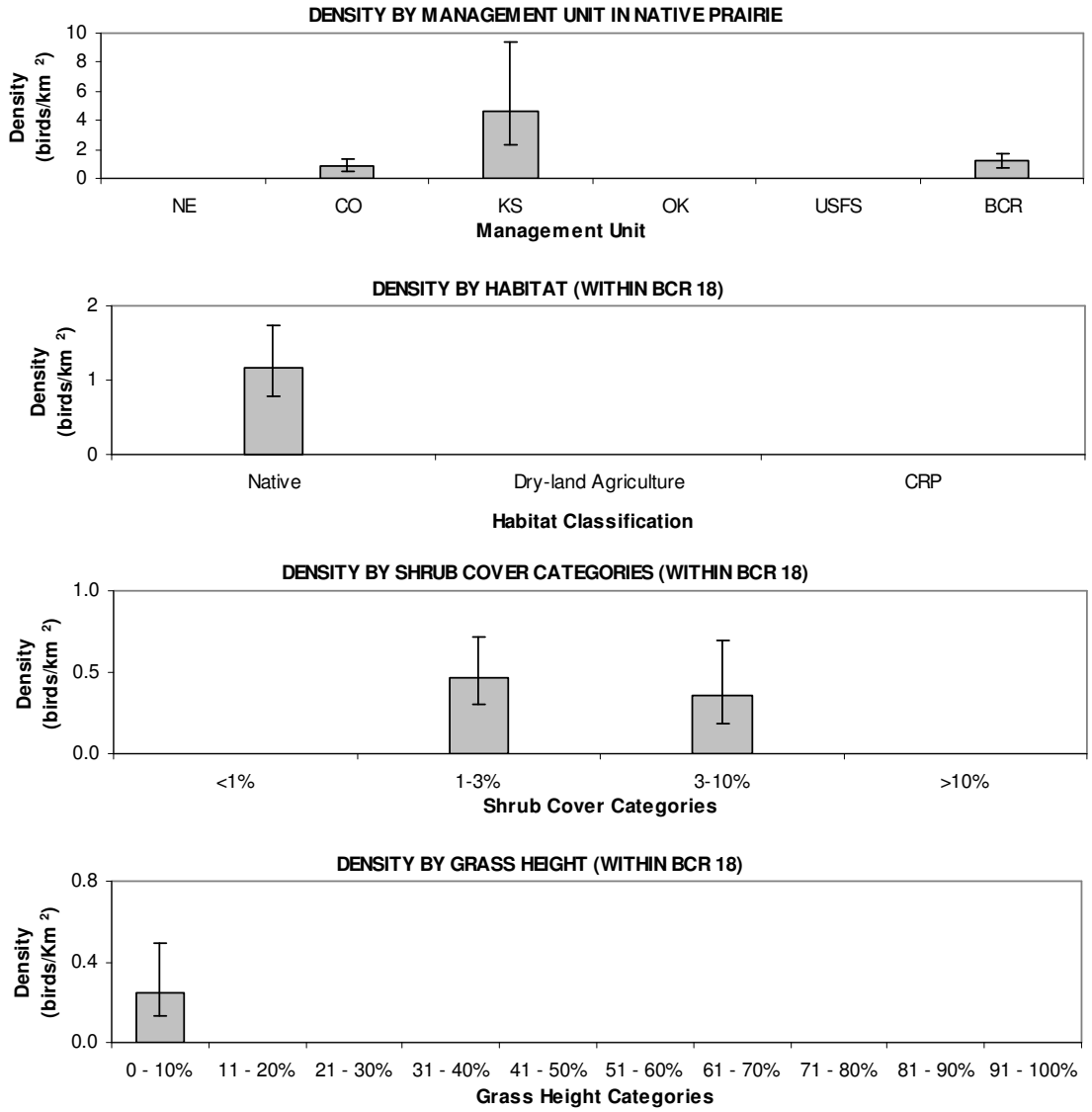
Northern Flicker

Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

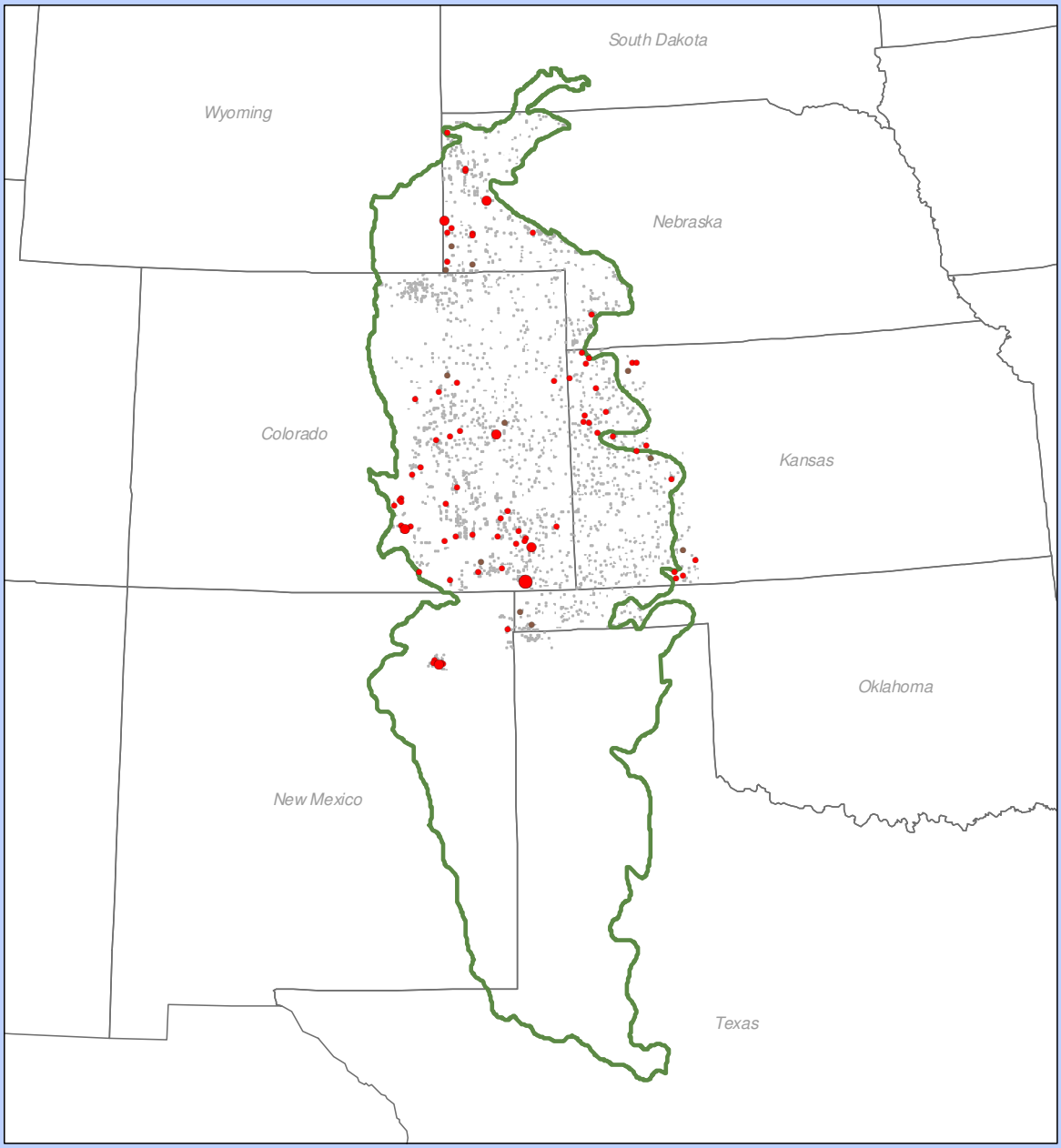
Say's Phoebe

(Sayornis saya)

In 2004, we detected 94 Say's Phoebes on 85 (3.5%) of the surveyed sections. This species was widely distributed across the study area with observations occurring in every state. Highest density (D = 4.67 birds/km^2, CV = 36%, *n* = 18) occurred in native prairie habitat in Kansas. Across the study area, highest density (D = 0.48 birds/km^2, CV = 22%, *n* = 30) occurred in native prairie habitat with 1-3 % shrub cover. Say's Phoebe is a Partners In Flight Tier II (high regional priority) species.



Say's Phoebe



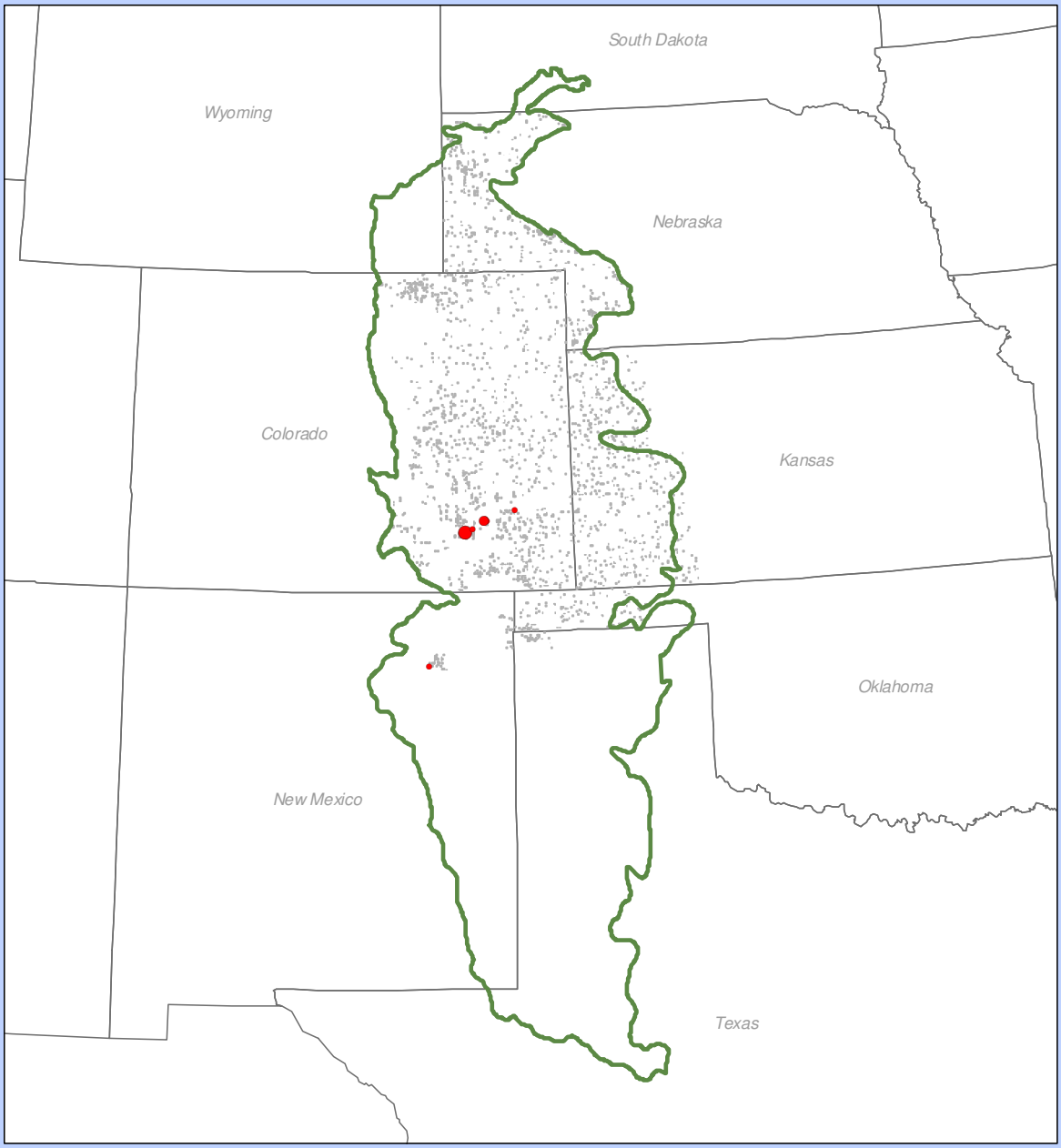
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Ash-throated Flycatcher

(Myiarchus cinerascens)

In 2004, we detected 8 individuals on 7 (.3%) of the sections surveyed. The Ash-throated Flycatcher was mainly distributed in the southern portion of the Shortgrass Prairie BCR. This species only occurred in Colorado and Kiowa National Grassland.

Ash-throated Flycatcher

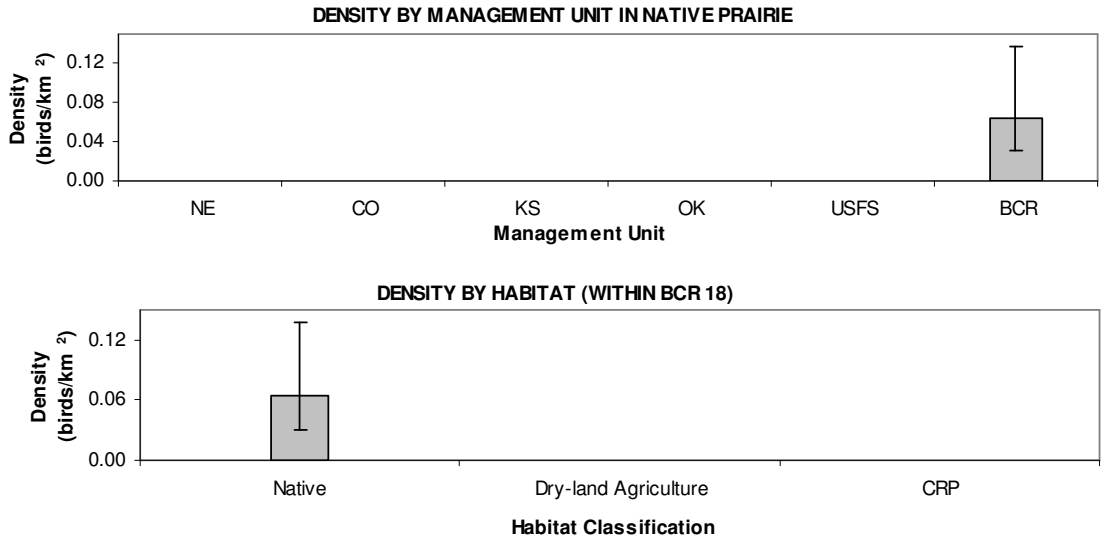


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

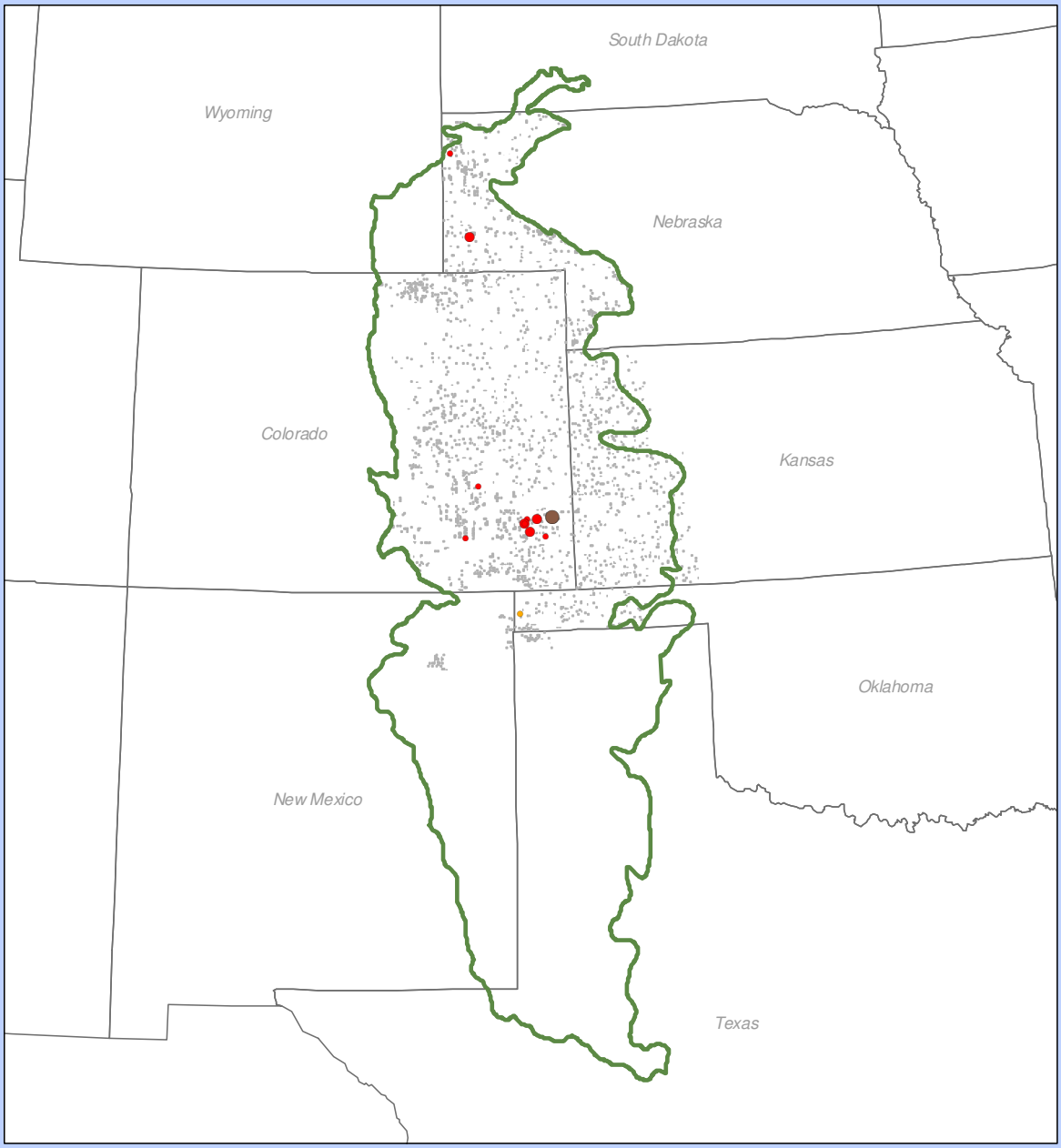
Cassin's Kingbird

(Tyrannus vociferans)

In 2004, we detected 18 individuals on 37 (1%) of the sections surveyed. The Cassin's Kingbird was mainly distributed in the southern and northern portion of the Shortgrass Prairie BCR. The greatest densities for this species occur in native habitat (D = .06 birds/km^2, CV = 39%, n = 13). Cassin's Kingbird is a species of moderate concern in Nebraska.



Cassin's Kingbird

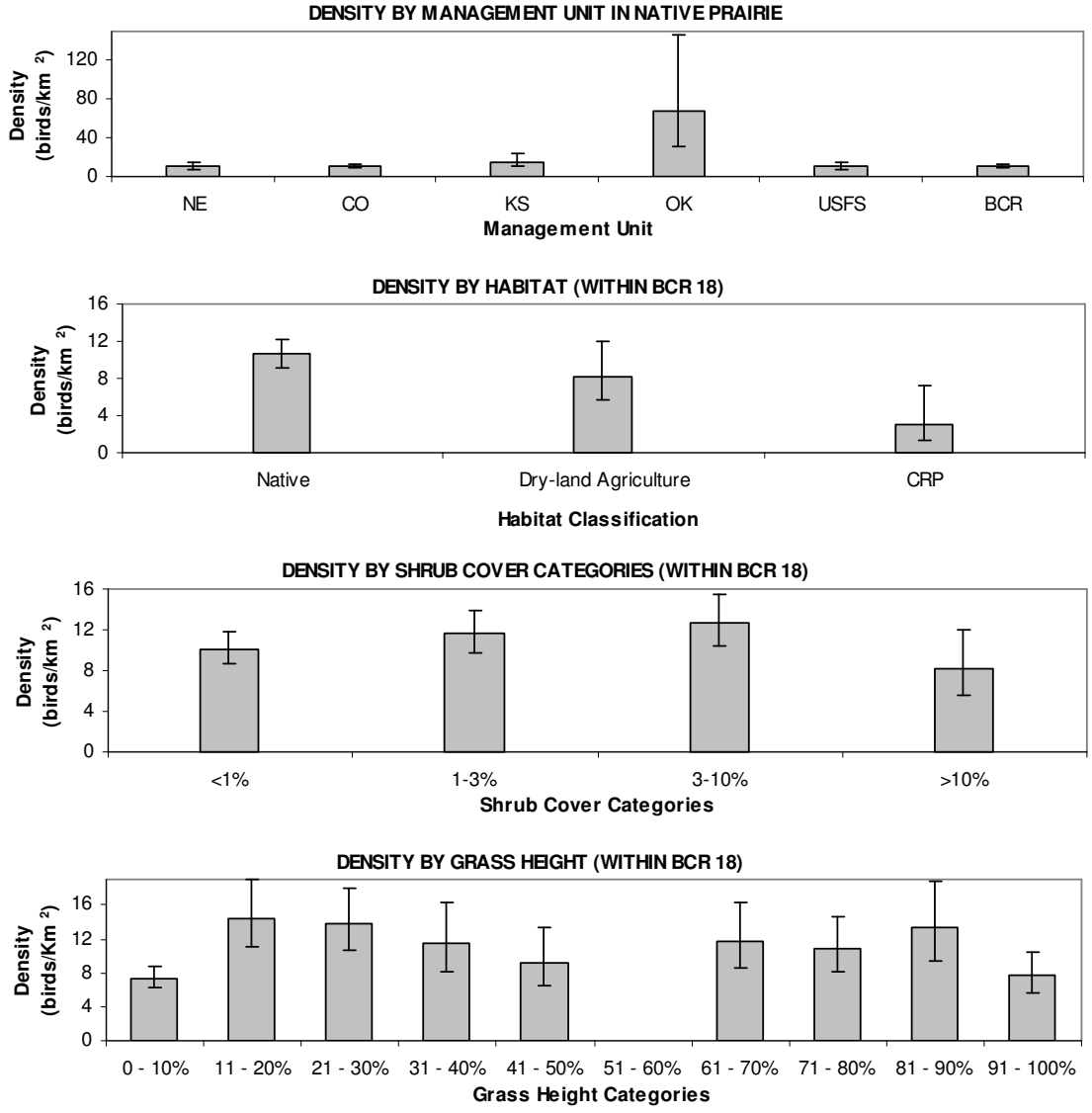


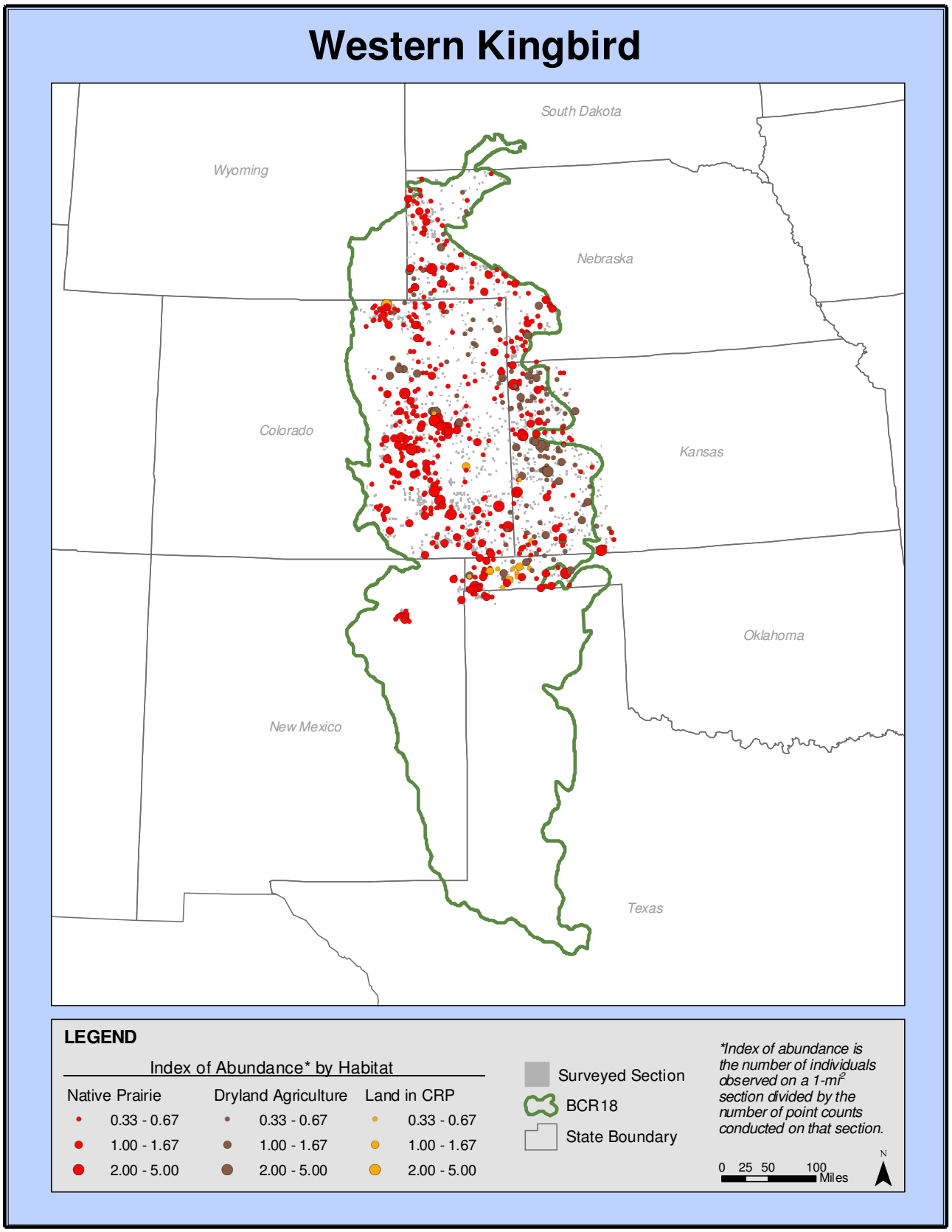
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Western Kingbird

(Tyrannus verticalis)

In 2004, we detected 1287 individuals on 662 (27.4%) of the sections surveyed. The Western Kingbird was distributed throughout the Shortgrass Prairie BCR. This species had highest densities in Oklahoma 68.27 birds/km^2 (CV = 40%, n = 24). Native habitat contained higher densities (10.61 birds/km^2, CV = 7%, n = 706) than dry-land agriculture and CRP habitat. The Western Kingbird exhibited generalist behavior between shrub and grass height categories.



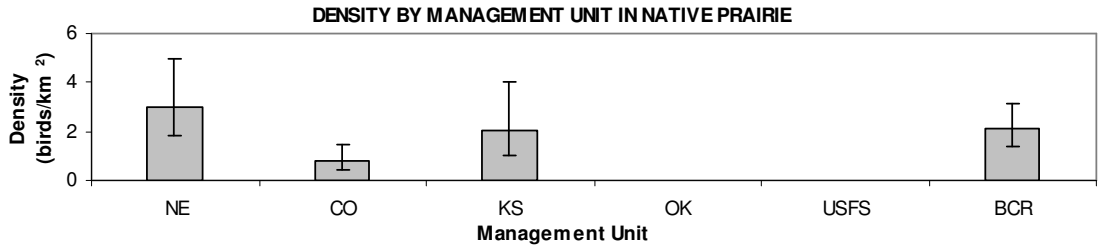


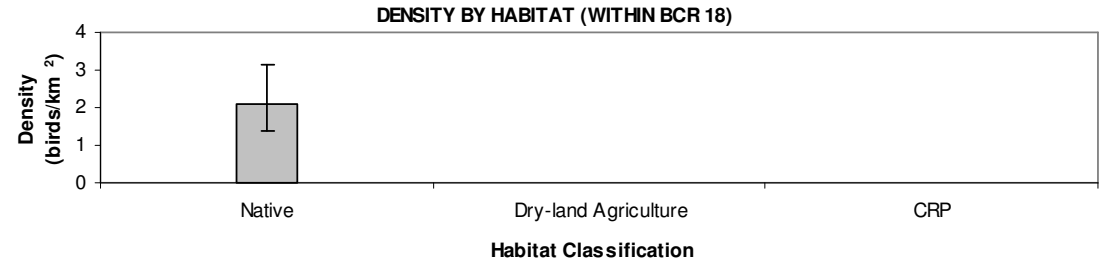
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

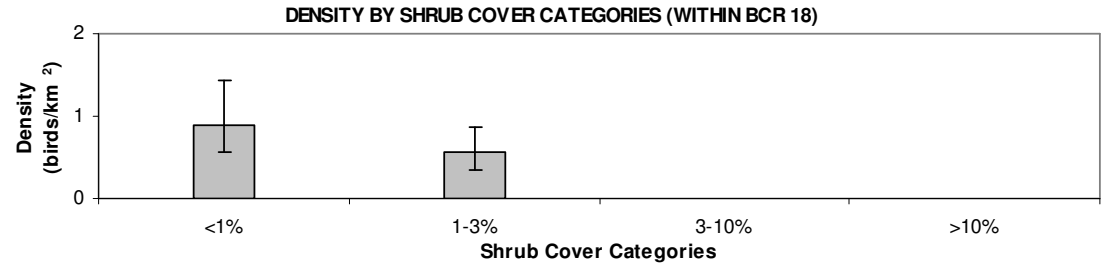
Eastern Kingbird

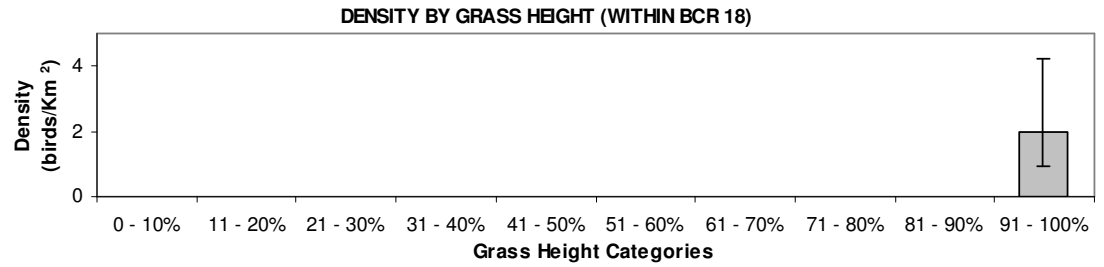
(Tyrannus tyrannus)

In 2004, we detected 120 individuals on 91 (3.8%) of the sections surveyed. The Eastern Kingbird was distributed throughout the shortgrass prairie BCR. This species occurred in greatest densities in Nebraska (D = 3.02 birds/km^2, CV = 25%, *n* = 42) and in native habitat within BCR 18 (D = 2.09 birds/km^2, CV = 21%, *n* = 87). This species was had higher densities in <1% shrub categories (D = .89 birds/km^2, CV = 24%, *n* = 54). In grass height 91-100% Eastern Kingbird had a density of 1.97 birds/km^2 (CV = 40%, *n* = 28).

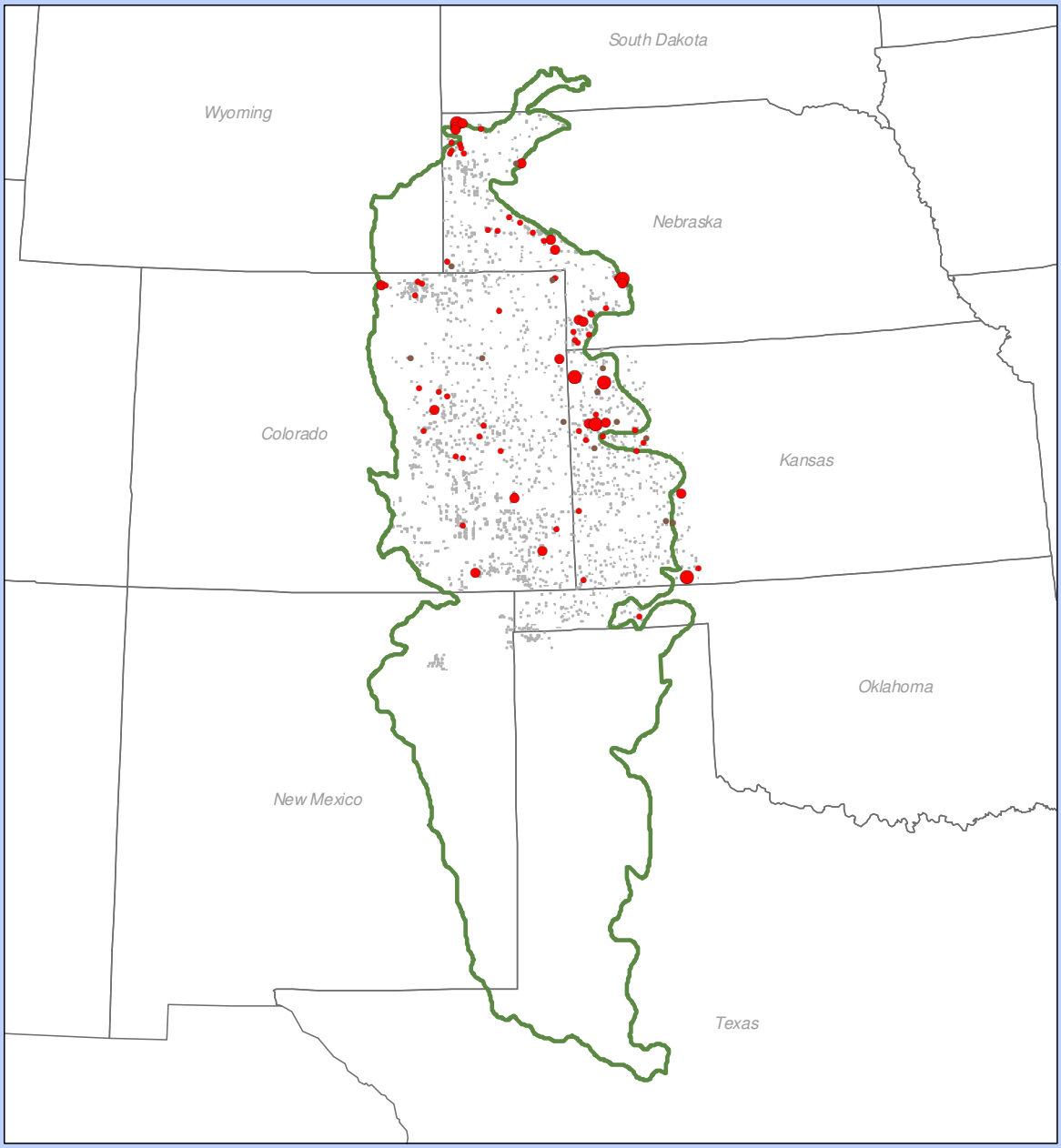








Eastern Kingbird

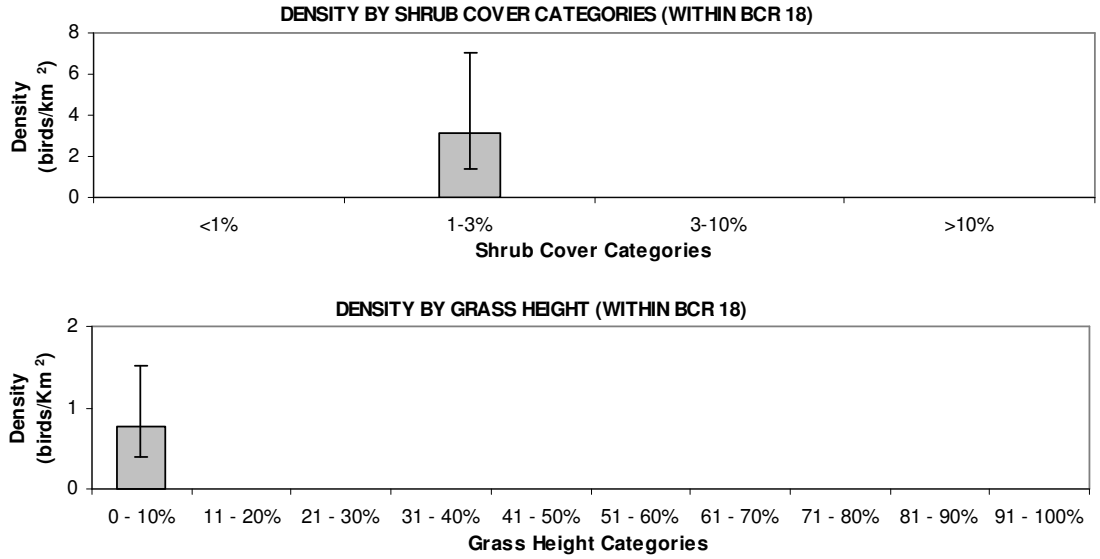


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

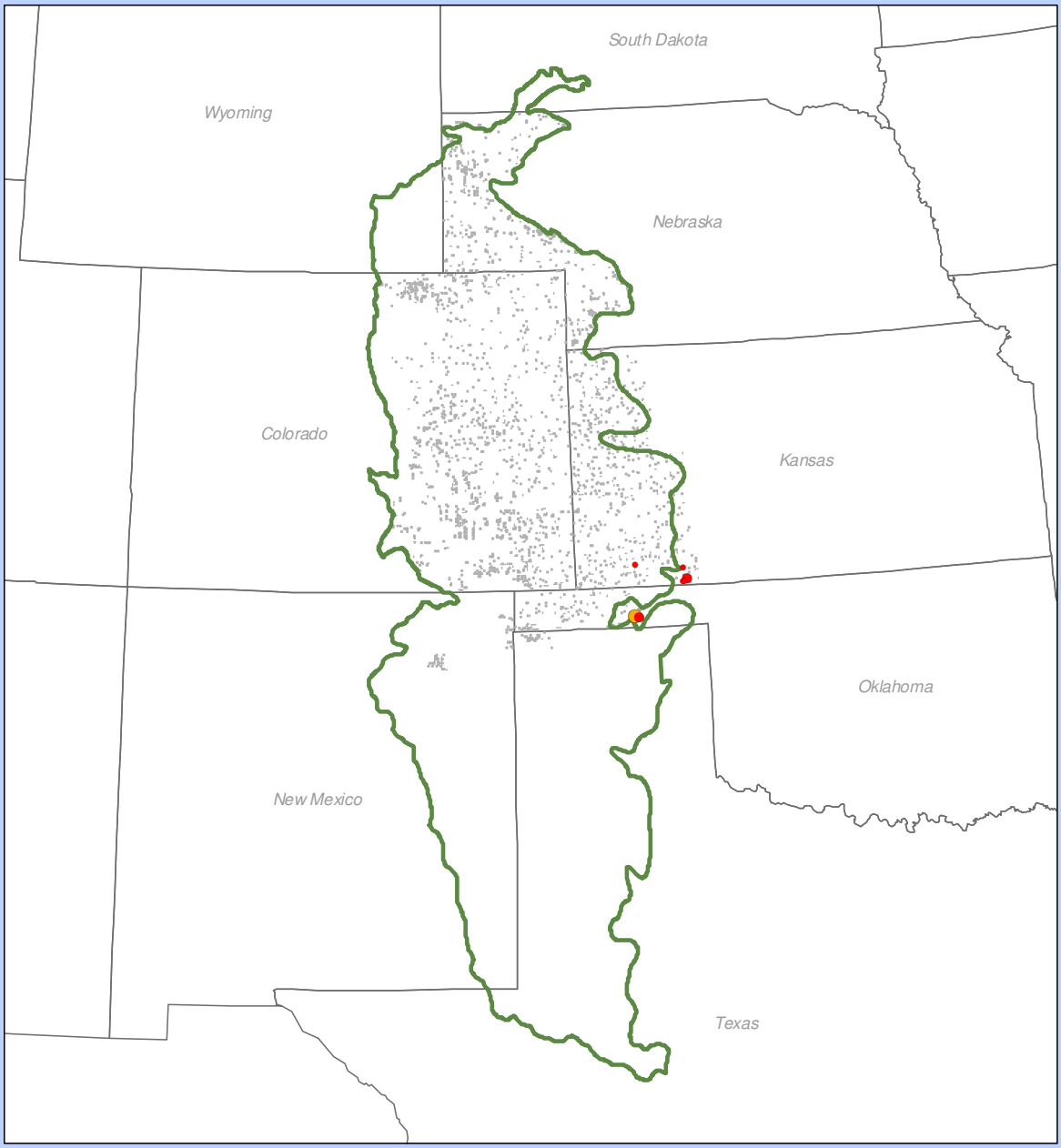
Scissor-tailed Flycatcher

(Tyrannus forticatus)

In 2004, we detected eleven Scissor-tailed Flycatchers on seven (.3%) of the surveyed sections. This species was observed in southwest Kansas, the panhandle of Oklahoma. Highest density in shrub cover categories occured in 1-3% (D = 3.15 birds/km^2, CV = 42%, *n* = 21). In grass height 0-10% Scissor-tailed Flycatcher had a density of .77 birds/km^2 (CV = 35%, *n* = 31). Scissor-tailed Flycatcher is a species of concern in Nebraska.



Scissor-tailed Flycatcher



Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

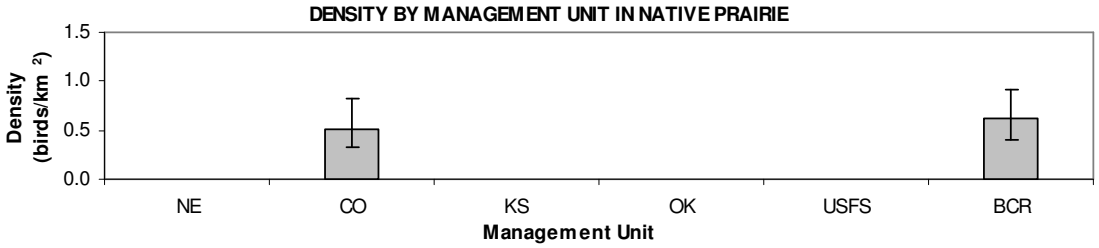
Loggerhead Shrike

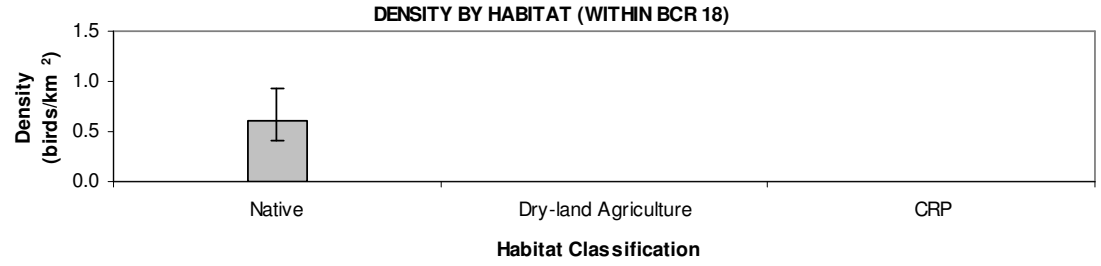
(Lanius ludovicianus)

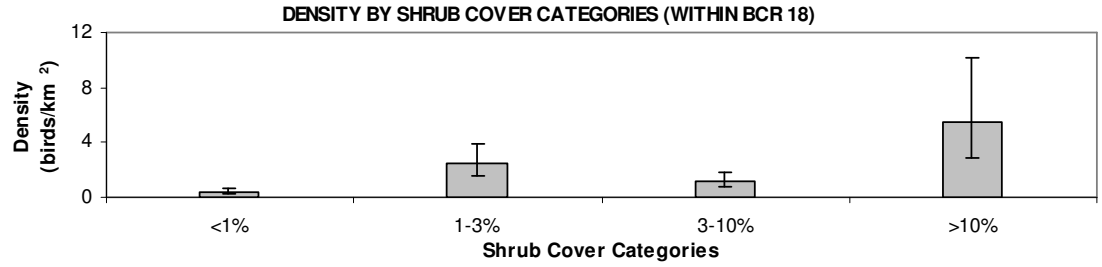
In 2004, we detected 89 Loggerhead Shrikes on 63 (2.6%) of the surveyed sections. This species was widely distributed across the study area. In the study area, density in native prairie habitat was .62 birds/km^2 (CV = 21%, n = 70). Highest density in native prairie habitat occurred in Colorado (D = .52 birds/km^2, CV = 24%, n = 48). Within native prairie habitat, highest density (D = 5.44 birds/km^2, CV = 33%, n = 30) occurred in areas of > 10% shrub cover. In grass height 61-70% Loggerhead Shrike had a density of 1.48 birds/km^2 (CV = 32%, n = 21).

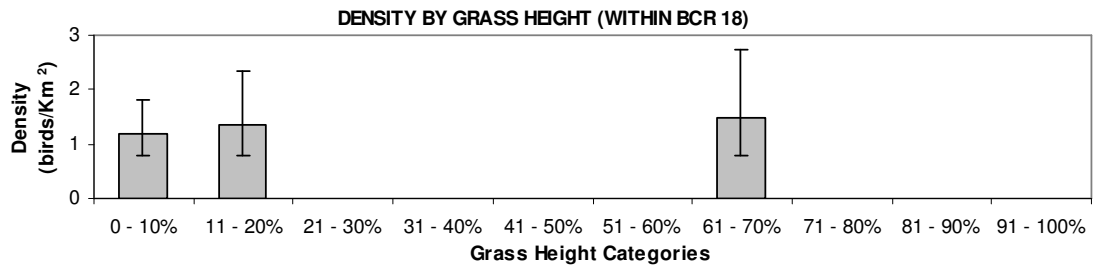
Loggerhead Shrike is a species of concern as follows:

- Nebraska – species of high concern
- New Mexico – wildlife of concern
- Oklahoma – species of special concern (Category II)
- USFS R2 – sensitive species.

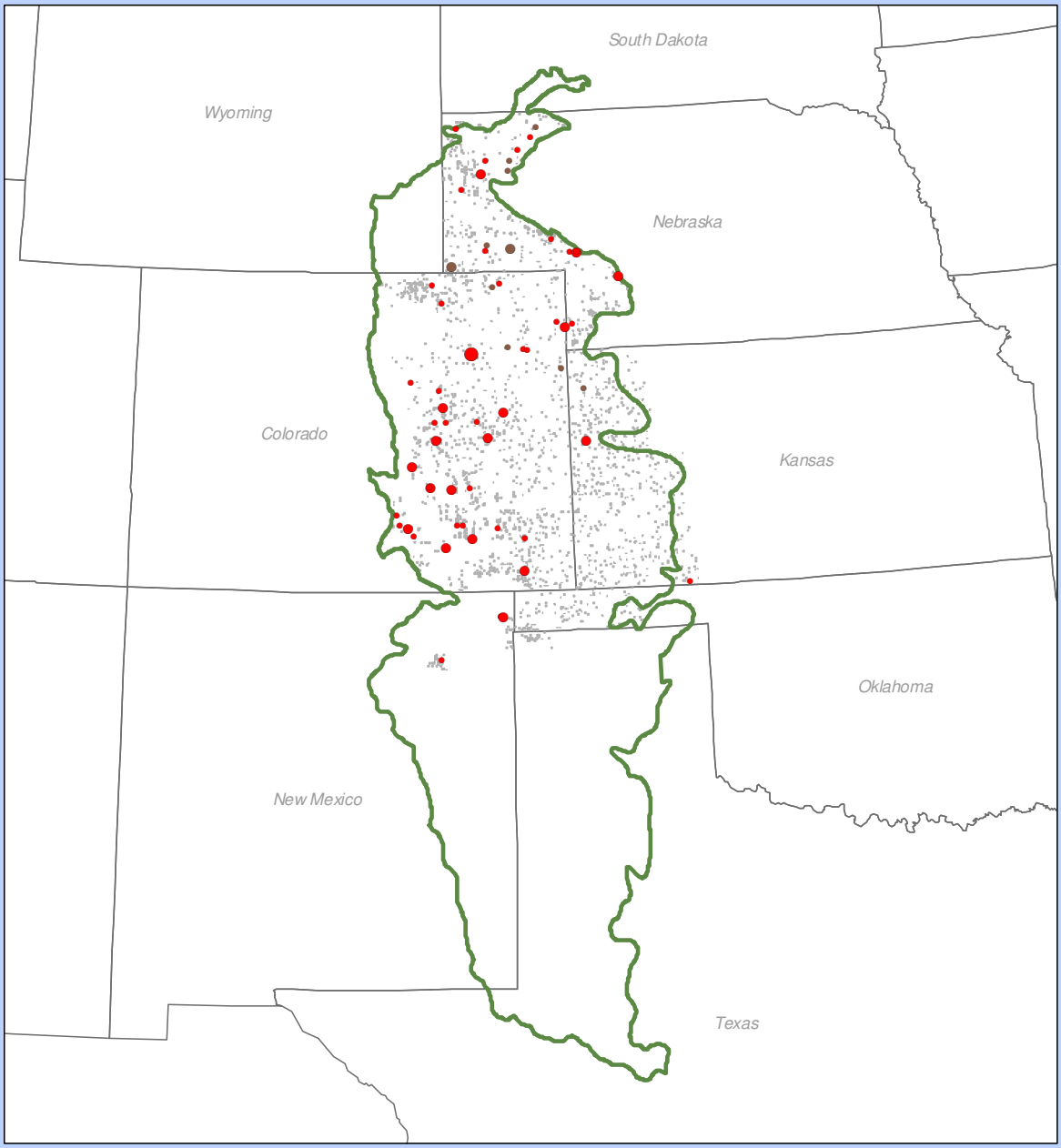








Loggerhead Shrike

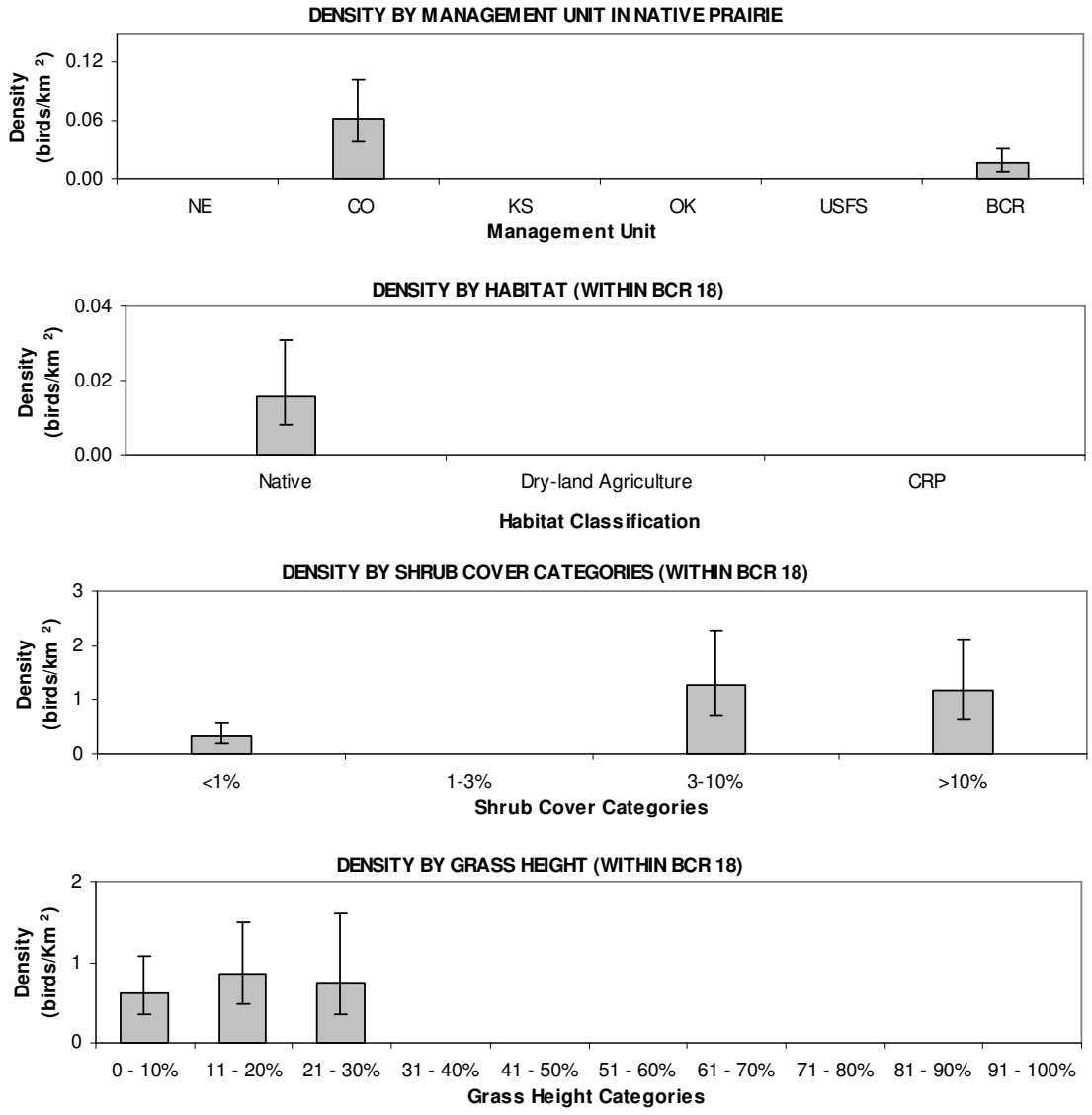


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

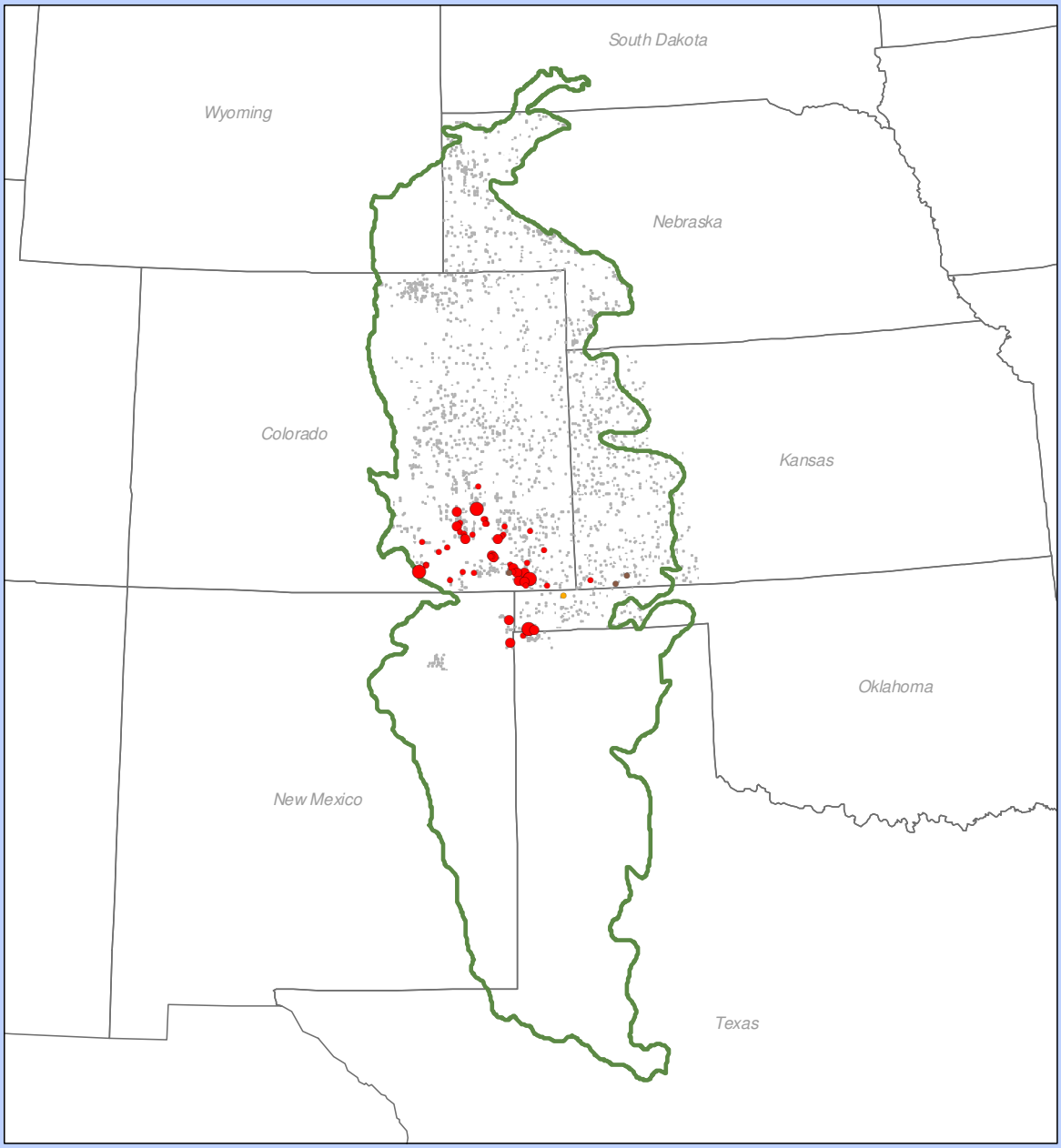
Chihuahuan Raven

(Corvus cryptoleucus)

In 2004, we detected 78 individuals on 56 (2.3%) of the sections surveyed. The Chihuahuan Raven was primarily distributed throughout native grassland habitats in the southern portion of BCR 18, where the highest densities (D = .06 birds/km^2, CV = 25%, *n* = 28) occur in Colorado. Within this area, this species has higher densities in native habitats that contain between 3-10% shrub cover (D = 1.27 birds/km^2, CV = 31%, *n* = 31). Chihuahuan Raven had similar densities in 0-10%,11-20% and 21-30% grass height pooled across years 2002-2004; .62 birds/km^2, CV = 29%, *n* = 214, .85 birds/km^2,CV = 29%, *n* = 49, .74 birds/km^2, CV = 41%, *n* = 25 respectively . Chihuahuan Raven is a Partners In Flight Tier II (high regional priority) species.



Chihuahuan Raven

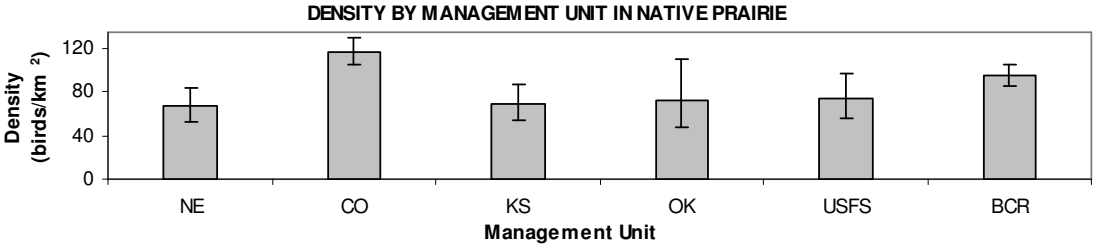


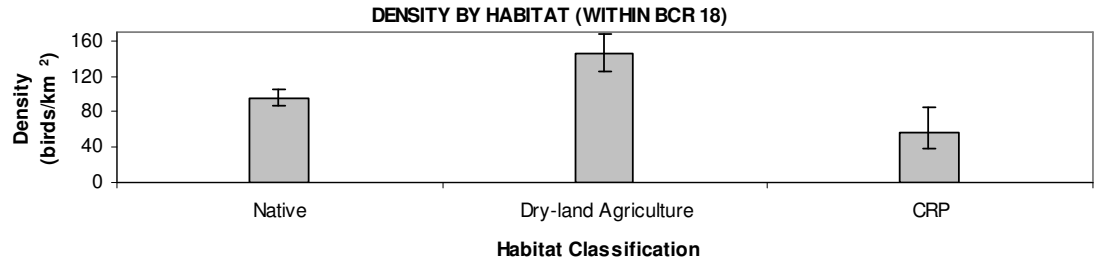
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

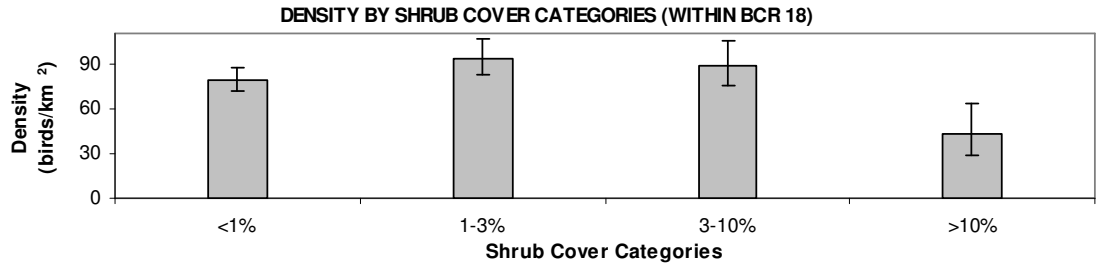
Horned Lark

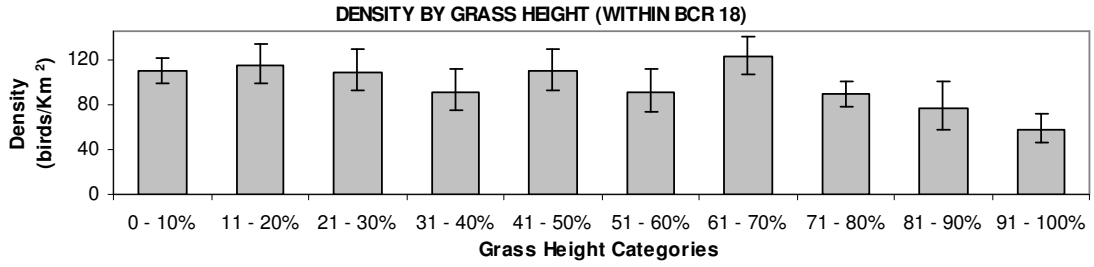
(Eremophila alpestris)

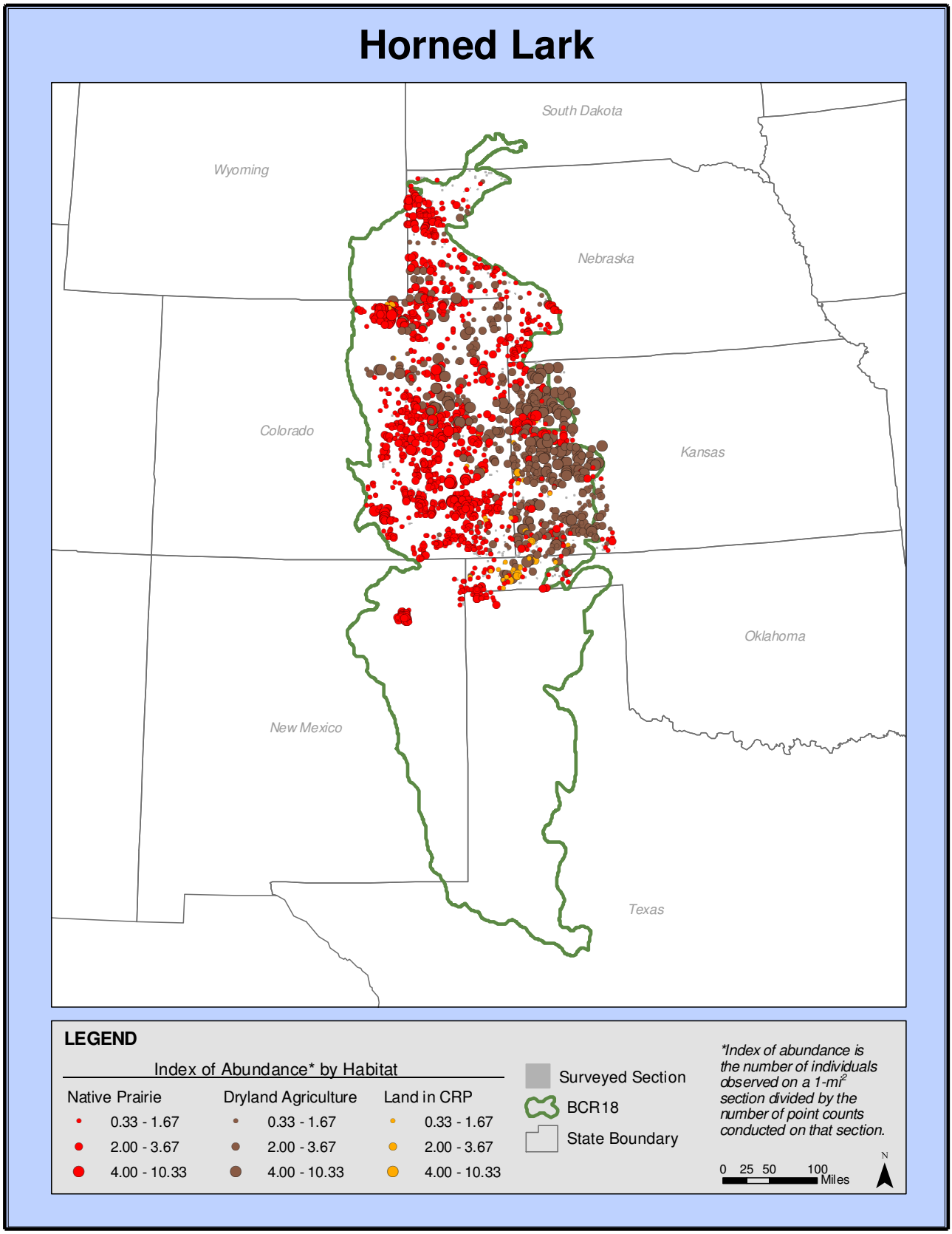
In 2004, we detected 11,012 Horned Larks on 2,036 (84%) of the surveyed sections. We observed more Horned Larks than any other species. This species was widely distributed over the study area with observations occurring in every state. Across the study area, density was higher in dry-land agriculture (D = 145.57 birds/km^2, CV = 7%, *n* = 2180) than in native prairie habitat (D = 95.58 birds/km^2, CV = 5%, *n* = 4666). Highest densities in native prairie habitat occurred in Colorado (D = 116.44 birds/km^2, CV = 5%, *n* = 3226). In shrub cover and grass height categories, this species exhibited a generalist behavior with densities decreasing towards more dense vegetation structure. Horned Lark is a Partners In Flight Tier III (additional watch list) species.









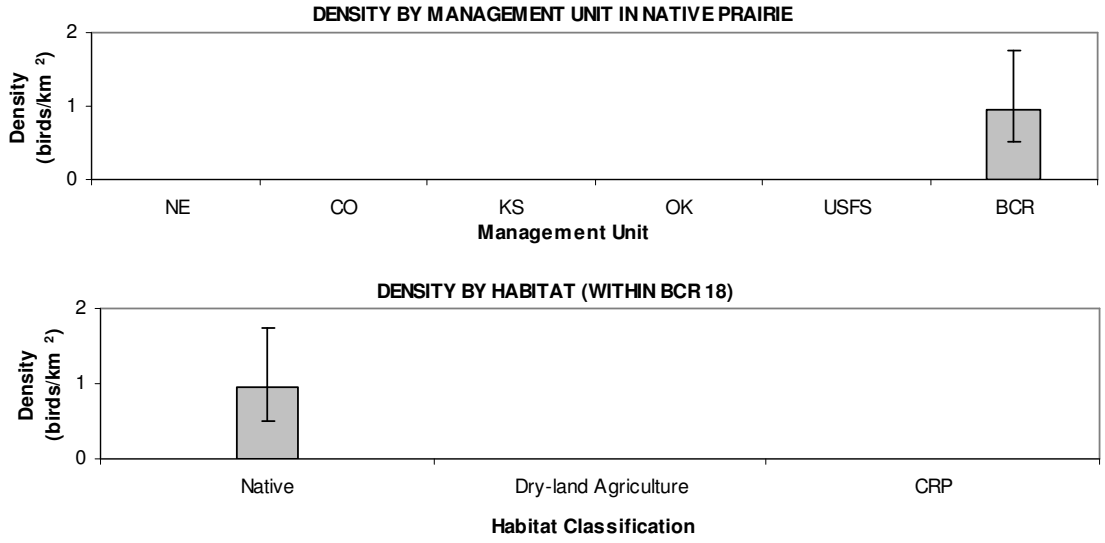


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

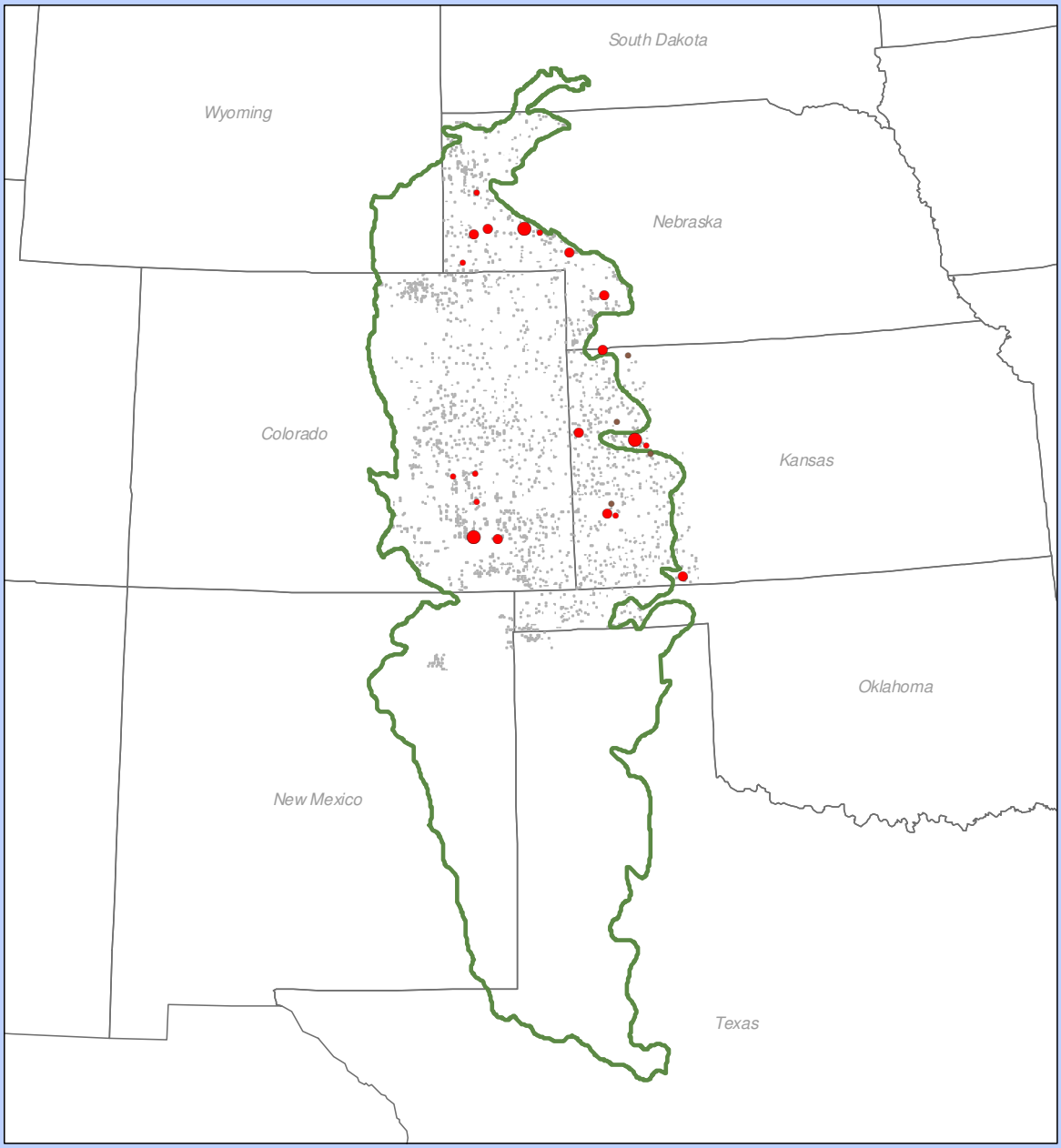
Northern Rough-winged Swallow

(Stelgidopteryx serripennis)

In 2004, we detected 46 individuals on 27 (1.1%) of the sections surveyed. This species was concentrated in Kansas and Nebraska. Shortgrass prairie BCR density estimates in native prairie habitat was .94 birds/km^2 (CV = 32%, n = 46).



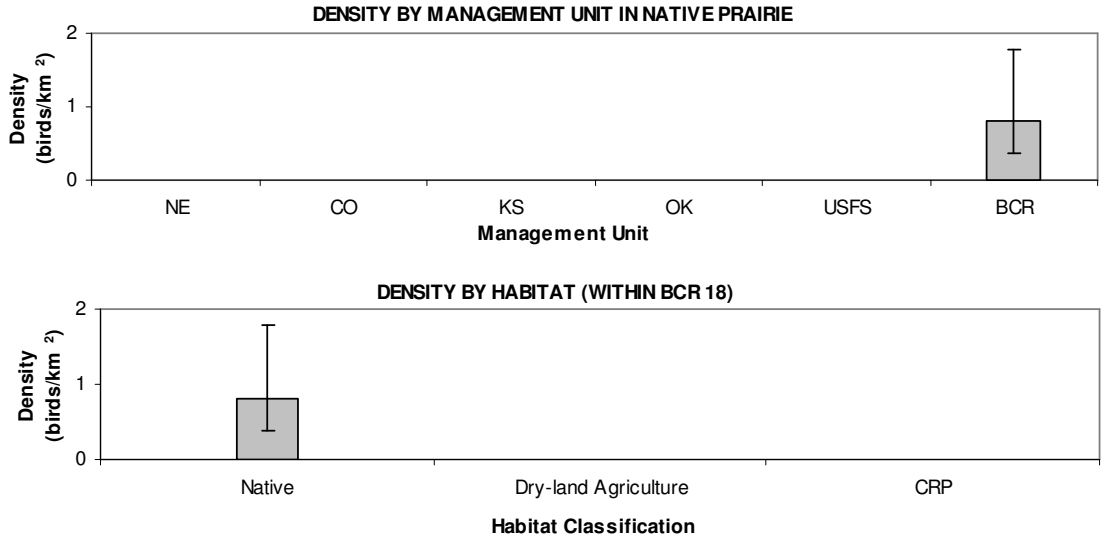
Northern Rough-winged Swallow

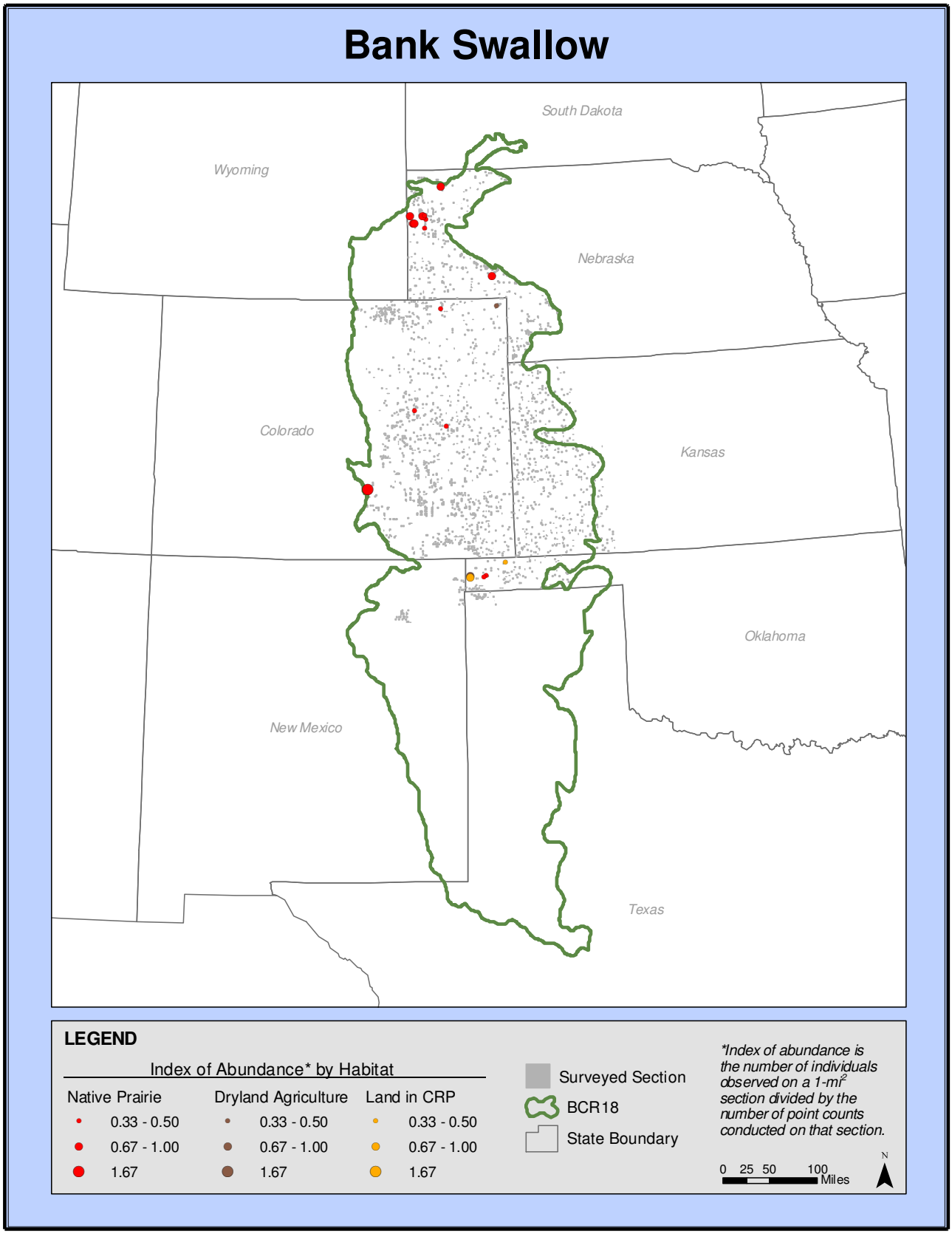


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Bank Swallow
(Riparia riparia)

In 2004, we detected 32 individuals on 19 (.8%) of the sections surveyed. The majority of the Bank Swallow detections occurred in Nebraska. Shortgrass prairie BCR density estimates in native prairie habitat was .82 birds/km^2 (CV = 41%, n = 20).



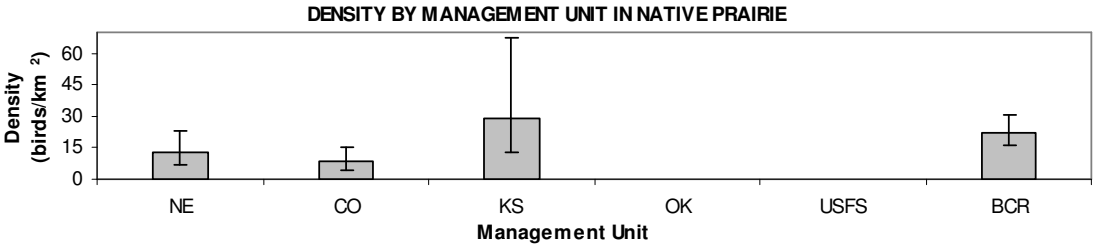


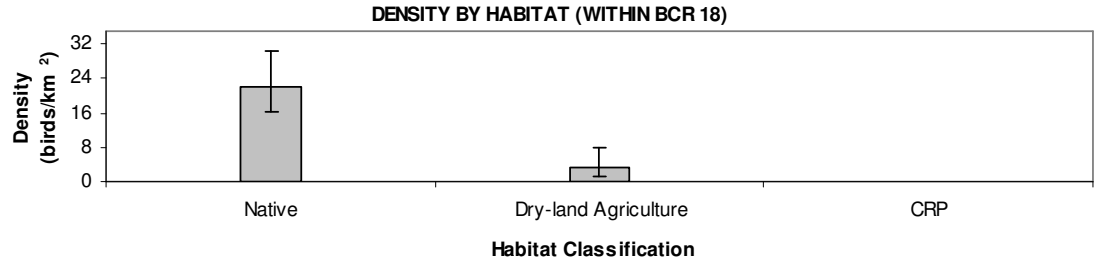
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

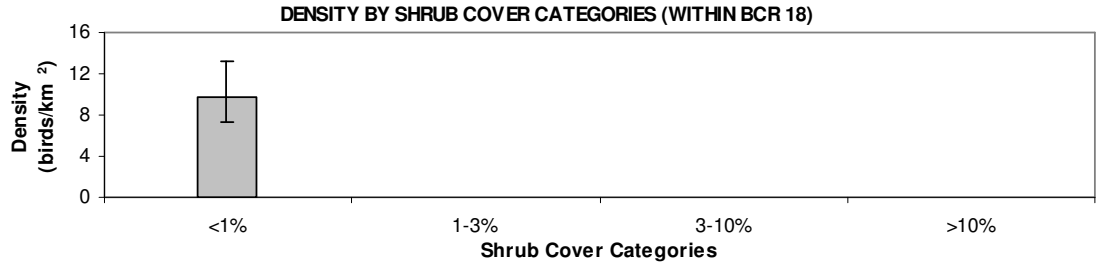
Cliff Swallow

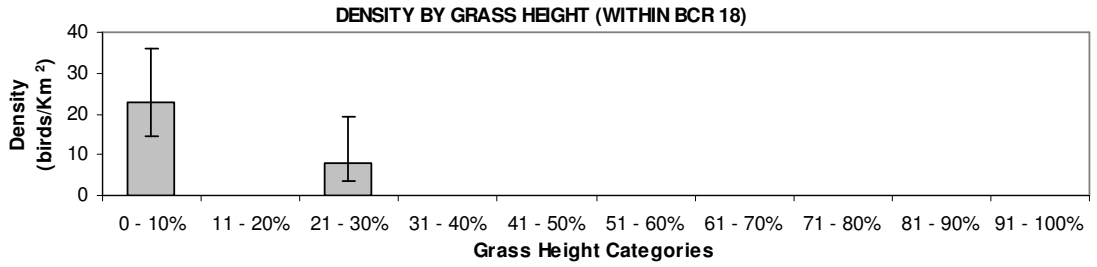
(Petrochelidon pyrrhonota)

In 2004, we detected 408 individuals on 200 (8.3%) of the sections surveyed. The Cliff Swallow was distributed throughout the Shortgrass Prairie BCR. The largest density of this species occurred in Kansas (D = 28.99 birds/km^2, CV = 45%, *n* = 28). This species had higher densities in <1% shrub cover categories (D = 9.78 birds/km^2, CV = 16%, *n* = 543). In grass height 0-10% Cliff Swallow had a density of 22.80 birds/km^2 (CV = 24%, *n* = 77).

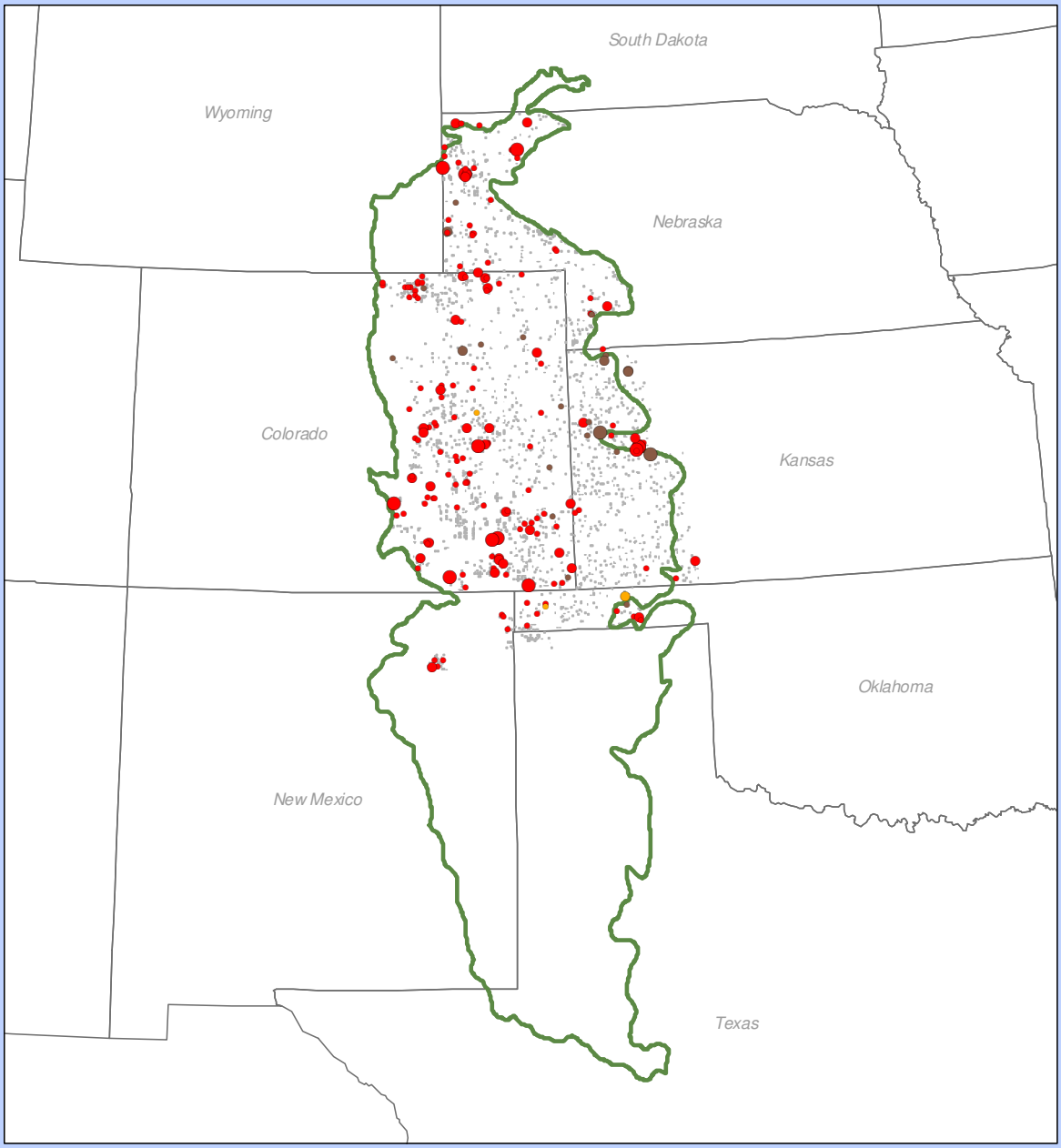








Cliff Swallow

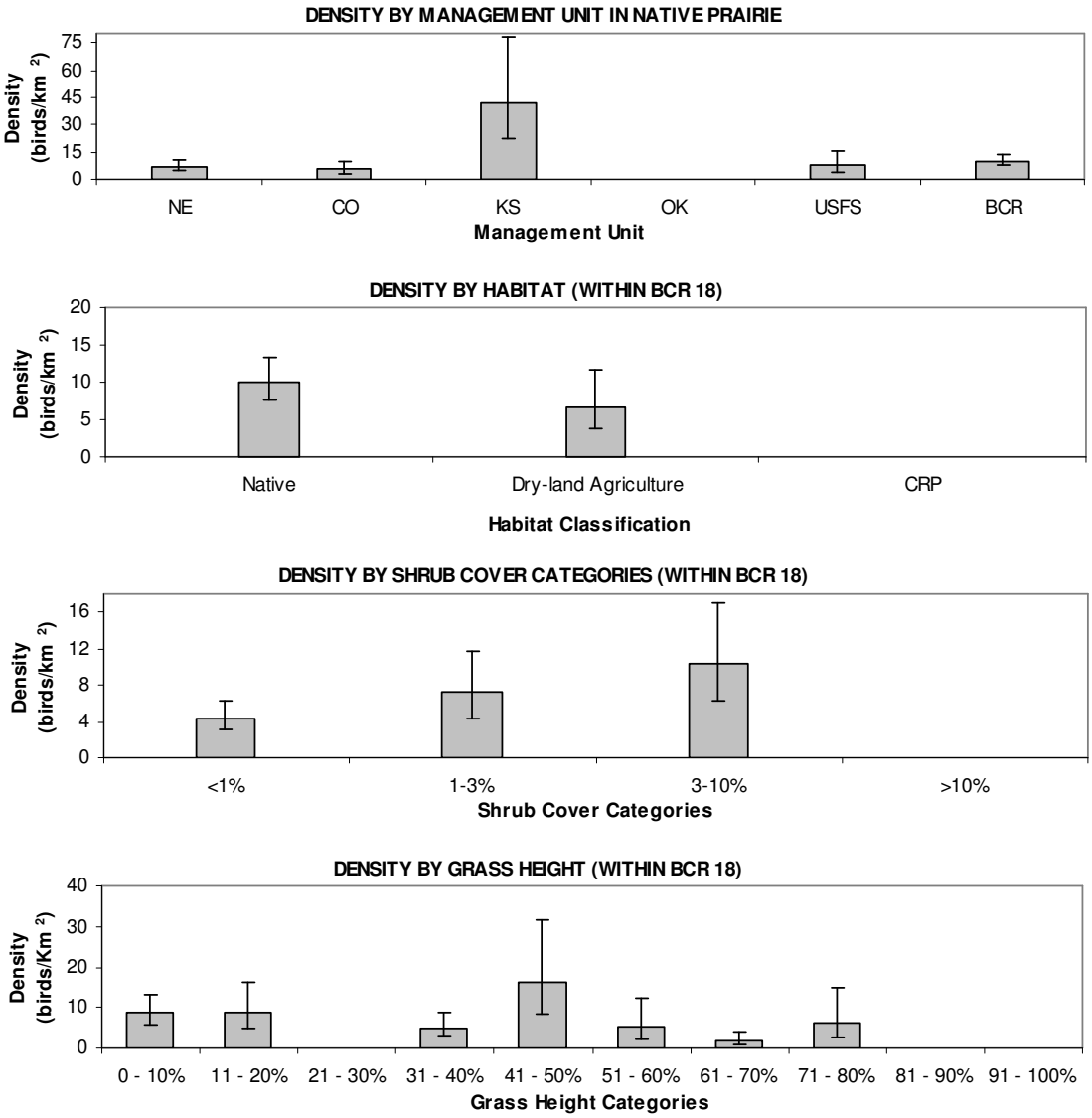


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

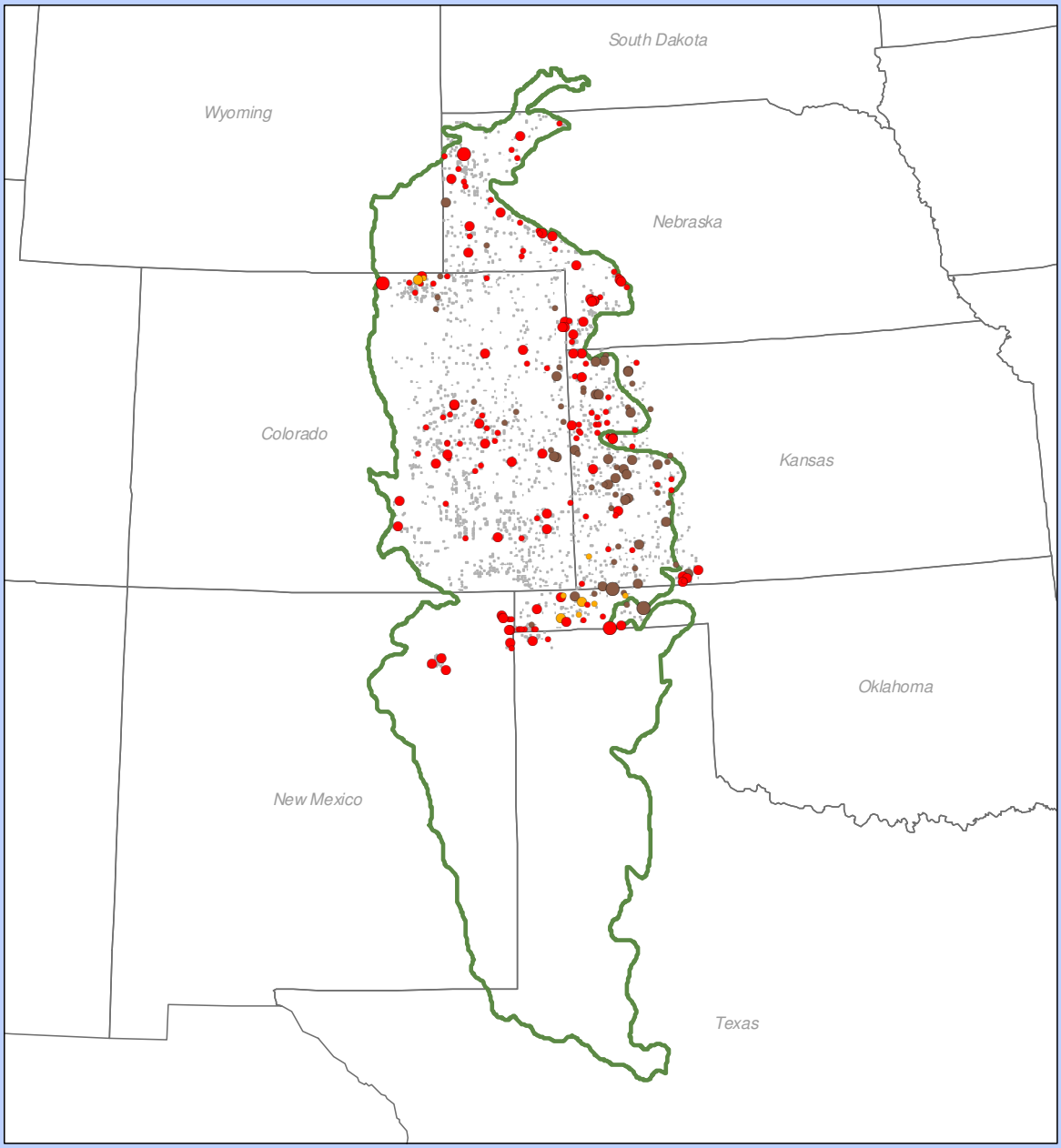
Barn Swallow

(Hirundo rustica)

In 2004, we detected 391 individuals on 225 (9.5%) of the sections surveyed. The Barn Swallow was distributed throughout the Shortgrass Prairie BCR. The largest densities for this species occurred in Kansas (D = 42.12 birds/km^2, CV = 32%, *n* = 31). This species had higher densities in the 3-10% shrub category (D = 10.42 birds/km^2, CV = 26%, *n* = 45). Barn Swallow had highest densities in grass height 41-50% (D = 16.44 birds/km^2,CV = 35%, *n* = 31).



Barn Swallow

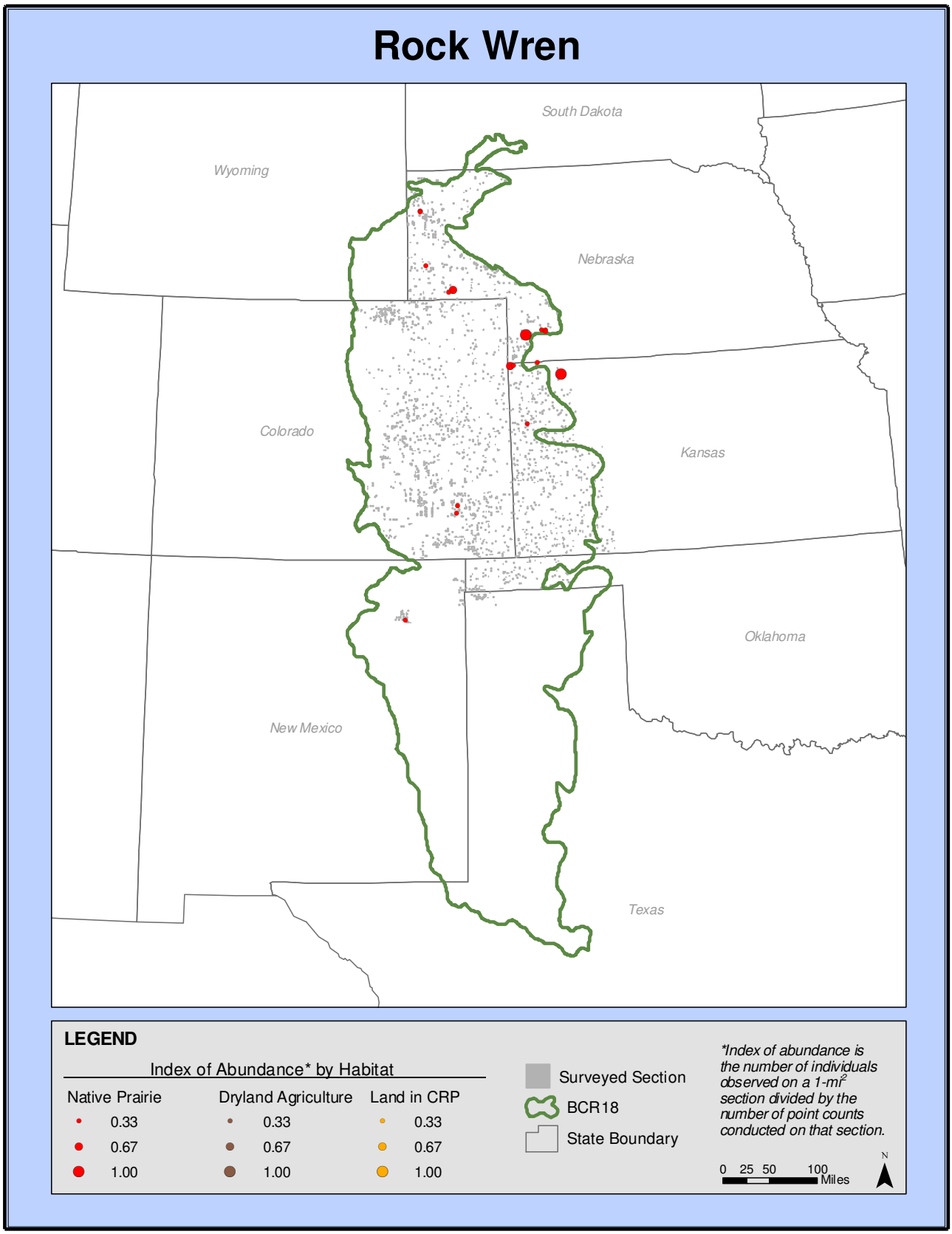


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Rock Wren
(Salinctes obsoletus)

In 2004, we detected 23 individuals on seventeen (.7%) of the sections surveyed. The Rock Wren occurred mainly in Nebraska and Kansas parts of the Shortgrass Prairie BCR.

Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

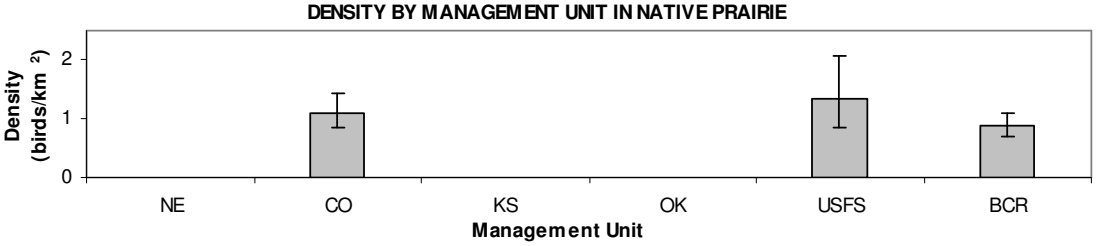


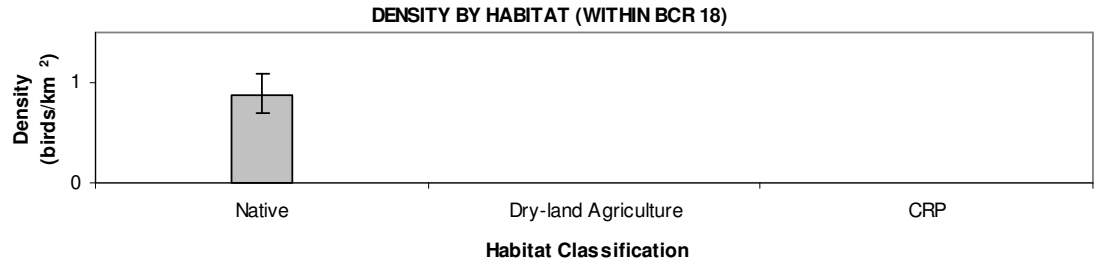
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

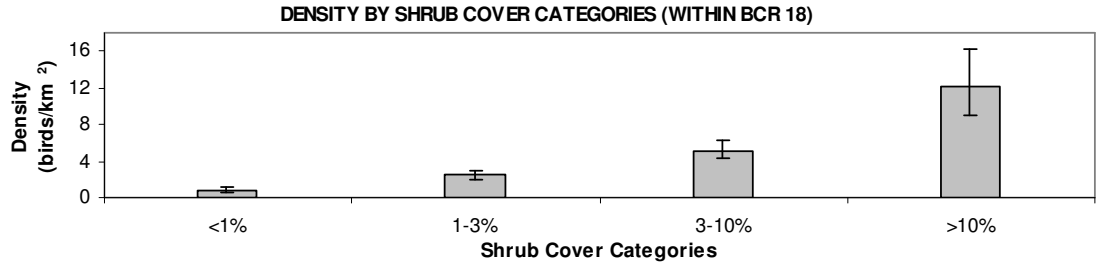
Northern Mockingbird

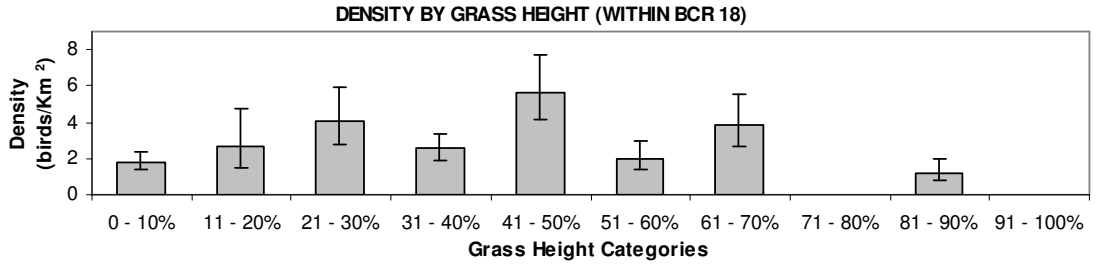
(Mimus polyglottos)

In 2004, we detected 251 individuals on 168 (7%) of the sections surveyed. The Northern Mockingbird was mainly distributed throughout the southern portion of Colorado. USFS land has the highest densities (D = 1.34 birds/km^2, CV = 23%, *n* = 40). This species prefers shrub cover >10% (D = 12.12 birds/km^2, CV = 15%, *n* = 241). Northern Mockingbird had highest densities in grass height 41-50% (D = 5.66 birds/km^2,CV = 16%, *n* = 92).

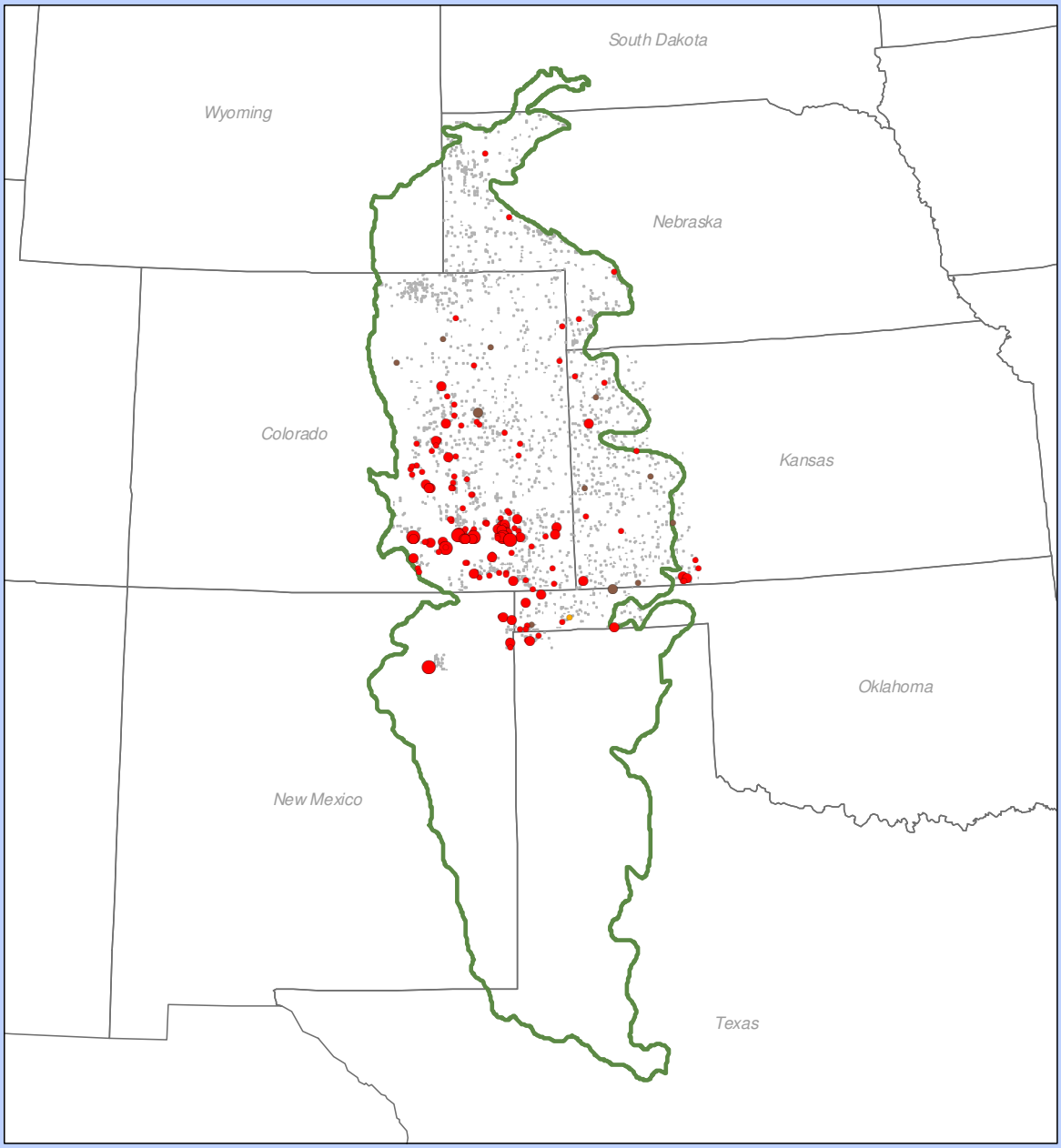








Northern Mockingbird



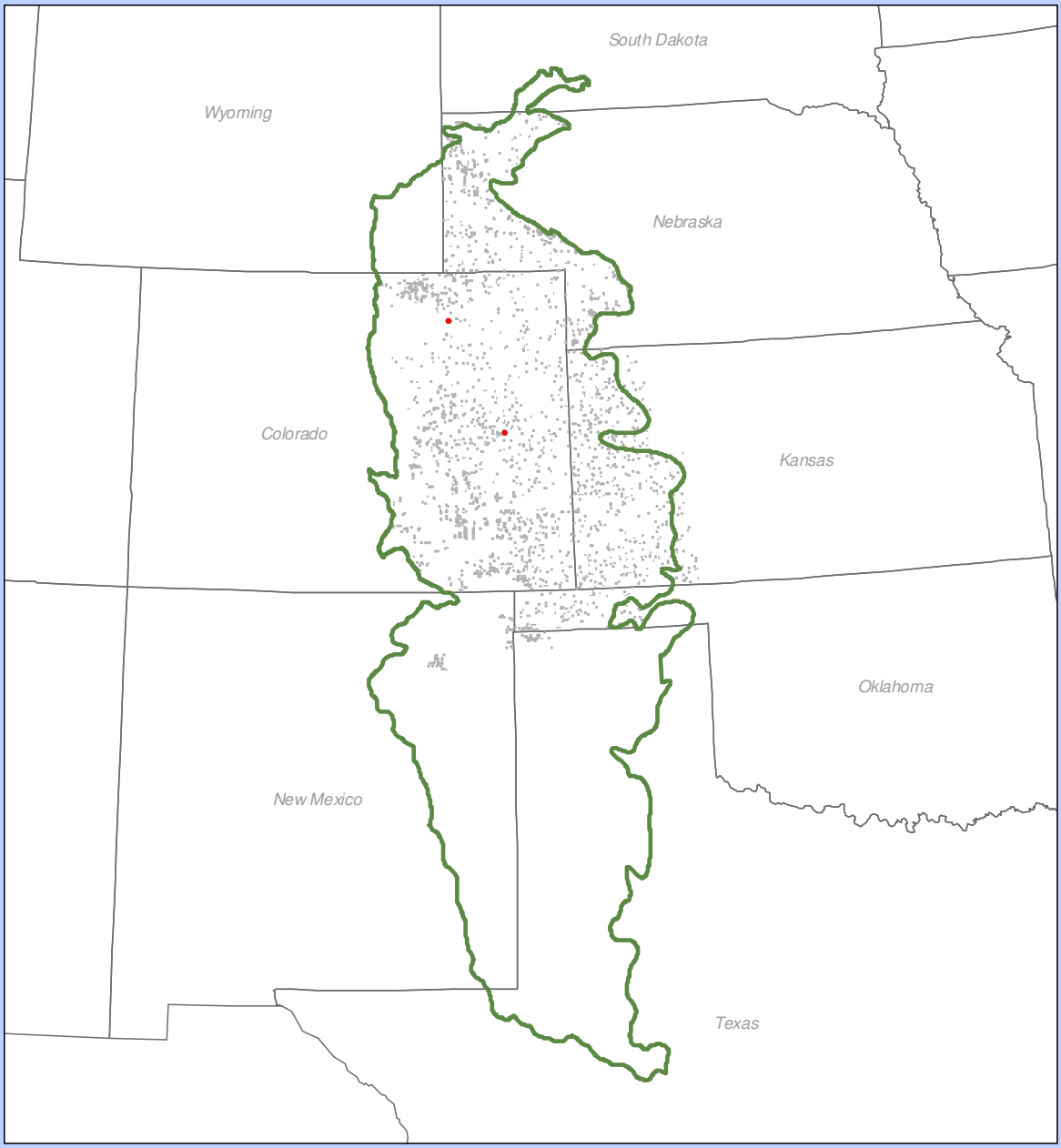
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Sage Thrasher

(Oreoscoptes montanus)

In 2004, we detected two individuals on two (.08%) of the sections surveyed. The Sage Thrasher occurred rarely in the Shortgrass Prairie BCR. The two detections were in Colorado.

Sage Thrasher

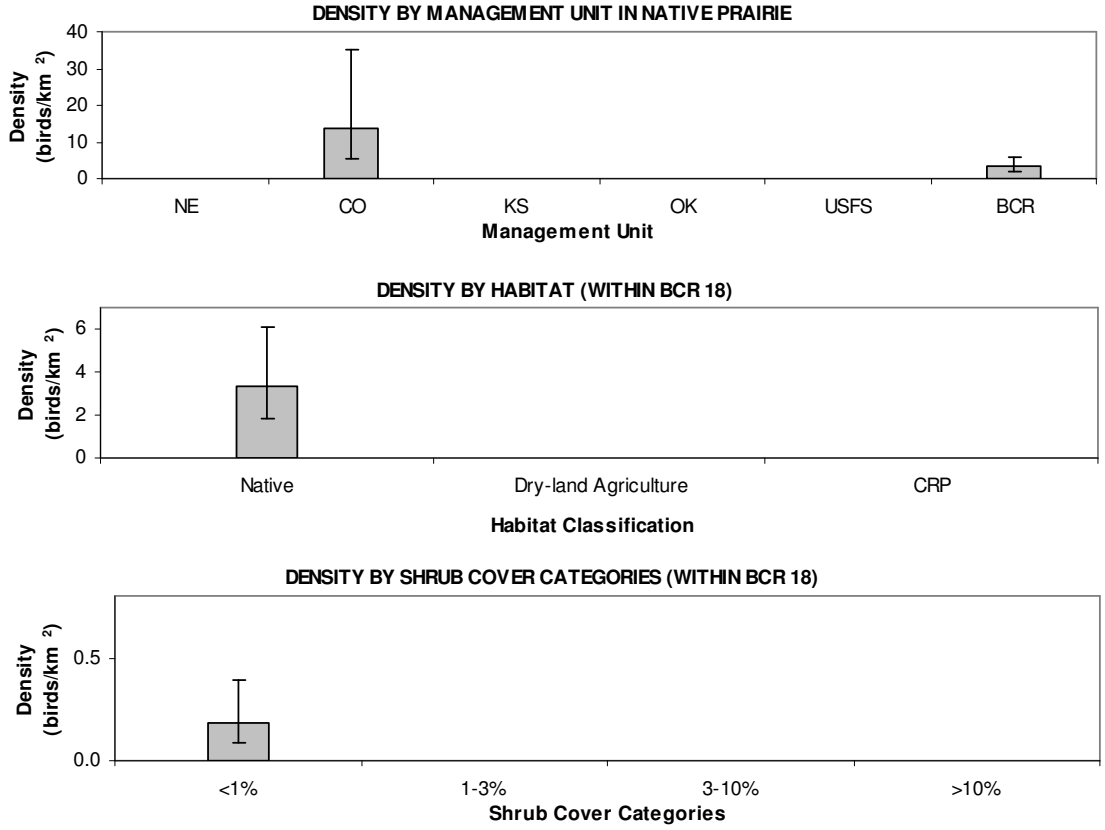


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

European Starling

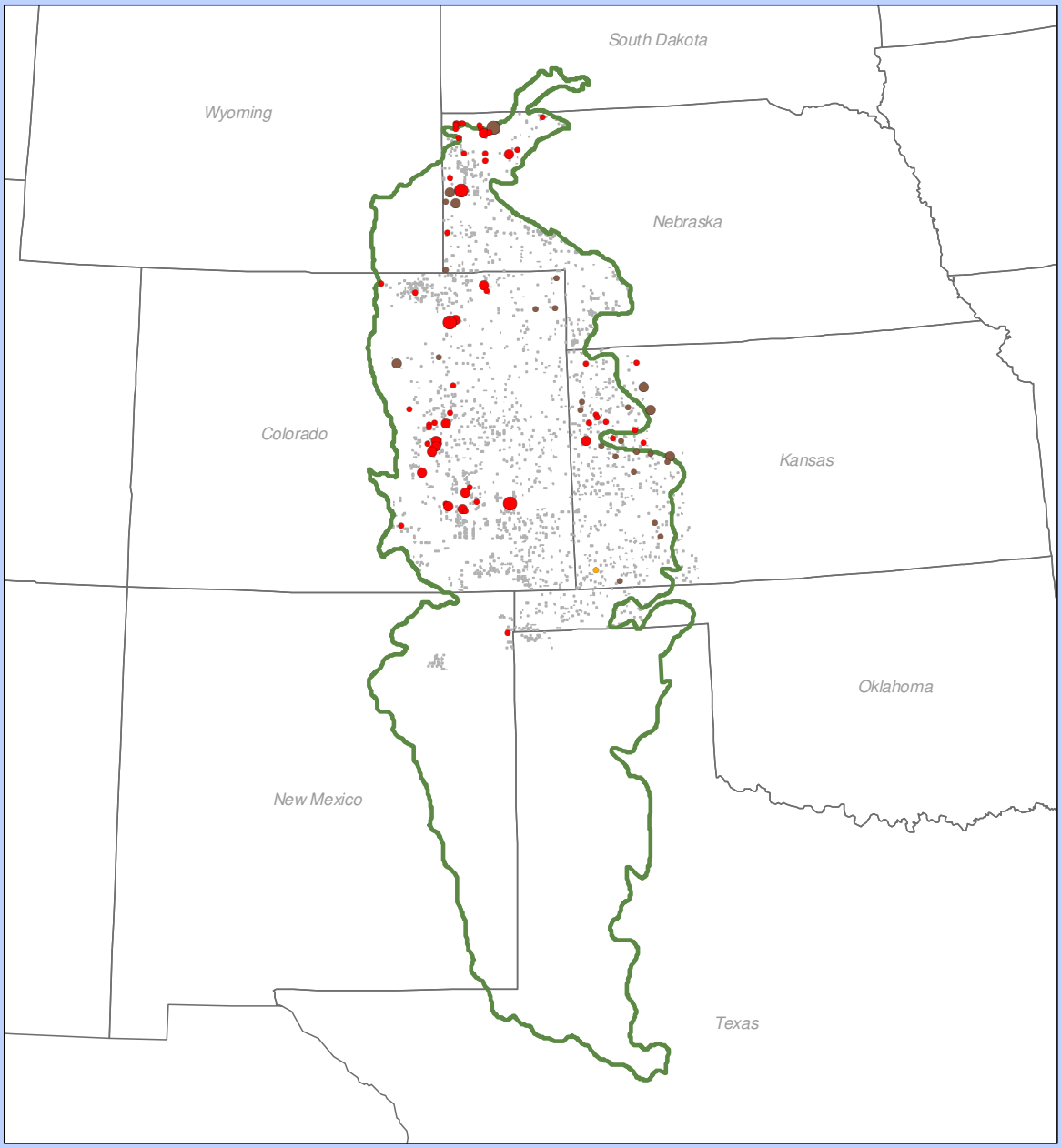
(Sturnus vulgaris)

In 2004, we detected 168 individuals on 89 (3.7%) of the sections surveyed. The European Starling was detected throughout the study area. Colorado had a density of 13.67 birds/km^2 (CV = 51%, *n* = 27). In <1% shrub cover, this species had a density of .19 birds/km^2 (CV = 39%, *n* = 33). Management for this invasive species should be to conserve and create un-fragmented grassland habitats, which this species tends to avoid.



Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

European Starling

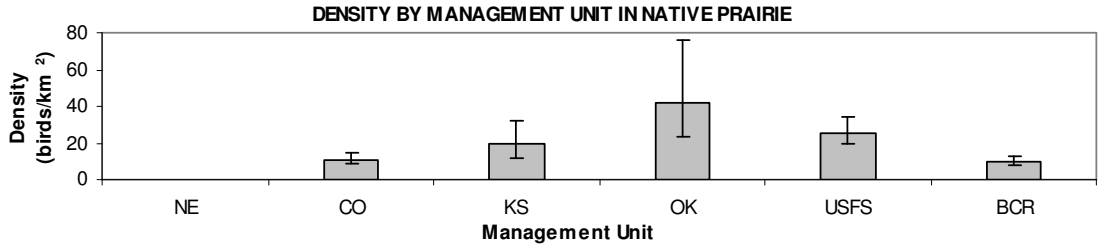


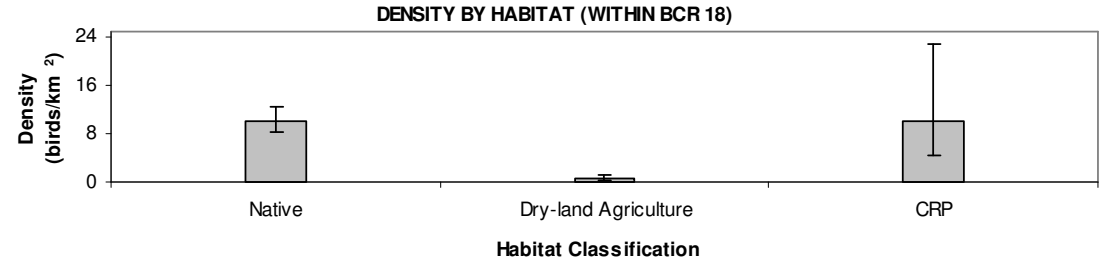
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

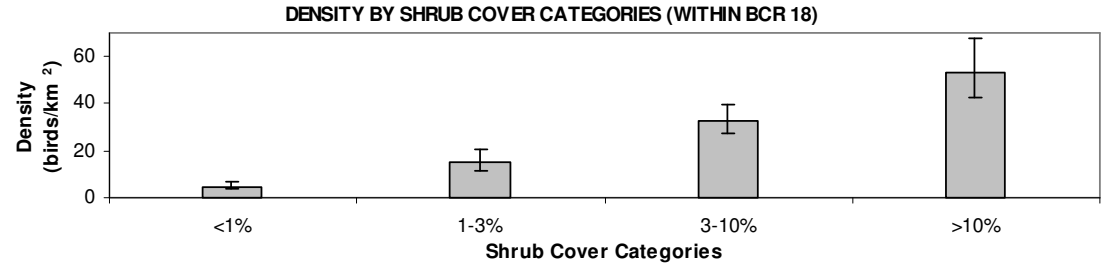
Cassin's Sparrow

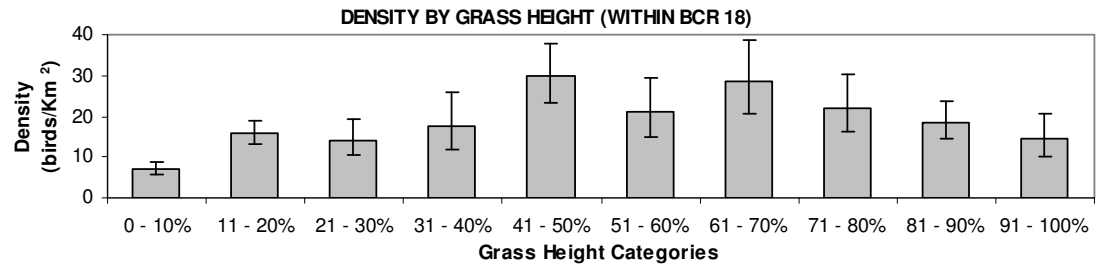
(Aimophila cassinii)

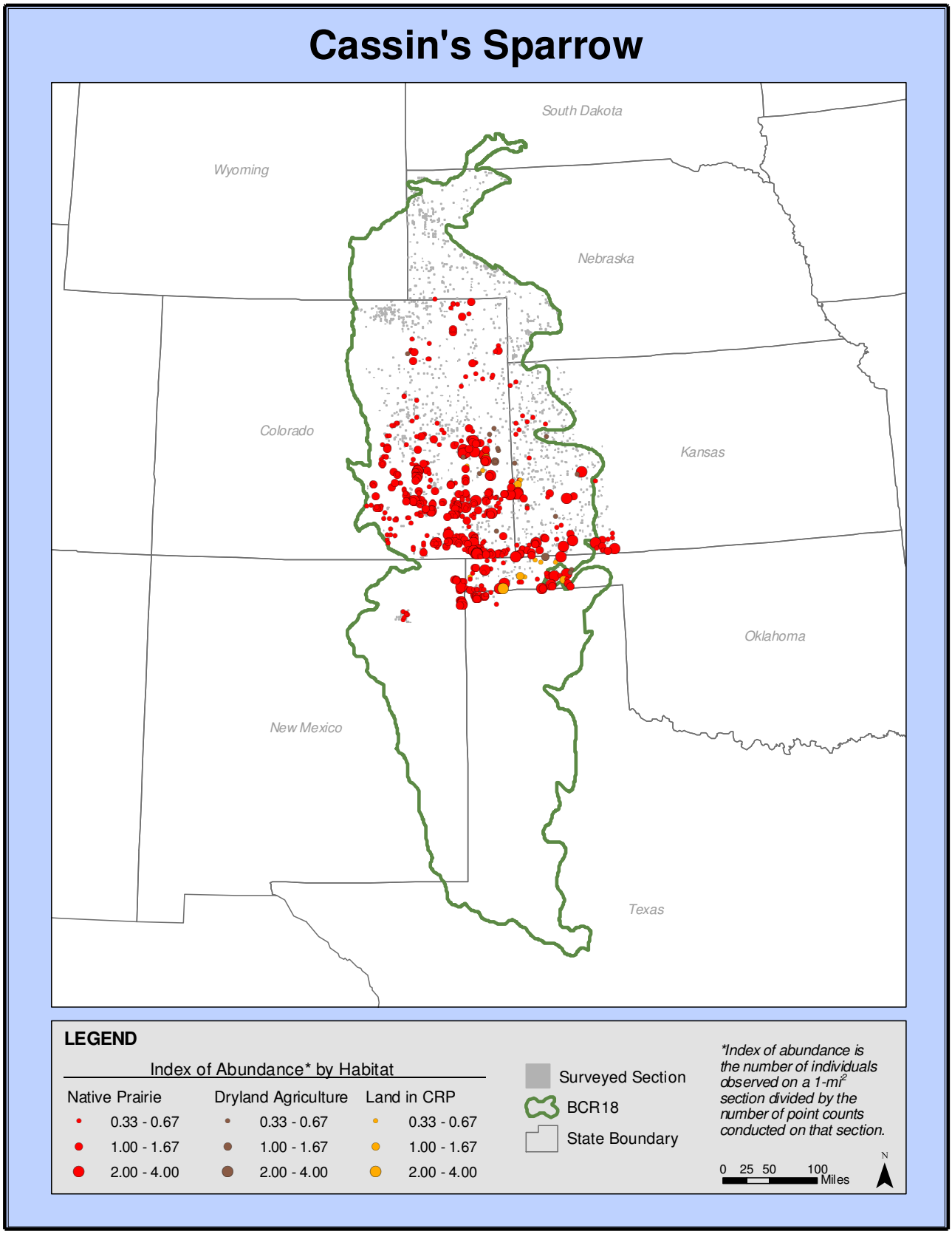
In 2004, we detected 1,452 Cassin's Sparrows on 563 (23.3%) of the surveyed sections. This species was the fifth most abundant bird detected. Cassin's Sparrows were widely distributed across the study area except for Nebraska where only a few individuals were detected. In the study area, density was the same in native prairie habitat (D = 10.16 birds/km^2, CV = 10%, *n* = 1055) and CRP (D = 10.16 birds/km^2, CV = 42%, *n* = 24). Highest densities in native prairie habitat occurred in Oklahoma (D = 41.91 birds/km^2, CV = 31%, *n* = 58) and in areas of >10% shrub cover (D = 53.59 birds/km^2, CV = 12%, *n* = 665). Cassin's Sparrow had highest densities in grass height 41-50% (D = 29.77 birds/km^2,CV = 12.3%, *n* = 228).
Cassin's Sparrow is a Partners In Flight Tier I (high overall priority) species.









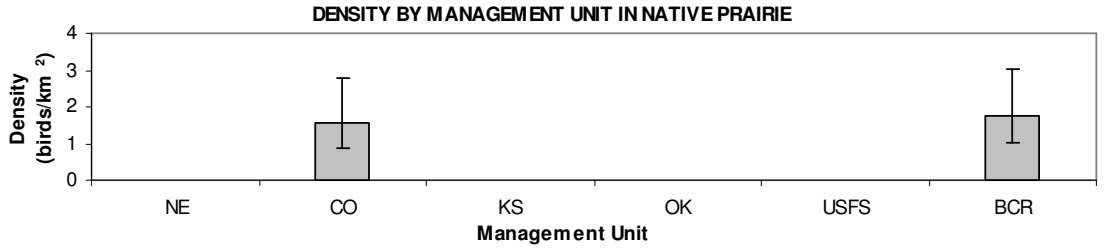


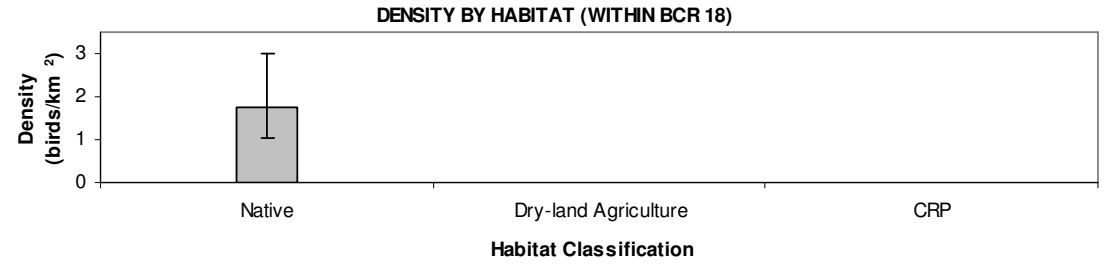
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

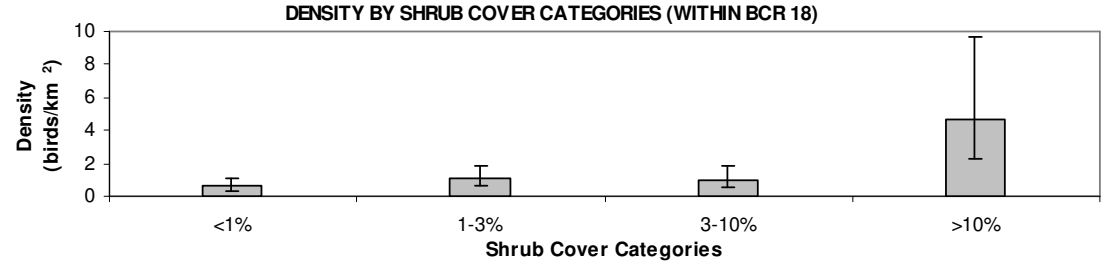
Brewer's Sparrow
(Spizella breweri)

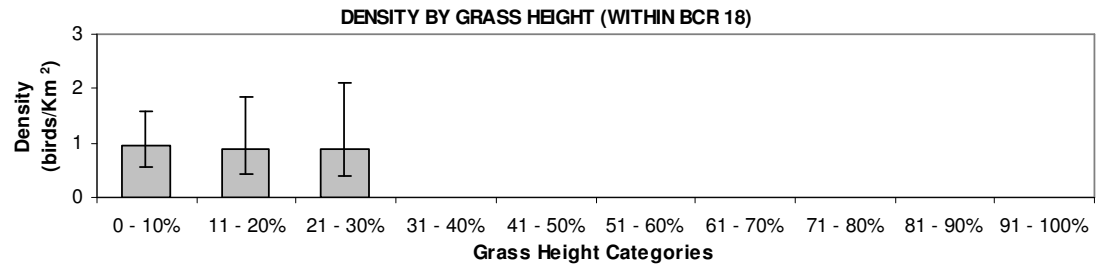
In 2004, we detected 54 Brewer's Sparrows on 34 (1.4%) of the surveyed sections. This species was distributed across eastern Colorado and the panhandle of Oklahoma. Density in native prairie habitat across the study area was 1.76 birds/km^2 (CV = 28%, n = 40). This species preferred areas of >10% shrub cover (D = 4.71 birds/km^2, CV = 38%, n = 30). Brewer's Sparrow had no density difference within 0-10% grass height (D = .95 birds/km^2, CV = 26%, n = 62), 11-20% grass height (D = .90 birds/km^2, CV = 37%, n = 29) and 21-30% grass height (D = .90 birds/km^2, CV = 44%, n = 20). Brewer's Sparrow is a species of concern as follows:

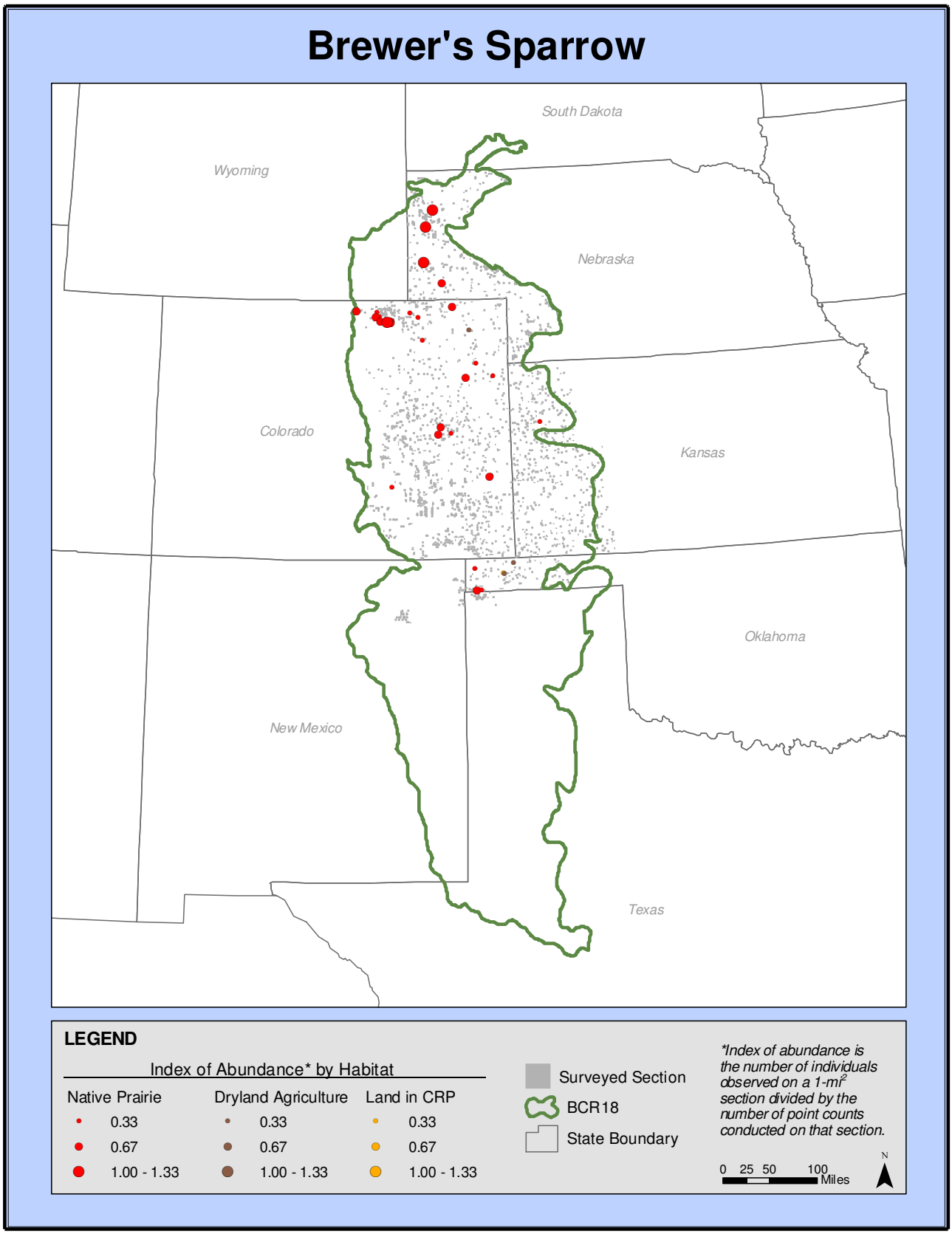
- Partners In Flight – Tier III (additional watch list species)
- Nebraska – species of concern
- USFS R2 – proposed sensitive species.









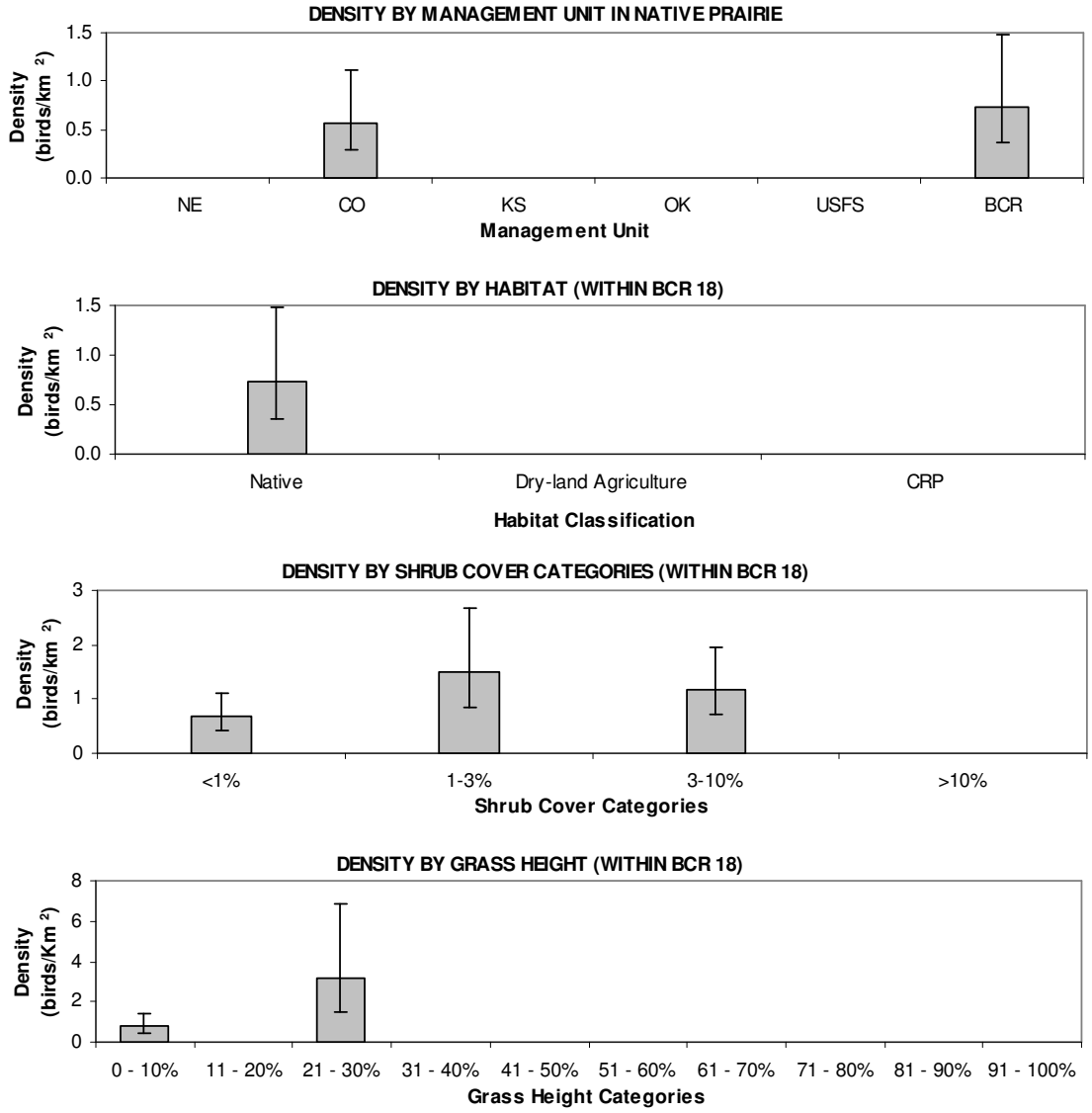


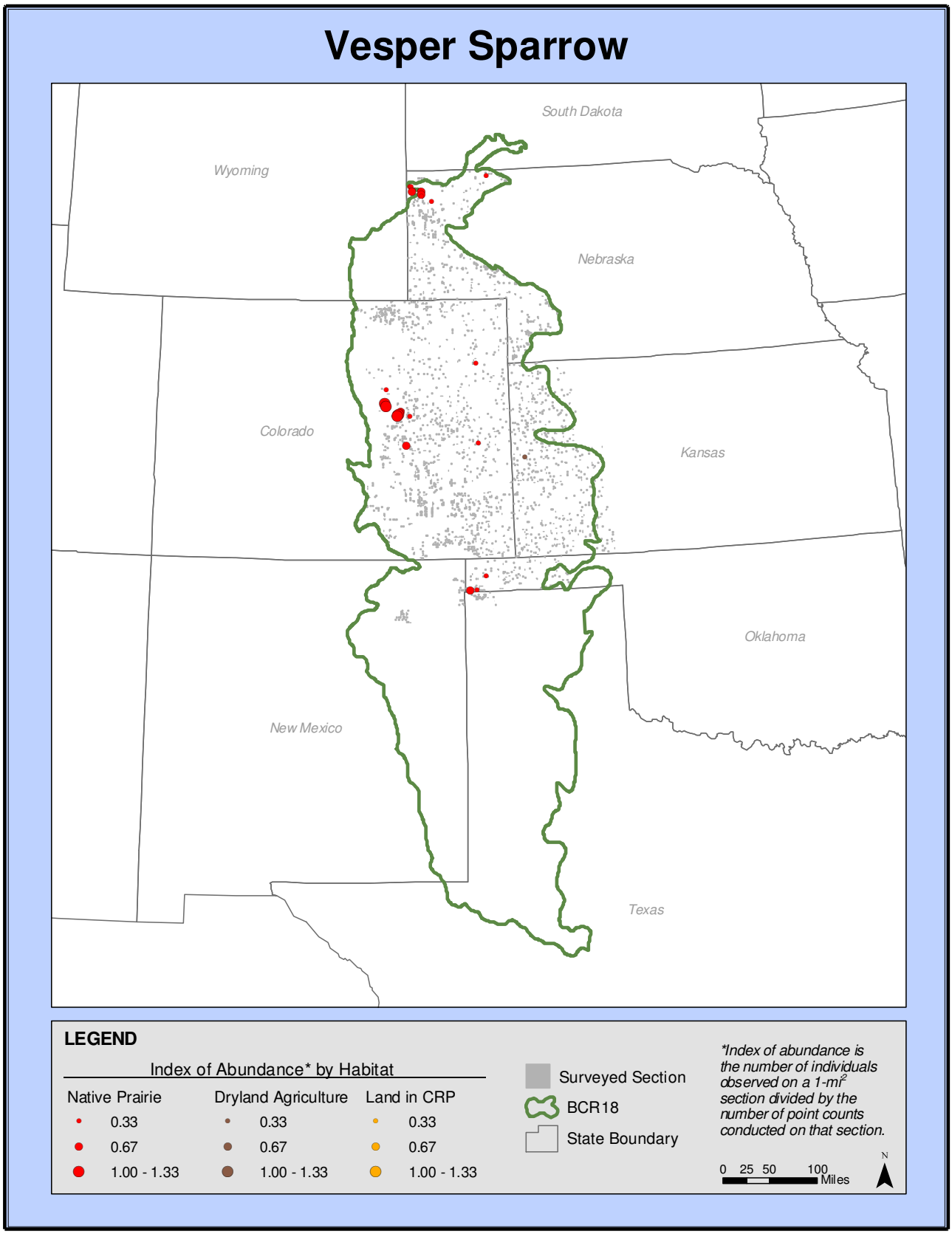
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Vepser Sparrow

(Pooecetes gramineus)

In 2004, we detected 46 Vesper Sparrows on 30 (1.2%) of the surveyed sections. This species was scattered throughout the study area. Density in native prairie habitat across the study area was 0.73 birds/km^2 (CV = 37%, *n* = 36). This species shows overlapping density confidence intervals in three shrub cover categories, <1%, 1-3% and 3-10% with higher density estimates in the 1-3% shrub cover category (D = 1.49 birds/km^2, CV = 30%, *n* = 46). In grass height 21-30% Vesper Sparrow had a density of 3.16 birds/km^2 (CV = 41%, *n* = 27).



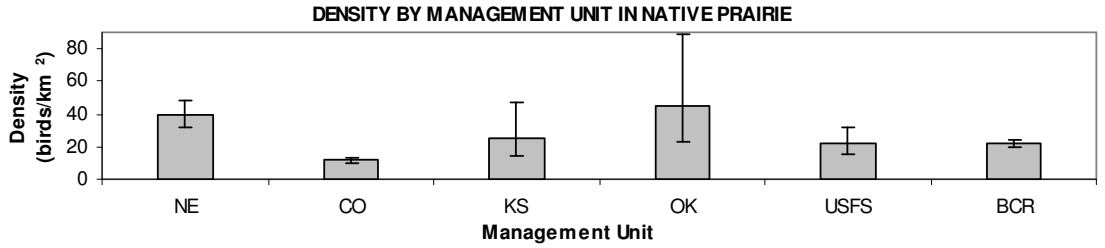


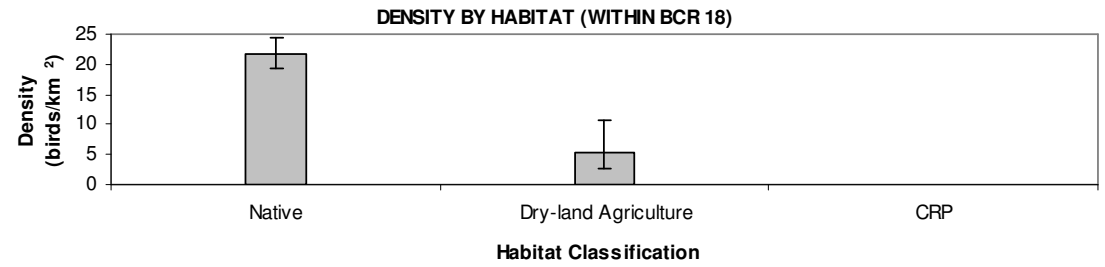
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

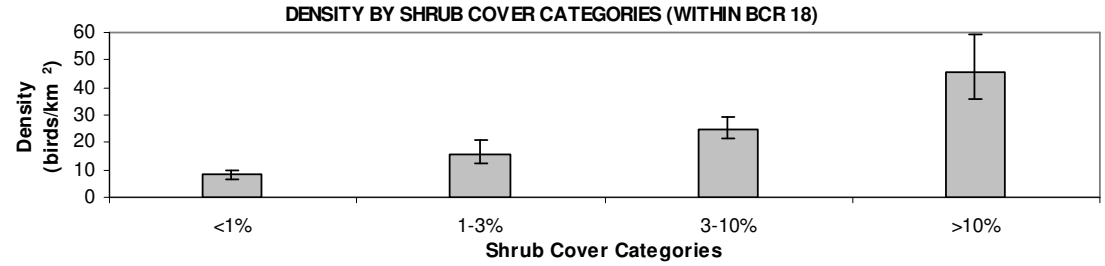
Lark Sparrow

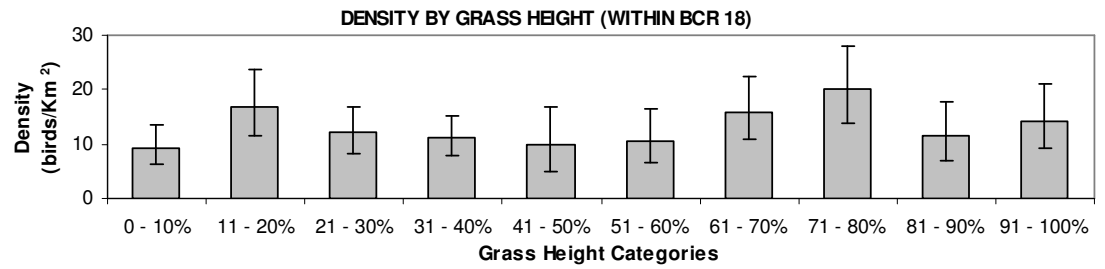
(Chondestes grammacus)

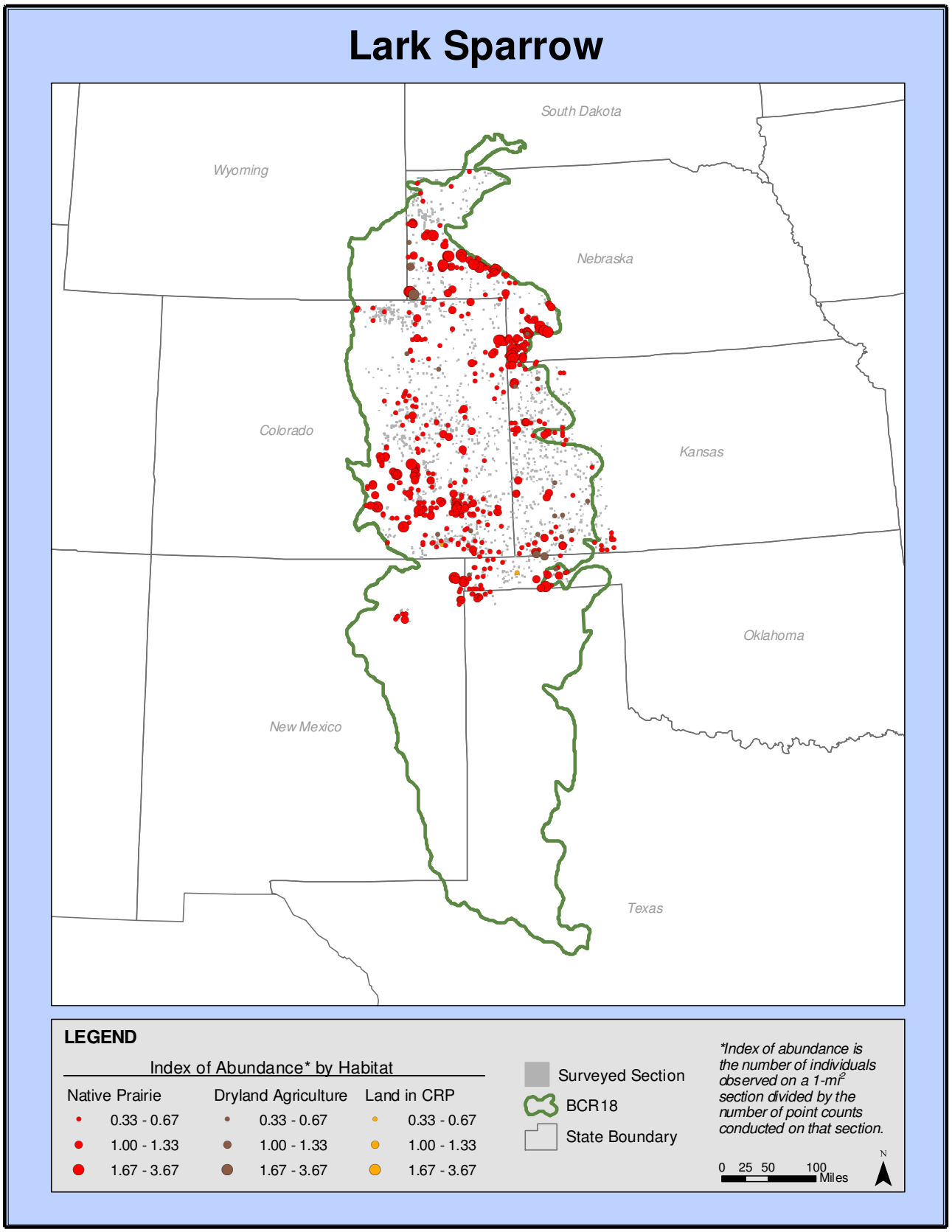
In 2004, we detected 1,155 Lark Sparrows on 567 (23.5%) of the surveyed sections. This species was widely distributed across the study area. Density was higher in native prairie habitat (D = 21.73 birds/km^2, CV = 6%, *n* = 905) than in dry-land agriculture (D = 5.46 birds/km^2, CV = 35%, *n* = 22) in the Shortgrass Prairie BCR. Highest densities in native prairie habitat occurred in Oklahoma (D = 45.36 birds/km^2, CV = 35%, *n* = 25) and in areas of >10% shrub cover (D = 45.88 birds/km^2, CV = 13%, *n* = 242). In grass height categories, Lark Sparrow has density estimates all ten categories with 71-80% being the highest (D = 26.25 birds/km^2, CV = 14%, *n* = 175). Lark Sparrow is a Partners In Flight Tier II (high regional priority) species and a species of moderate concern in Nebraska.







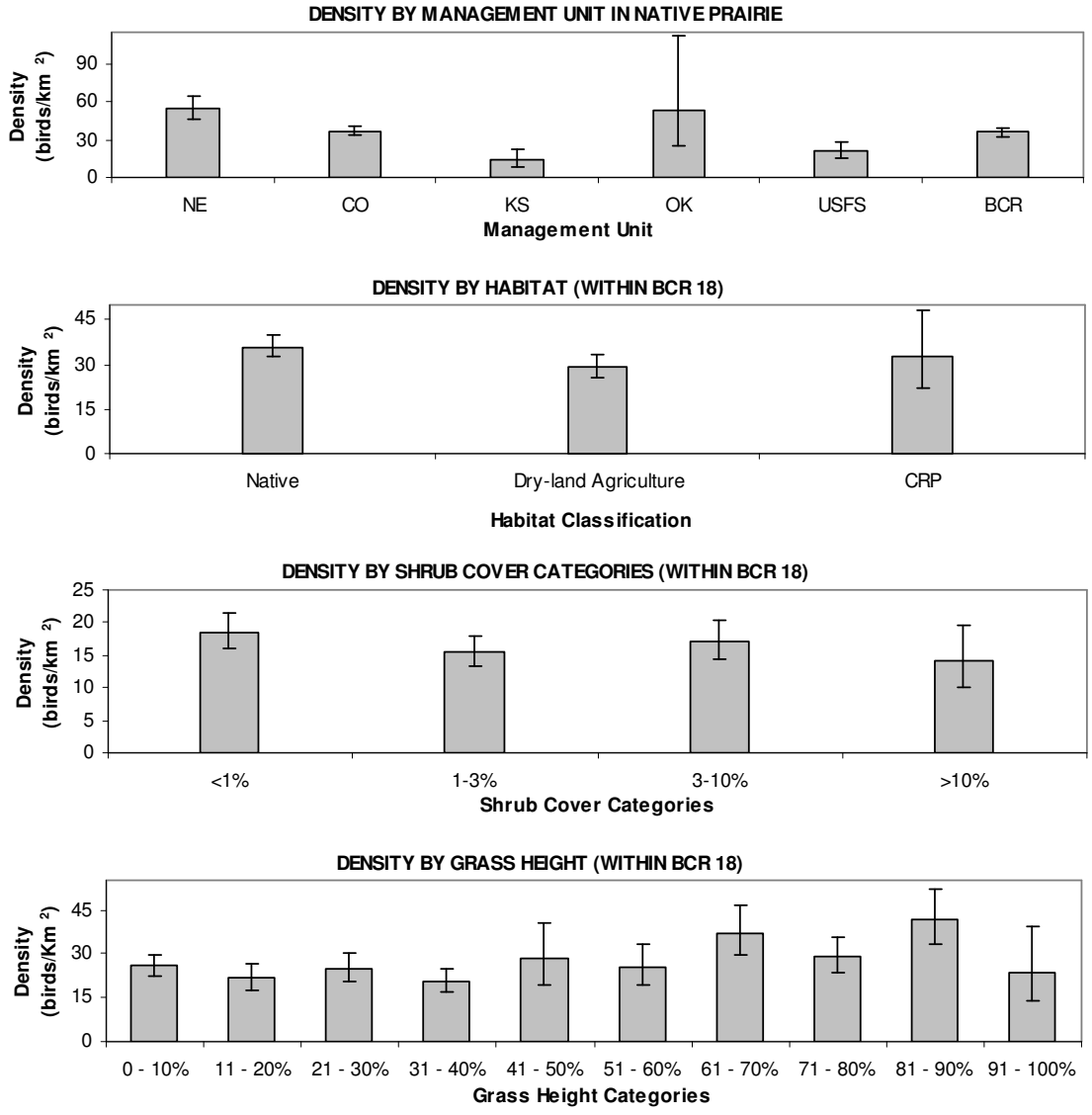




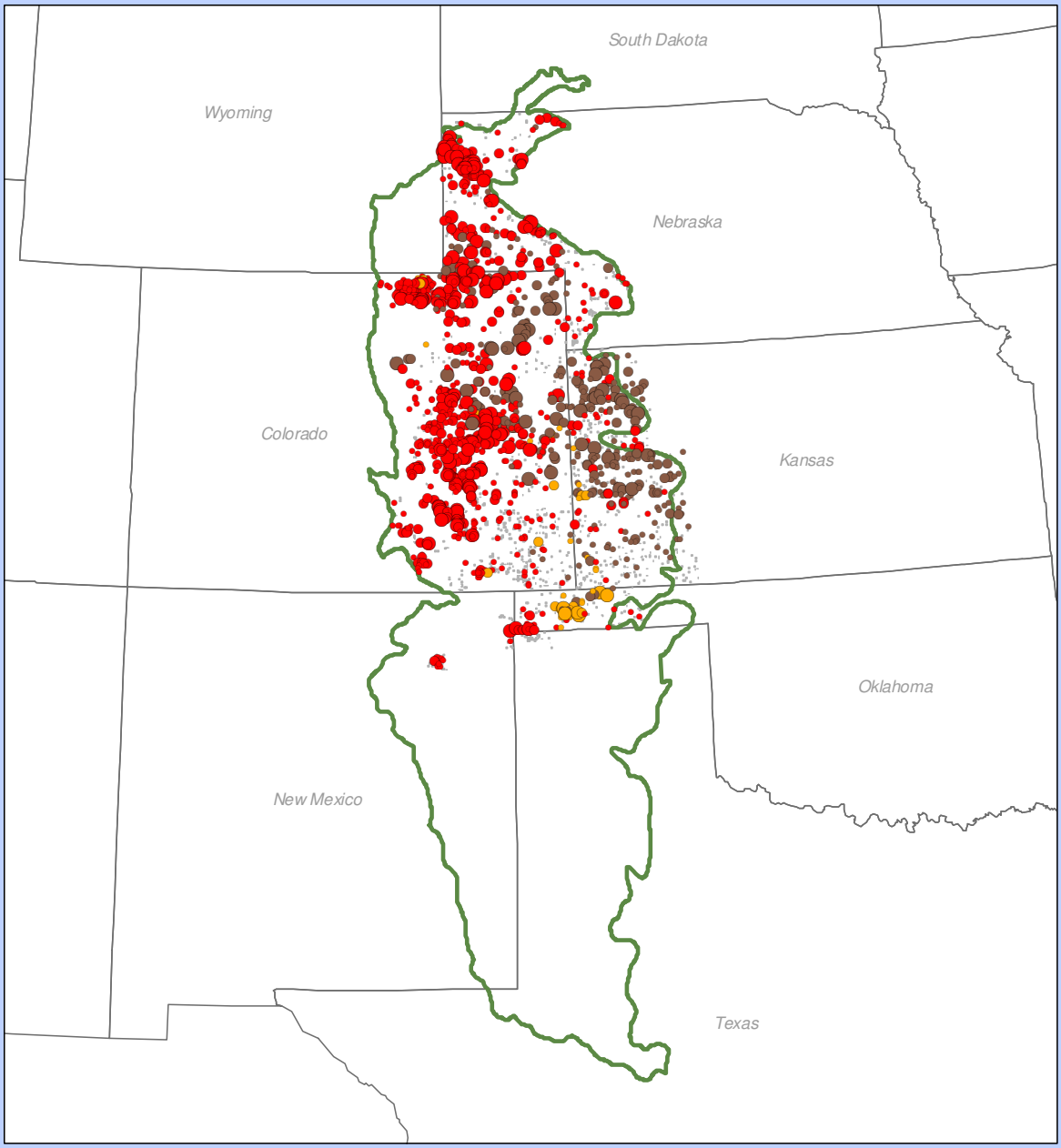
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

*L*ark Bunting
(Calamospiza melanocorys)

In 2004, we detected 6,472 Lark Buntings on 1,257 (52.1%) of the surveyed sections. This was the third most abundant species detected and it was widely distributed across the study area. Across the study area, density was similar for all three habitats, in native prairie habitat (D = 35.99 birds/km^2, CV = 5%, *n* = 3518), habitat in CRP (D = 32.88 birds/km^2, CV = 20%, *n* = 120) and in dry-land agriculture (D = 29.17 birds/km^2, CV = 7%, *n* = 997). Highest densities in native prairie occurred in Nebraska (D = 54.55 birds/km^2, CV = 8%, *n* = 890). In shrub cover categories, this species exhibited a generalist behavior. Lark Bunting had density estimates in all grass height categories with higher estimates in 81-90% (D = 41.55 birds/km^2, CV = 11%, *n* = 440). Lark Bunting is a Partners In Flight Tier I (high overall priority) species and a species of high concern in Nebraska.



Lark Bunting



Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Savannah Sparrow

(Passerculus sandwichensis)

In 2004, we detected 2 individuals on 1 (<1%) of the sections surveyed. The Savannah Sparrow occurs rarely in the Shortgrass Prairie BCR. In arid portions of their range, this species prefers irrigated areas or edges of free water bodies.

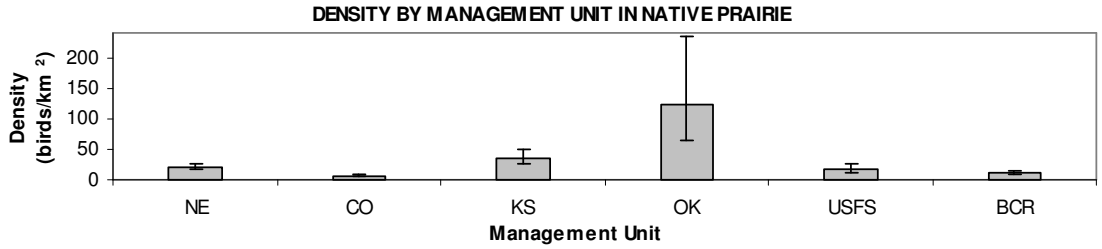
Savannah Sparrow

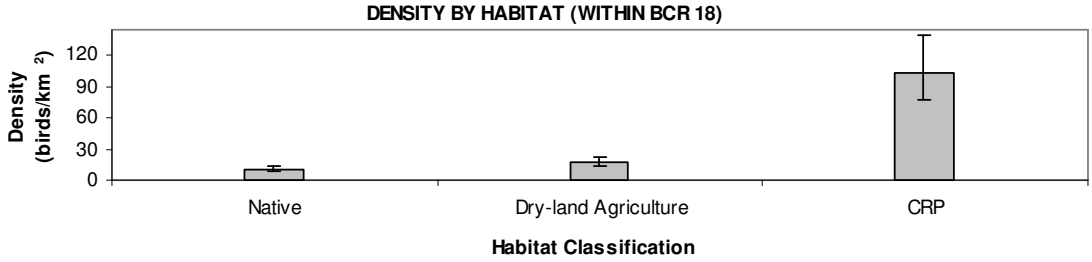
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

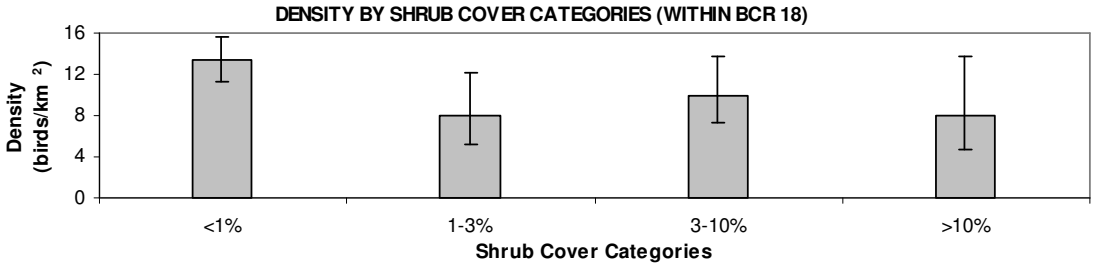
Grasshopper Sparrow

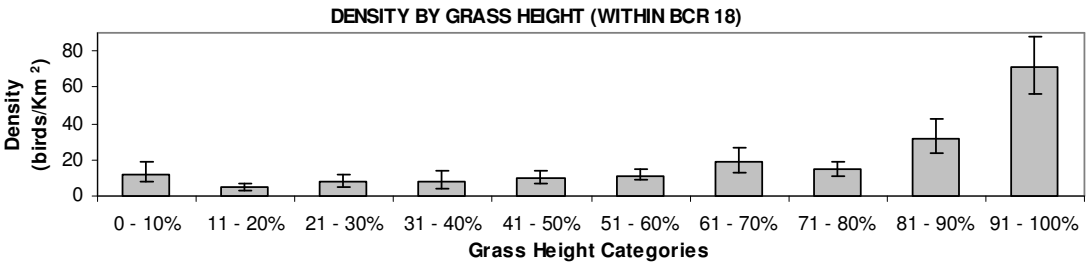
(Ammodramus savannarum)

In 2004, we detected 1381 individuals on 625 (25.9%) of the sections surveyed. The Grasshopper Sparrow was detected throughout the Shortgrass Prairie BCR. This species has higher densities in CRP habitat (D = 103.94 birds/km^2, CV = 15%, *n* = 202) than dry-land agriculture (D = 17.43 birds/km^2, CV = 12%, *n* = 192) and native prairie habitat (D = 10.50 birds/km^2, CV = 12%, *n* = 705). The Grasshopper Sparrow was more abundant in <1% shrub cover (D = 13.32 birds/km^2, CV = 8%, *n* = 602). In grass height, this species had higher densities in 91-100% category with 70.92 birds/km^2, CV = 11%, *n* = 298). Management for this species should consider the conservation and creation of native grassland habitats that contain <1% shrub cover with adequate vegetation structure. Grasshopper Sparrow is a Partners In Flight Tier II (high regional priority species, a species of moderate concern in Nebraska, and a proposed sensitive species in USFS Region 2.

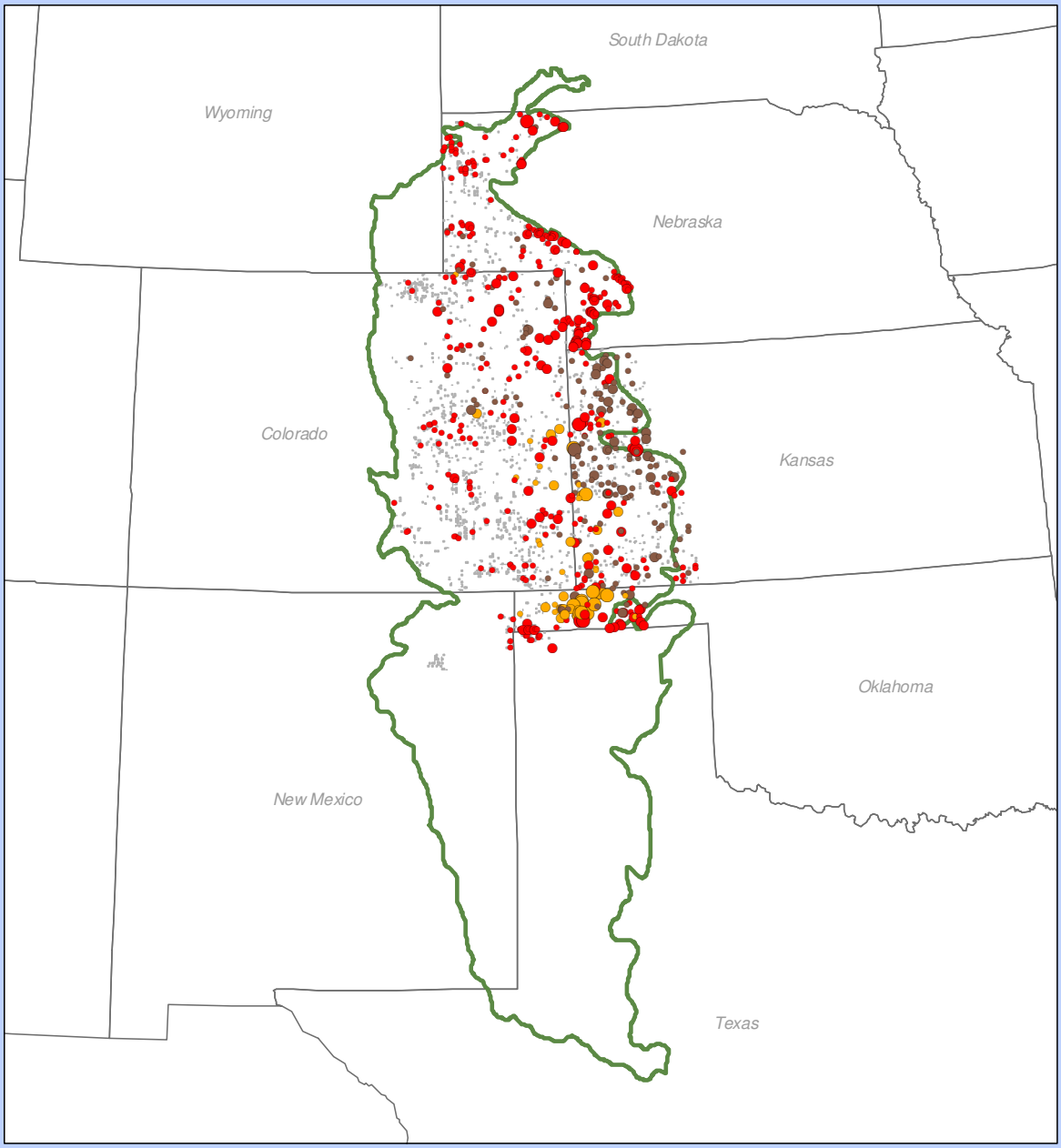








Grasshopper Sparrow



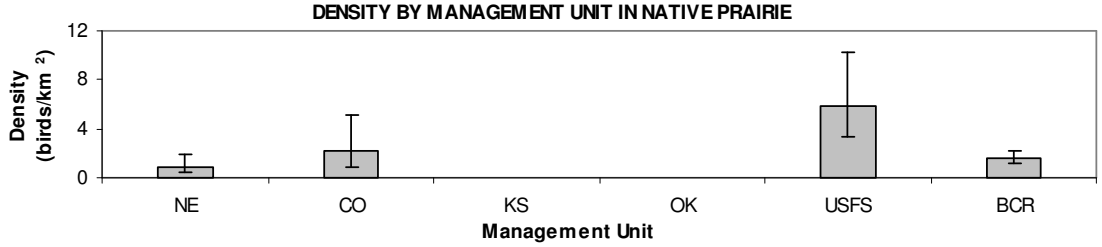
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

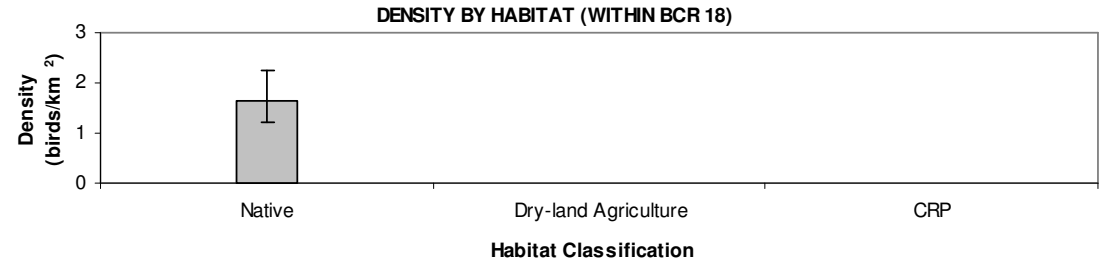
McCown's Longspur

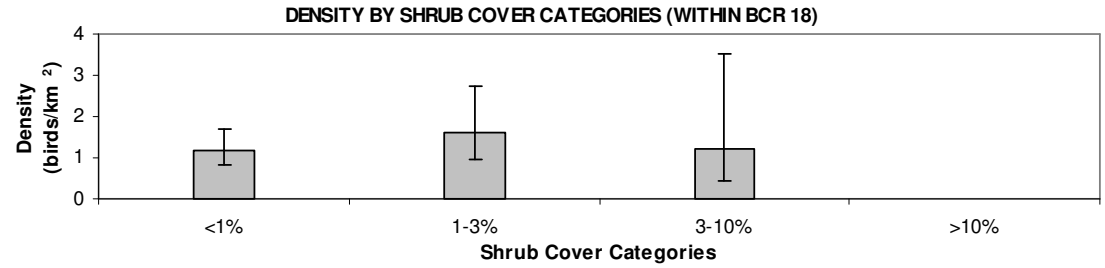
(Calcarius mccownii)

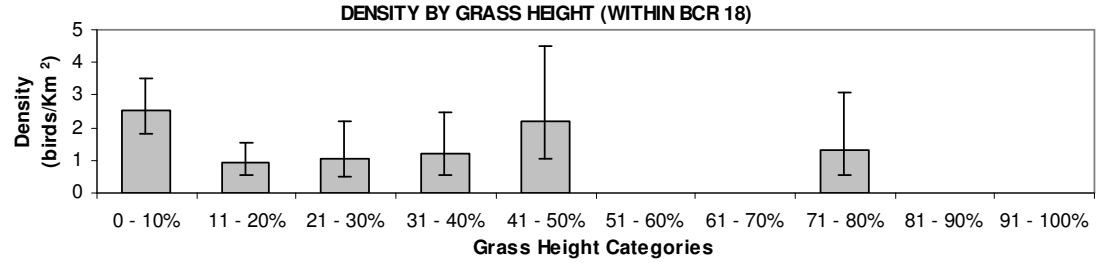
In 2004, we detected 221 individuals on 76 (3.2%) of the sections surveyed. The McCown's Longspur was strictly distributed in the northern portion of the Shortgrass Prairie BCR. This species occurred in largest densities on Pawnee National Grassland (D = 5.86 birds/km^2, CV = 29%, *n* = 52). In areas that were categorized as less than 1% (D = 1.18 birds/km^2, CV = 18%, *n* = 97), 1-3% (D = 1.63 birds/km^2, CV = 27%, *n* = 65) and 3-10% (D = 1.24 birds/km^2, CV = 18%, *n* = 97) shrub cover this species had overlapping confidence intervals. In grass height categories higher density estimates were in 0-10% (D = 2.53 birds/km^2, CV = 17%, *n* = 138) but with an irregular density pattern in the other grass height categories. Management for this species should focus on conserving and creating native prairie with less than 1% shrub cover. McCown's Longspur is a species of concern as follows:

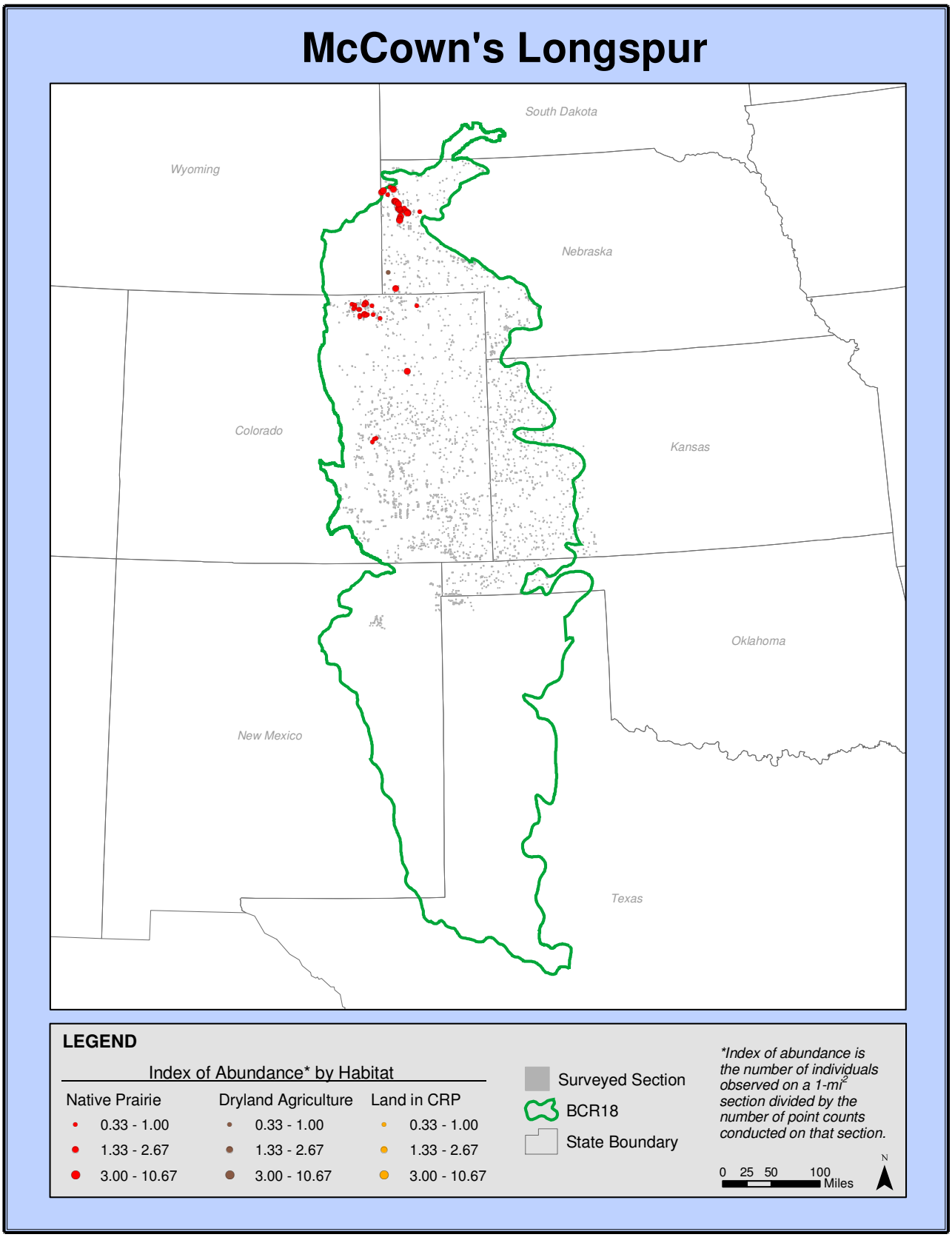
- Partners In Flight – Tier I (high overall priority)
- Nebraska – species of high concern
- USFS R2 – proposed sensitive species.











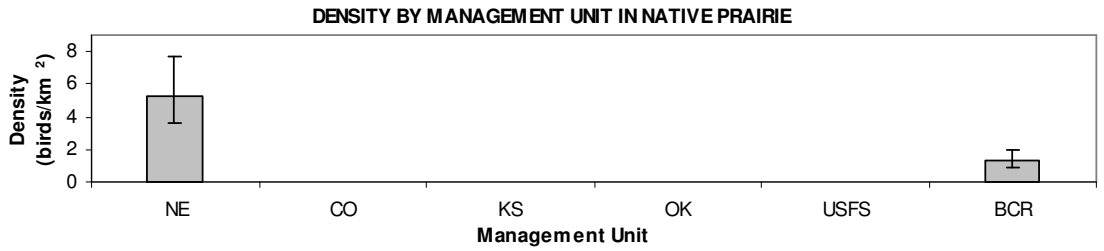
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

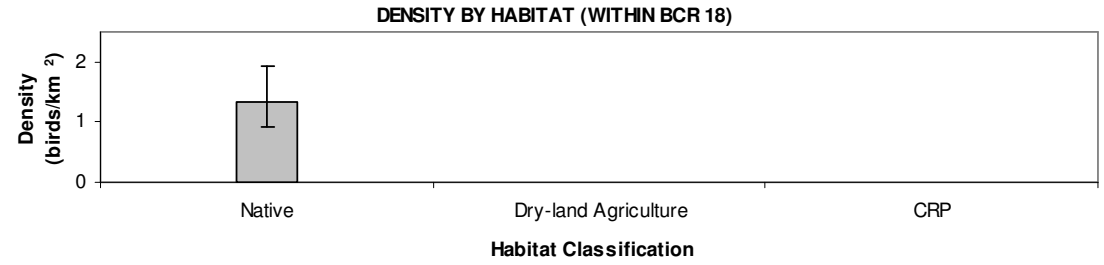
Chestnut-collared Longspur

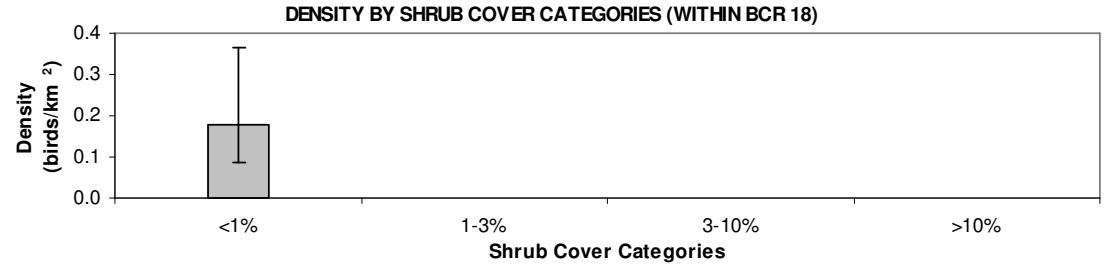
(Calcarius ornatus)

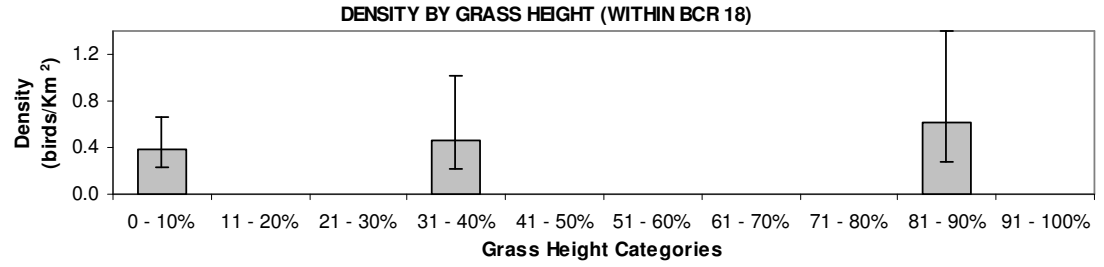
In 2004, we detected 178 individuals on 50 (2.1%) of the sections surveyed. The Chestnut-collared Longspur was strictly distributed in the northern portion of the Shortgrass Prairie BCR with a higher concentration in Nebraska. Density of Chestnut-collared Longspurs in native prairie habitat was 1.33 birds/km^2 (CV = 19%, n = 151). Higher densities in native habitat were observed in Nebraska (D = 5.28 birds/km^2, CV = 20%, n = 146). This species had higher densities in less than 1% shrub cover (D = 0.18 birds/km^2, CV = 38%, n = 20). In areas of grass height density estimates were obtained for three categories, 0-10% (D = 0.39 birds/km^2, CV = 27%, n = 48), 31-40% (D = 0.46 birds/km^2, CV = 42%, n = 21) and 81-90% (D = 0.62 birds/km^2, CV = 44%, n = 24). Chestnut-collared Longspur is a species of concern as follows:

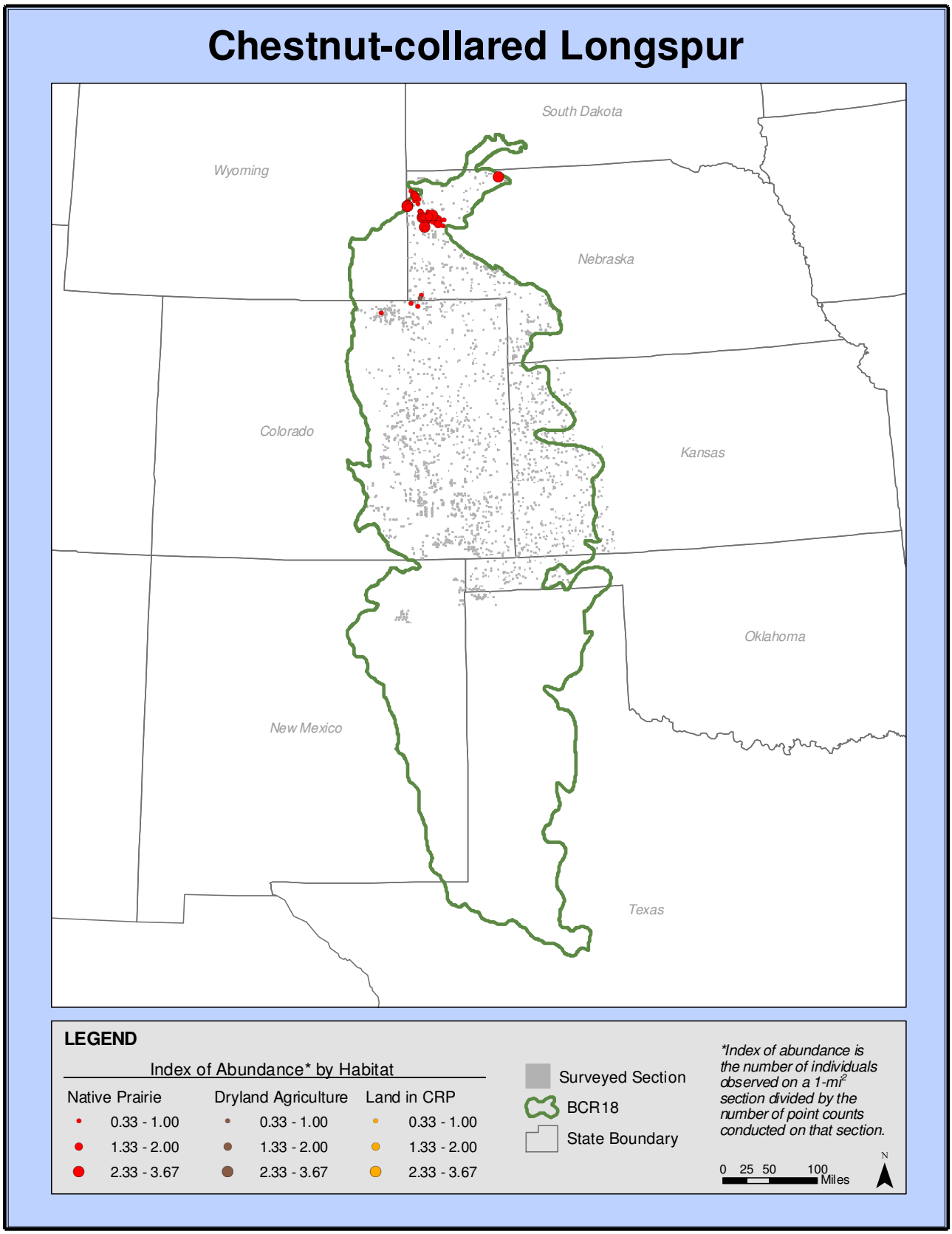
- Partners In Flight – Tier I (high overall priority)
- Nebraska – species of high concern
- USFS R2 – proposed sensitive species.









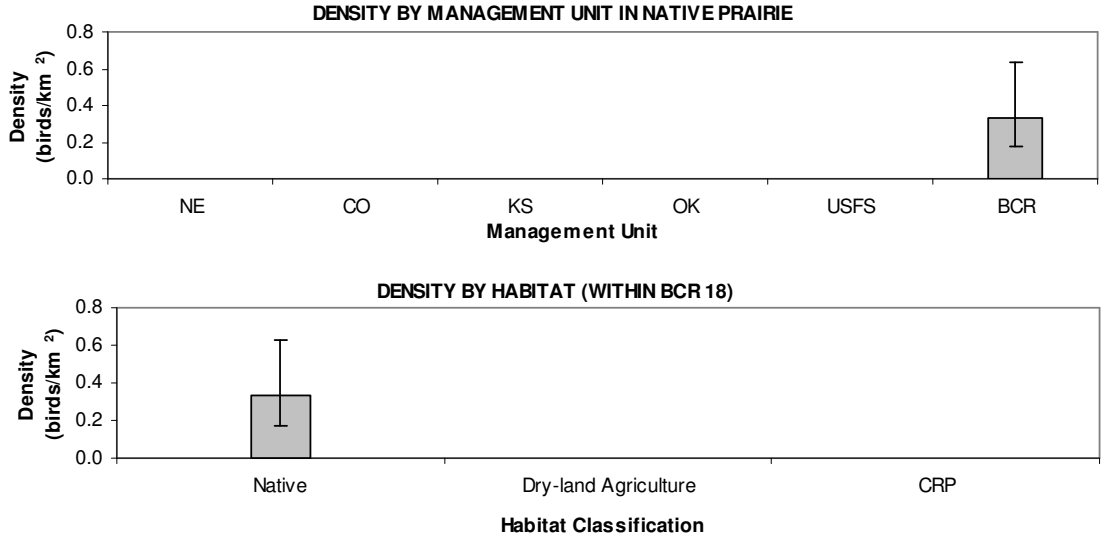


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

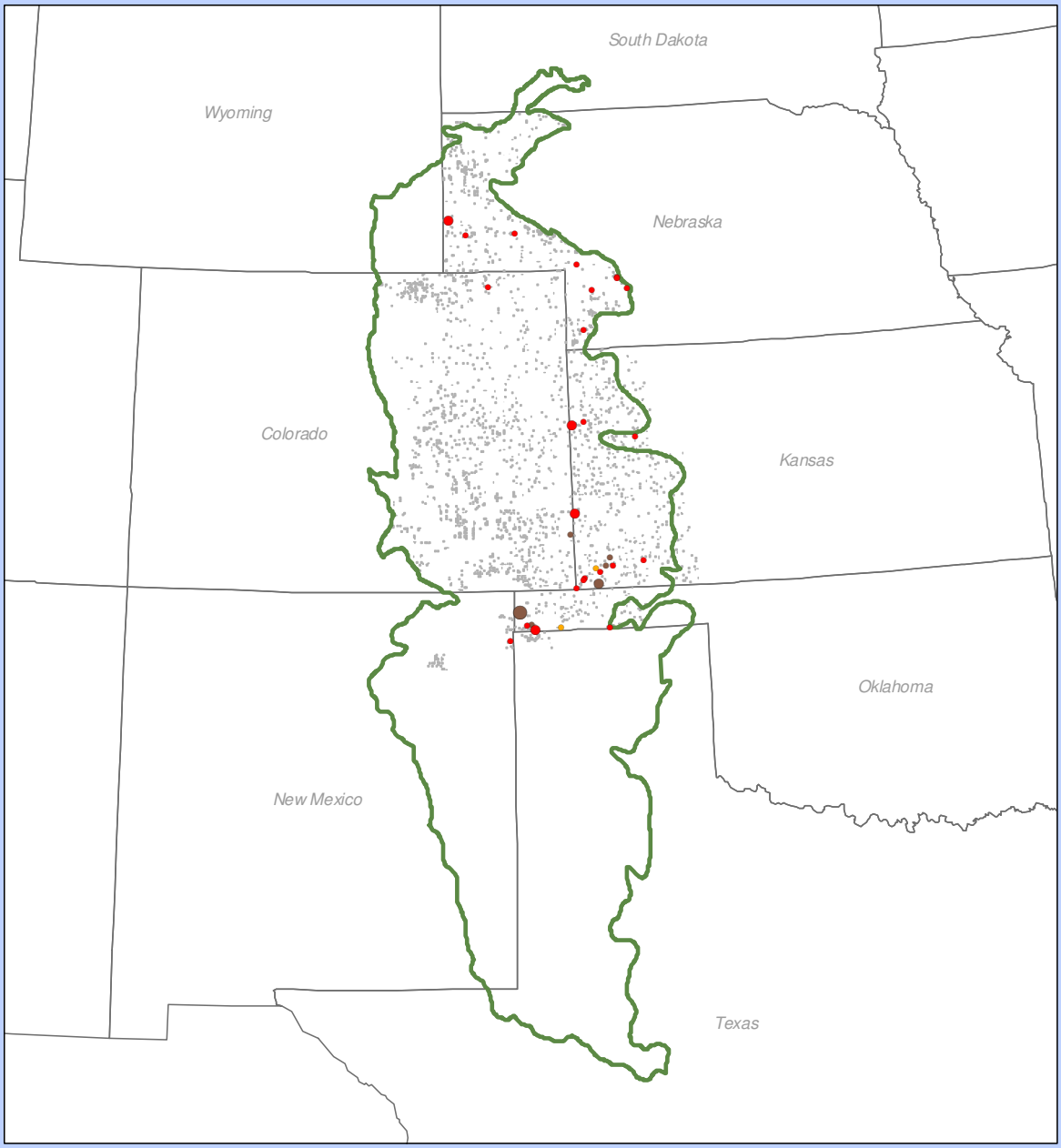
Blue Grosbeak

(Passerina caerulea)

In 2004, we detected 40 individuals on 32 (1.3%) of the sections surveyed. The Blue Grosbeak was sparsely distributed throughout grassland habitats in the Shortgrass Prairie BCR. The largest density of this species occurs in native habitats (D = .33 birds/km^2, CV = 33%, *n* = 23).



Blue Grosbeak

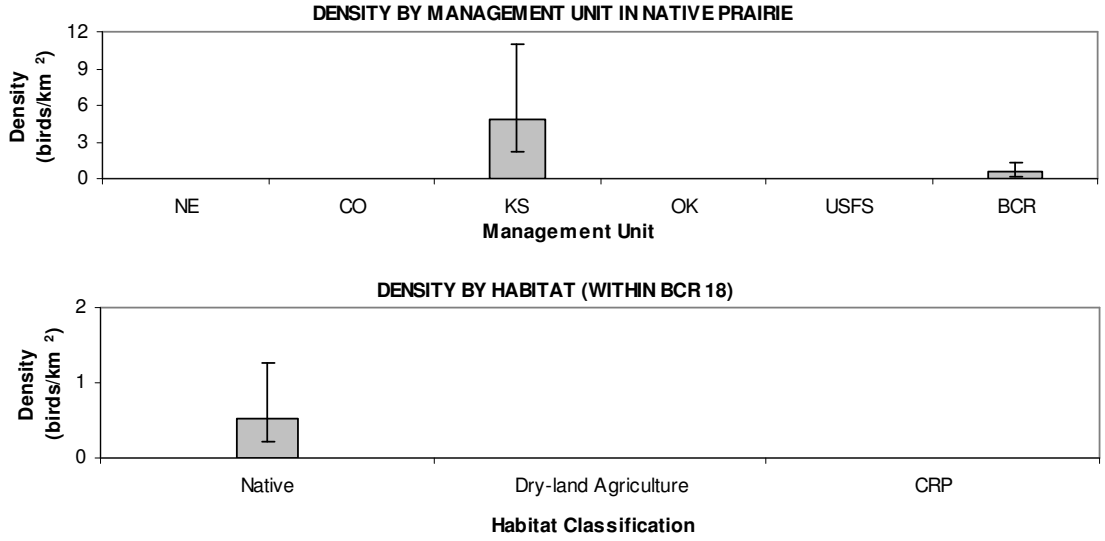


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

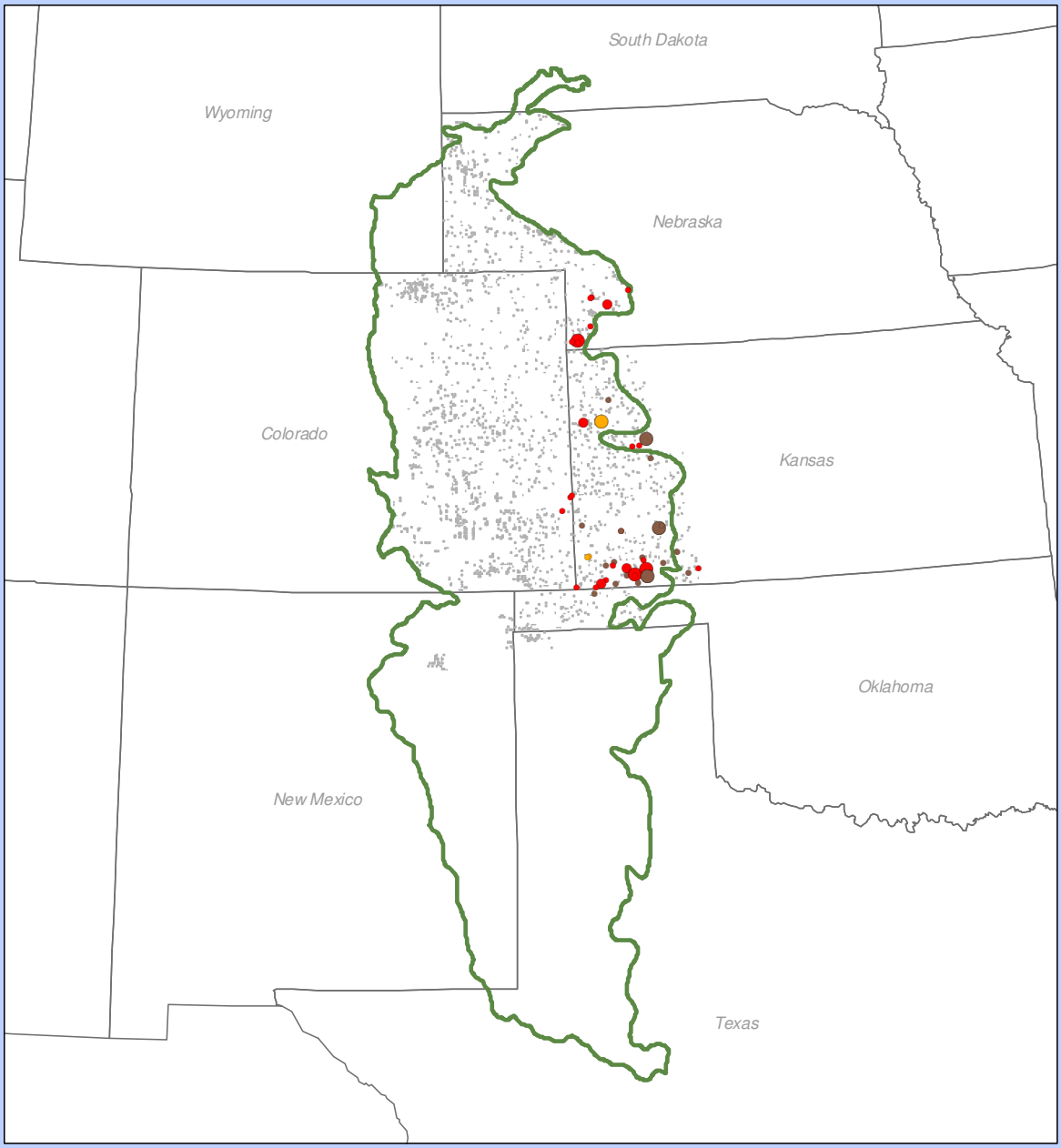
Dickcissel

(Spiza americana)

In 2004, we detected 90 individuals on 49 (2%) of the sections surveyed. The Dickcissel was distributed across the eastern portion of the Shortgrass Prairie BCR, mostly in southern Kansas. The largest densities of this species within the BCR occurred in Kansas (D = 4.87 birds/km^2, CV =43%, n = 26). Dickcissel is a Partners In Flight Tier II (high regional priority) species and a species of high concern in Nebraska.



Dickcissel

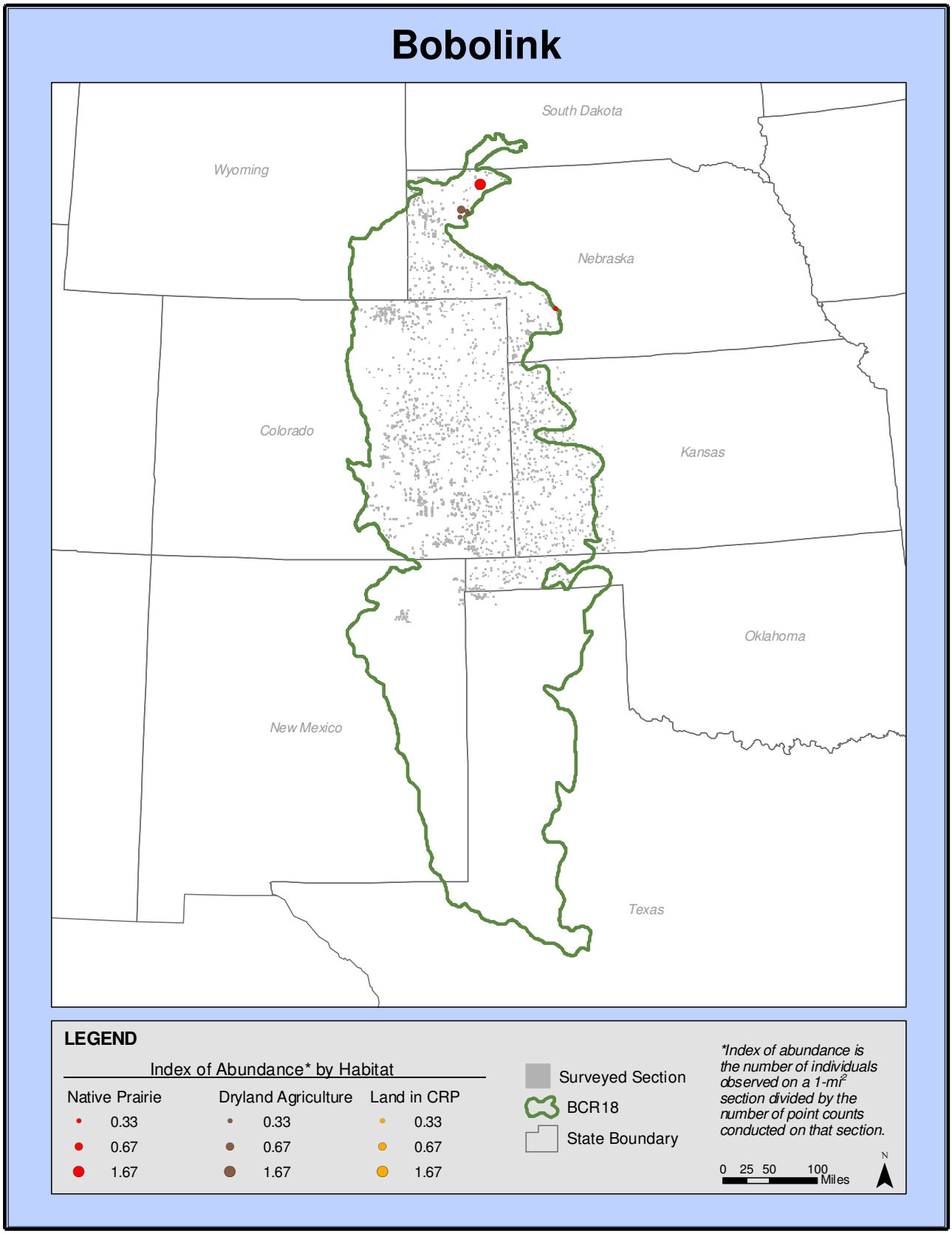


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Bobolink

(Dolichonyx oryzivorus)

The Bobolink rarely occurs within the Shortgrass Prairie BCR. During the 2004 field season, all eleven individuals detected occurred in Nebraska. Five individuals were observed in dry-land agriculture and six were observed in native prairie habitat. The range of this species is expected to include the northern most region of Short Grass prairie BCR. Bobolink is a species of high concern in Nebraska and a species in need of conservation (SINC) in Kansas.

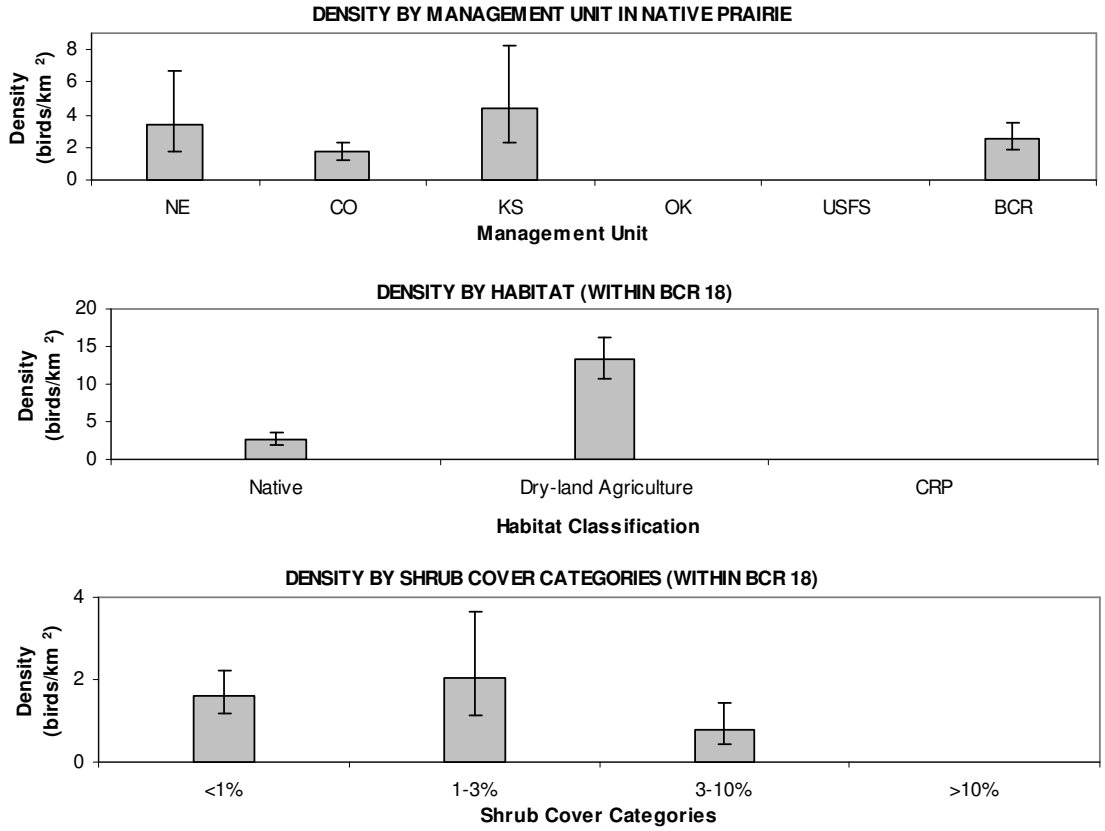


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

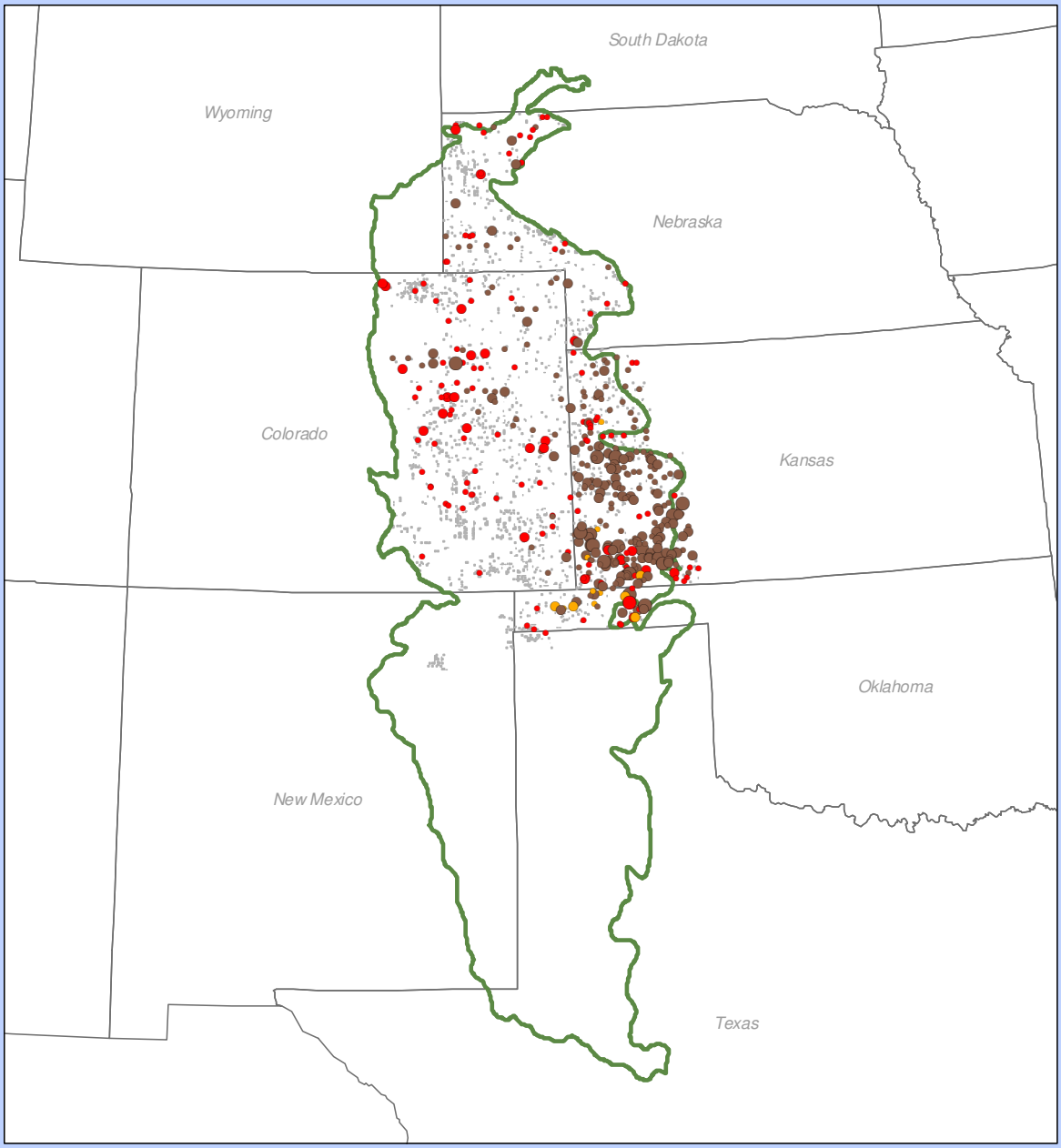
Red-winged Blackbird

(Agelaius phoeniceus)

In 2004, we detected 1,369 individuals on 420 (17.4%) of the sections surveyed. The Red-winged Blackbird was distributed mainly in anthropogenic habitat types throughout the Shortgrass Prairie BCR. The highest densities of this species occurred in Kansas (D = 4.34 birds/km^2, CV = 33%, *n* = 26). However, when analyzed by habitat, much larger densities were encountered in dry-land agriculture (D = 13.26 birds/km^2, CV = 11%, *n* = 299). In shrub cover categories density estimates were obtained for three categories, 1% (D = .62 birds/km^2, CV = 16%, *n* = 205), 1-3% (D = 2.06 birds/km^2, CV = 30%, *n* = 47) and 3-10% (D = .78 birds/km^2, CV = 32%, *n* = 44).



Red-winged Blackbird

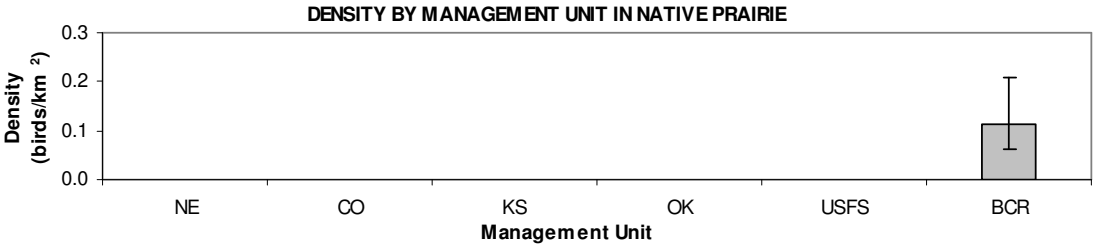


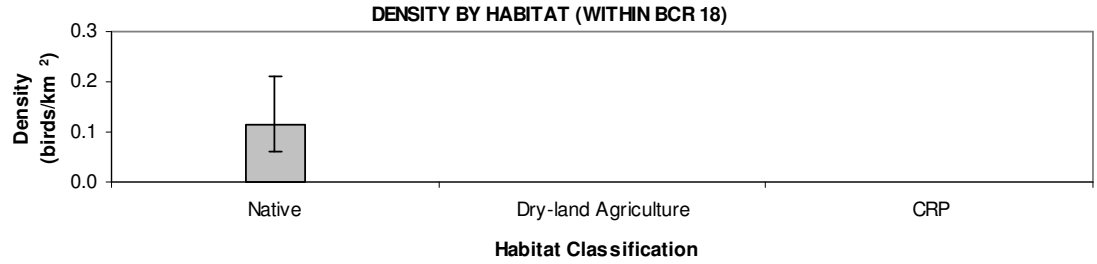
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

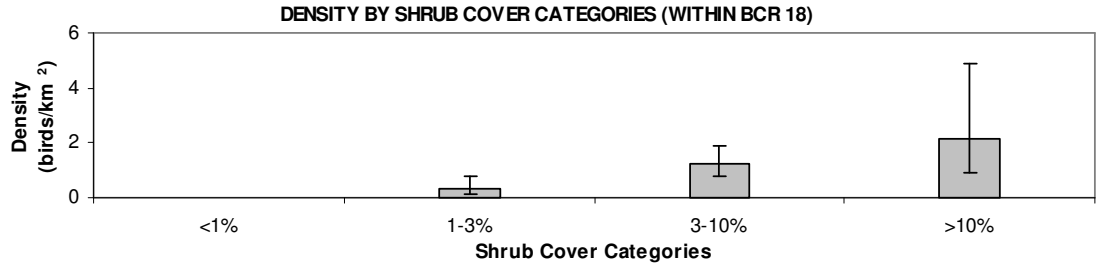
Eastern Meadowlark

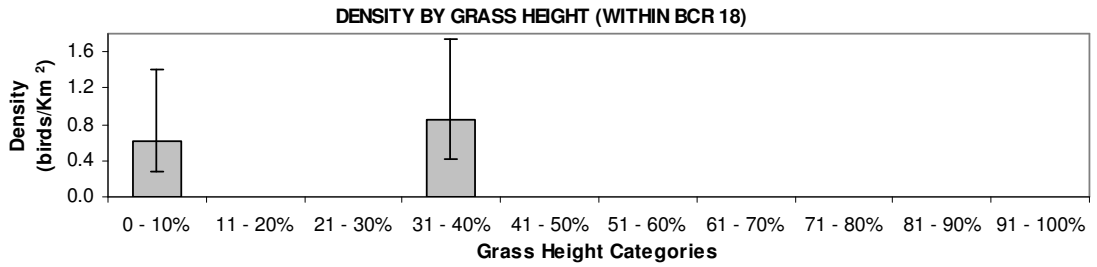
(Sturnella magna)

In 2004, we detected 18 individuals on 13 (.5%) of the sections surveyed. The Eastern Meadowlark was concentrated in the southern portion of the study area. This species exhibited highest densities in native prairie habitat (D = .11 birds/km^2, CV = 32%, *n* = 16). This species also occurred in higher densities in areas with >10% shrub cover (D = 2.12 birds/km^2, CV = 44%, *n* = 22). In grass height density estimates were obtained for two categories, 0-10% (D = .62 birds/km^2, CV = 43%, *n* = 24) and 31-40% (D = .85 birds/km^2, CV = 37%, *n* = 21). Management for this species in the BCR 18 should focus on generating and conserving habitat with a shrub component of >10%. Eastern Meadowlark is a species of moderate concern in Nebraska.

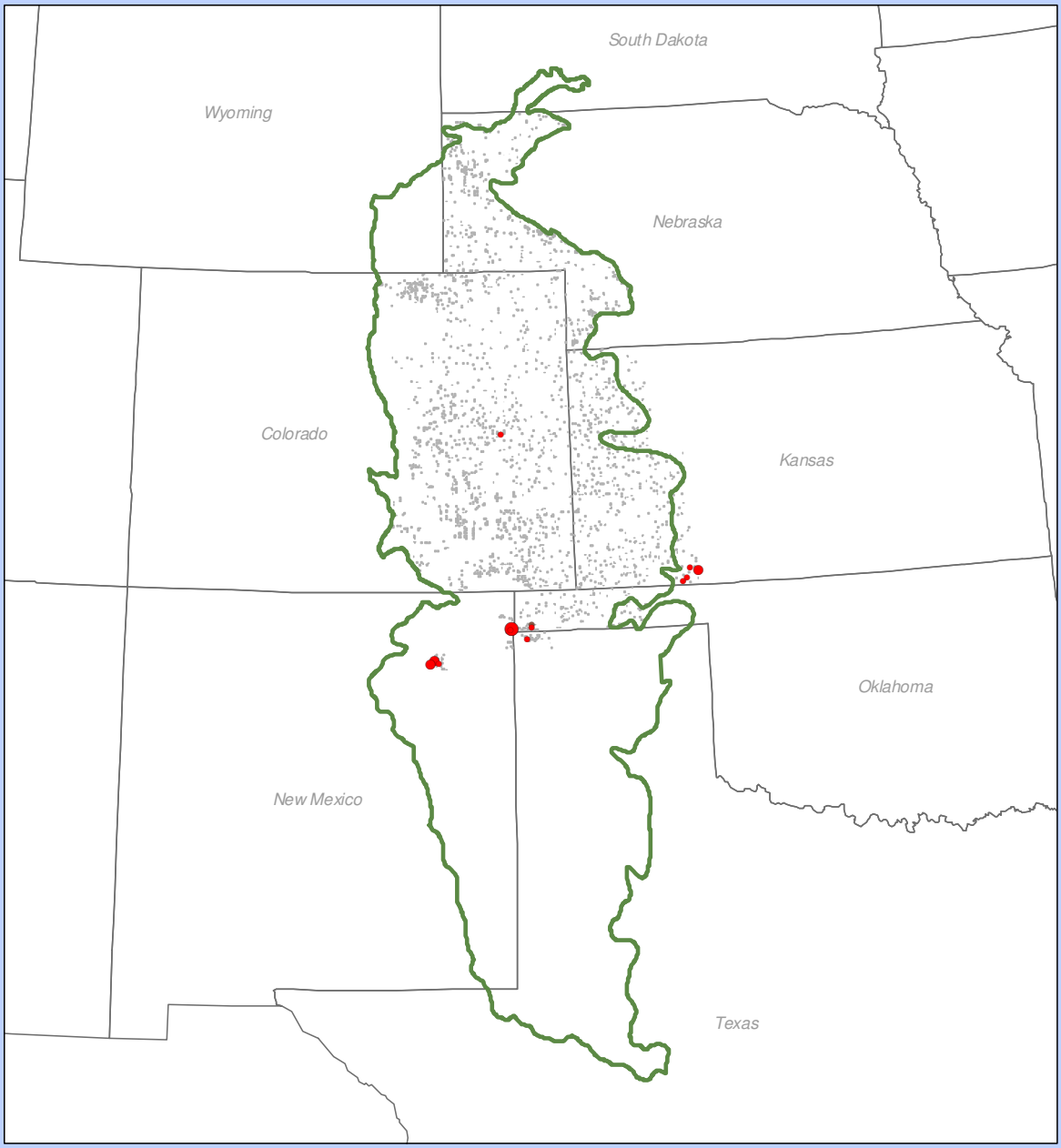








Eastern Meadowlark

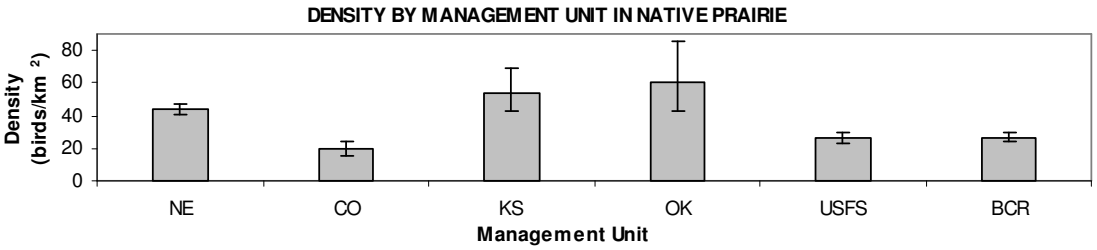


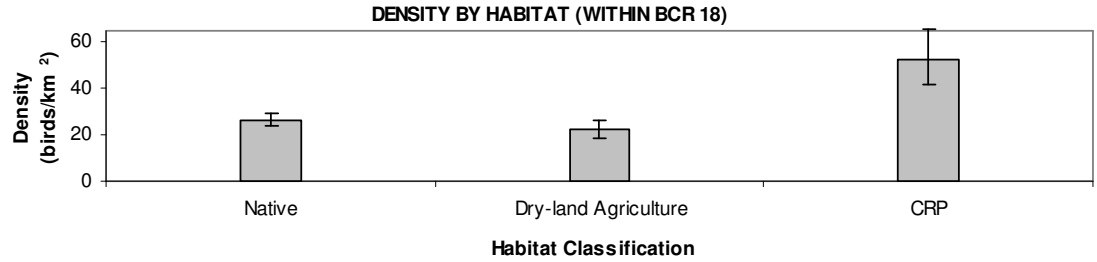
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

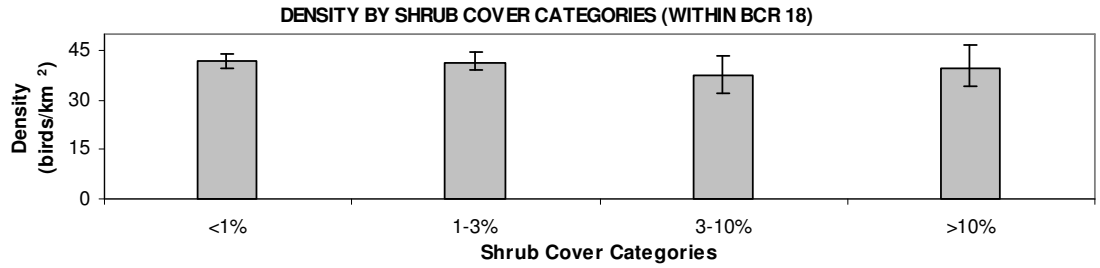
Western Meadowlark

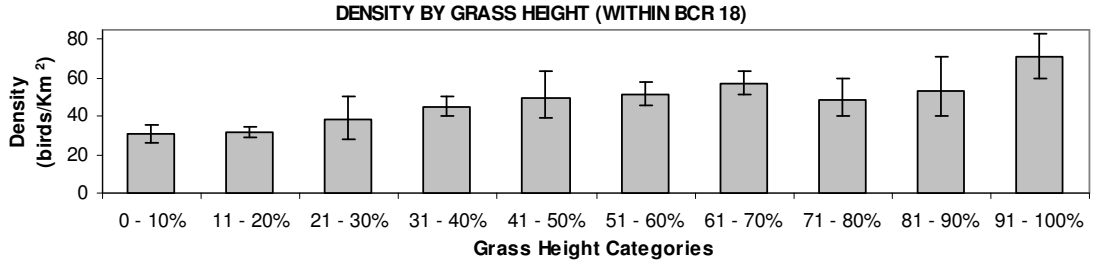
(Sturnella neglecta)

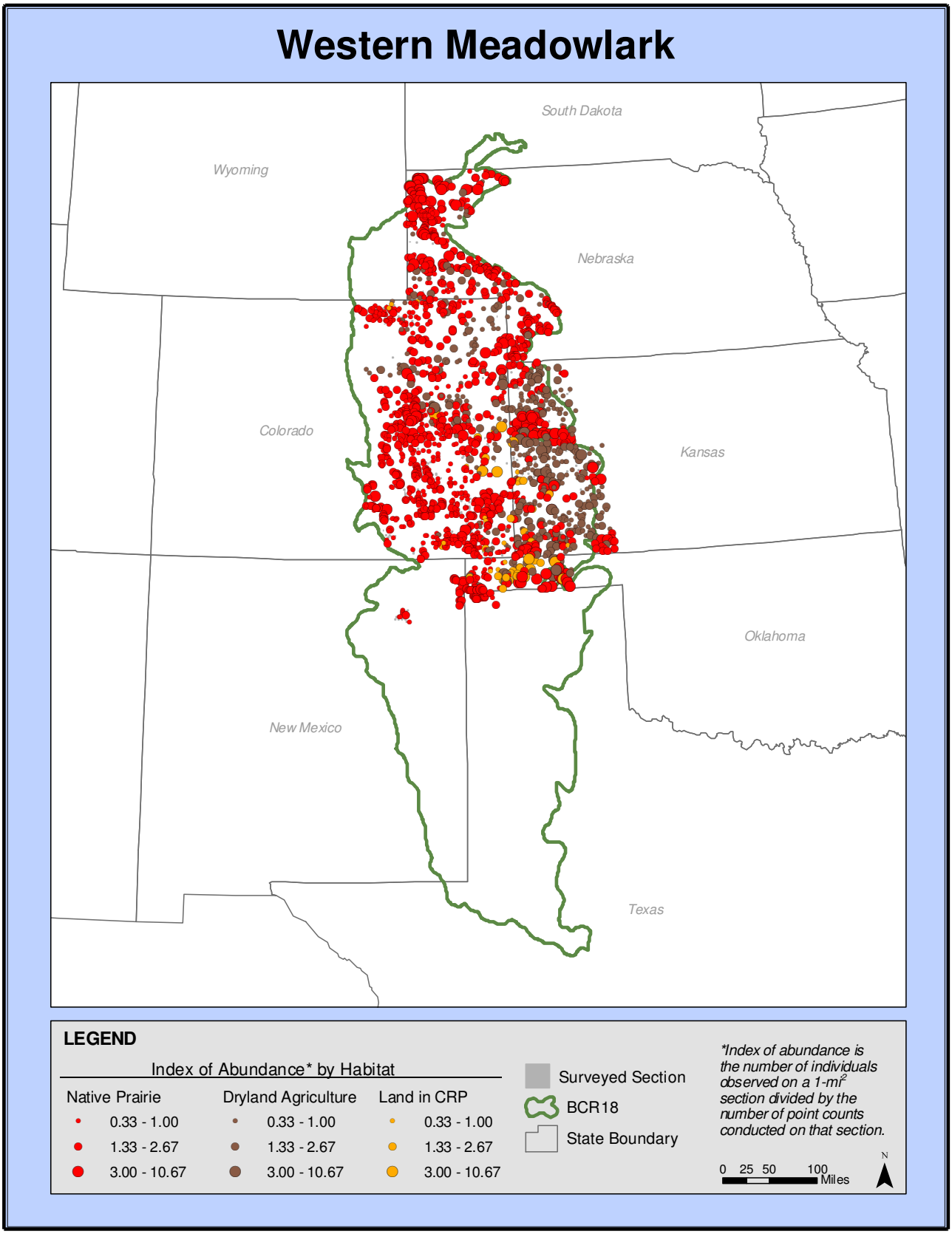
In 2004, we detected 8,148 individuals on 2072 (85.9%) of the sections surveyed. The Western Meadowlark ranked second in the total number of individuals detected, and was regularly distributed throughout the Shortgrass Prairie BCR. This species was found to occur in highest densities in the native prairie of Oklahoma (D = 60.10 birds/km^2, CV = 18%, *n* = 161) and Kansas (D = 54.17 birds/km^2 CV = 13%, *n* = 744). The Western Meadowlark showed no preference for shrub cover categories. Density within grass height was highest in 91-100% (D = 70.73 birds/km^2 CV = 8%, *n* = 1272). All of the habitats sampled appeared to provide the necessary cover required by the Western Meadowlark during the breeding season. Western Meadowlark is a Partners In Flight Tier III (additional watch list) species.









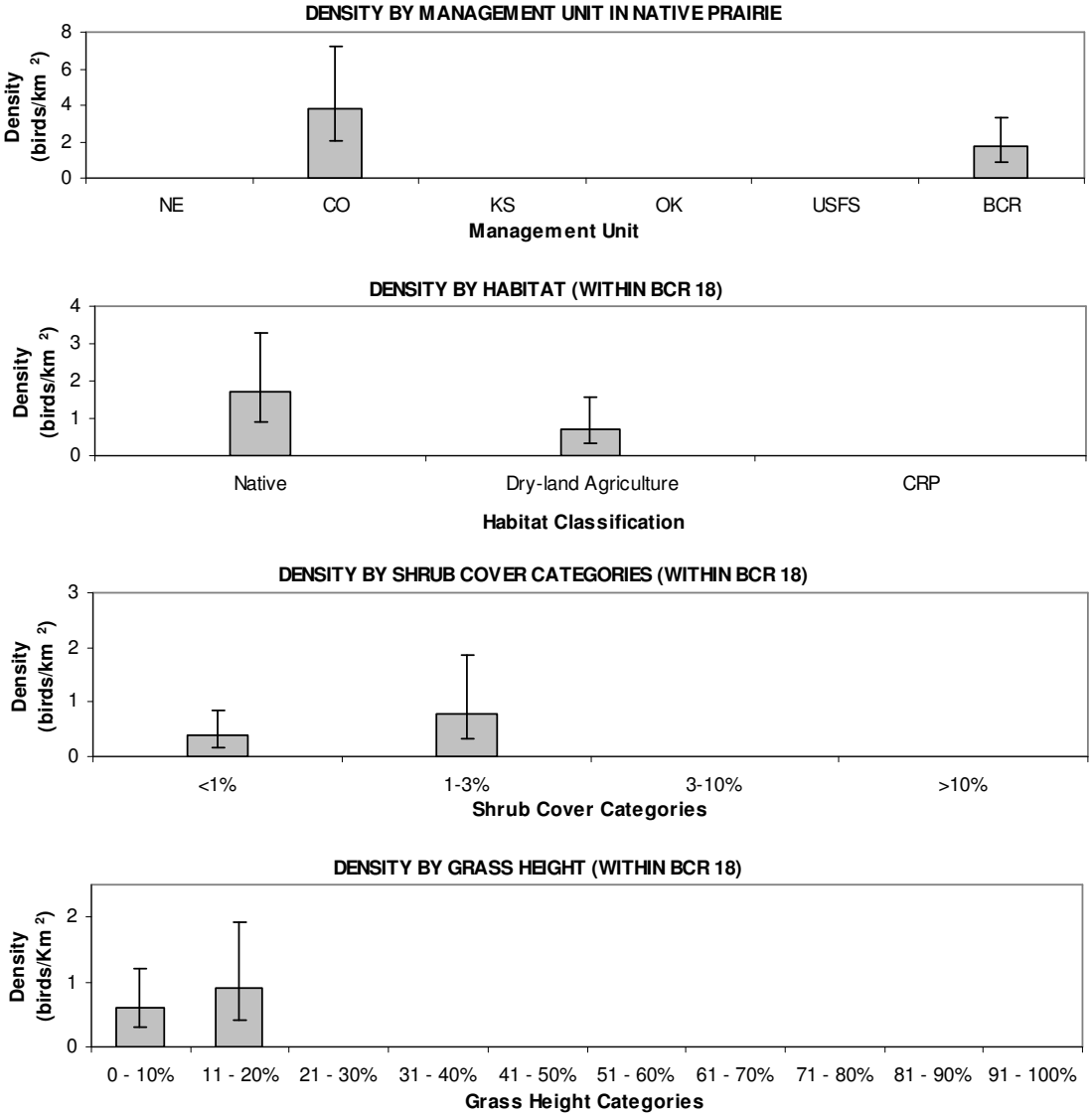


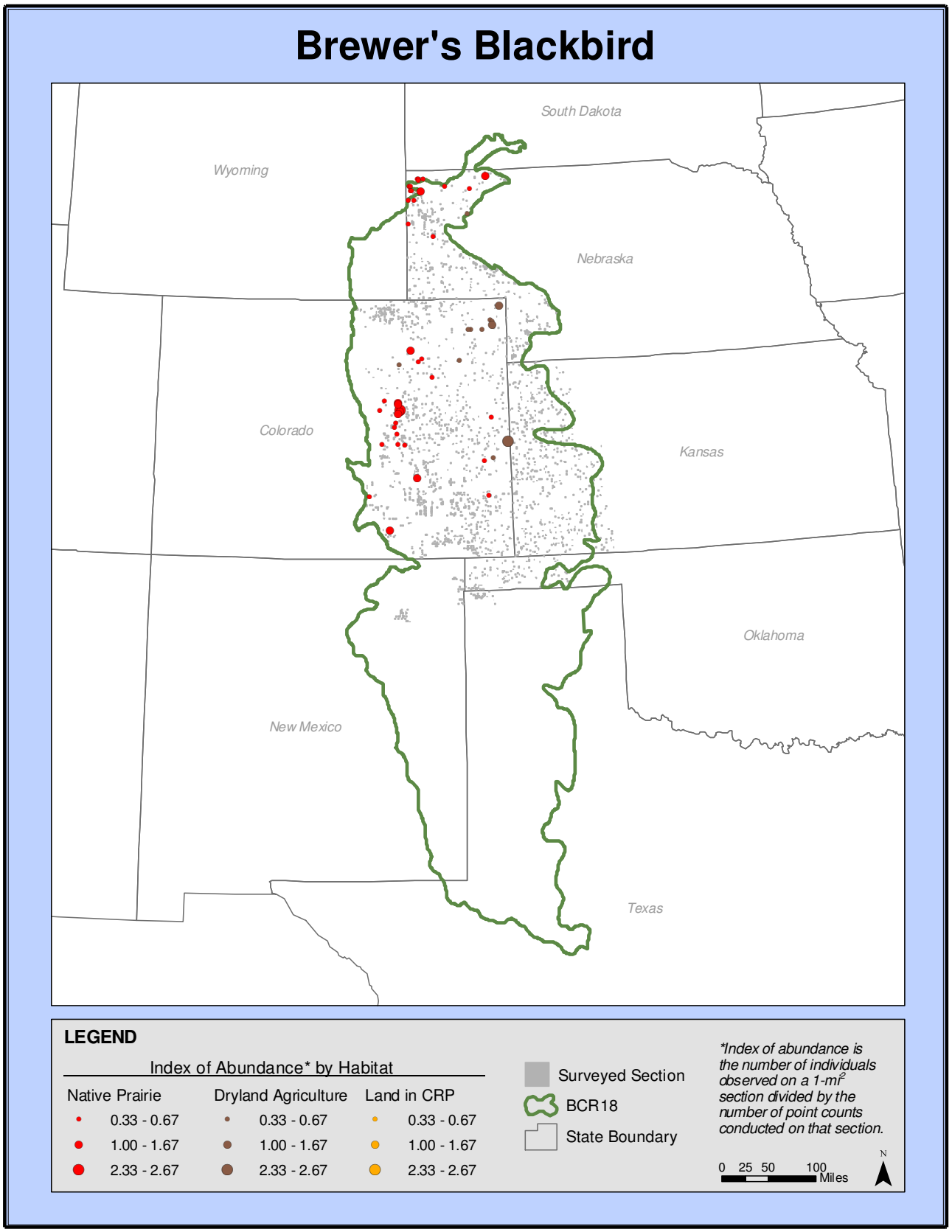
Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Brewer's Blackbird

(Euphagus cyancephalus)

In 2004, we detected 105 individuals on 52 (2.2%) of the sections surveyed. The Brewer's Blackbird was mainly distributed in Colorado within the Shortgrass Prairie BCR. In BCR 18 this species was found mainly in native prairie (D = 1.72 birds/km^2, CV = 34%, *n* = 51) most likely around anthropogenic features. In 1-3% shrub cover categories this species had a density estimate of .77 birds/km^2 (CV = 46%, *n* = 57). Brewer's Blackbird had a higher density in 11-20% grass height (D = .90 birds/km^2, CV = 40%, *n* = 29).



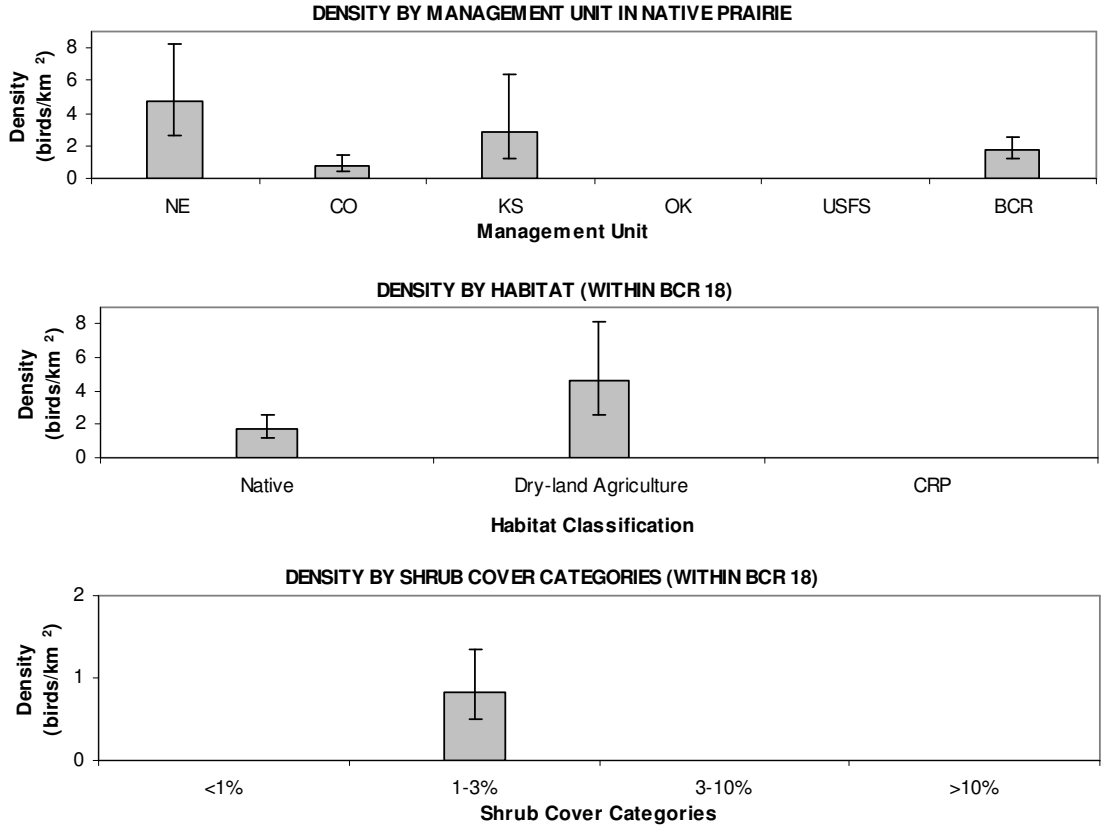


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

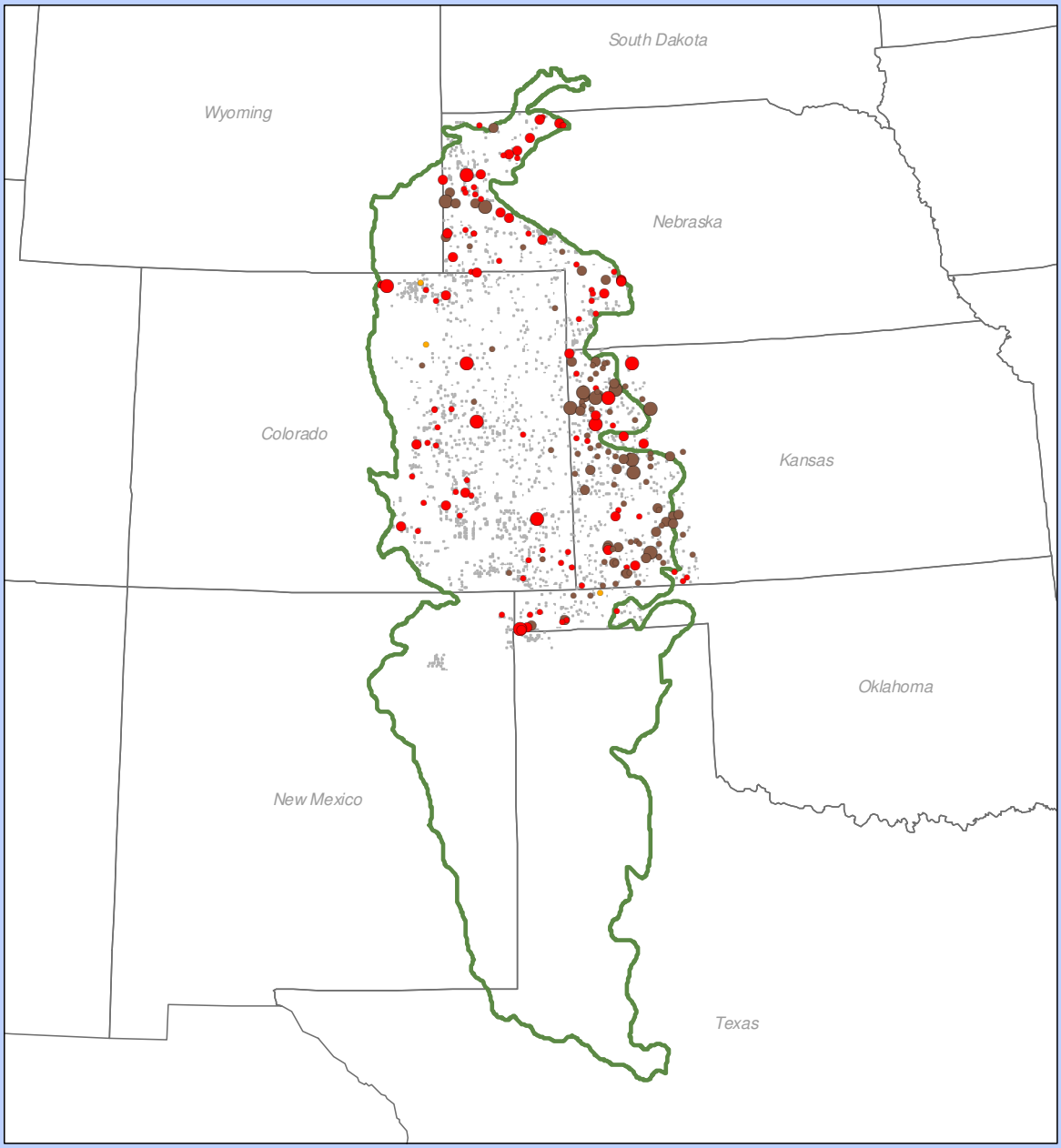
Common Grackle

(Quiscalus quiscula)

In 2004, we detected 563 individuals on 218 (9%) of the sections surveyed. The Common Grackle was common throughout Shortgrass Prairie BCR. This species was found to be most abundant in agricultural habitats (D = 4.56 birds/km^2, CV = 30%, *n* = 57). The Common Grackle had a density estimate of .77 birds/km^2 (CV = 25%, *n* = 58) in 1-3% shrub cover category.



Common Grackle

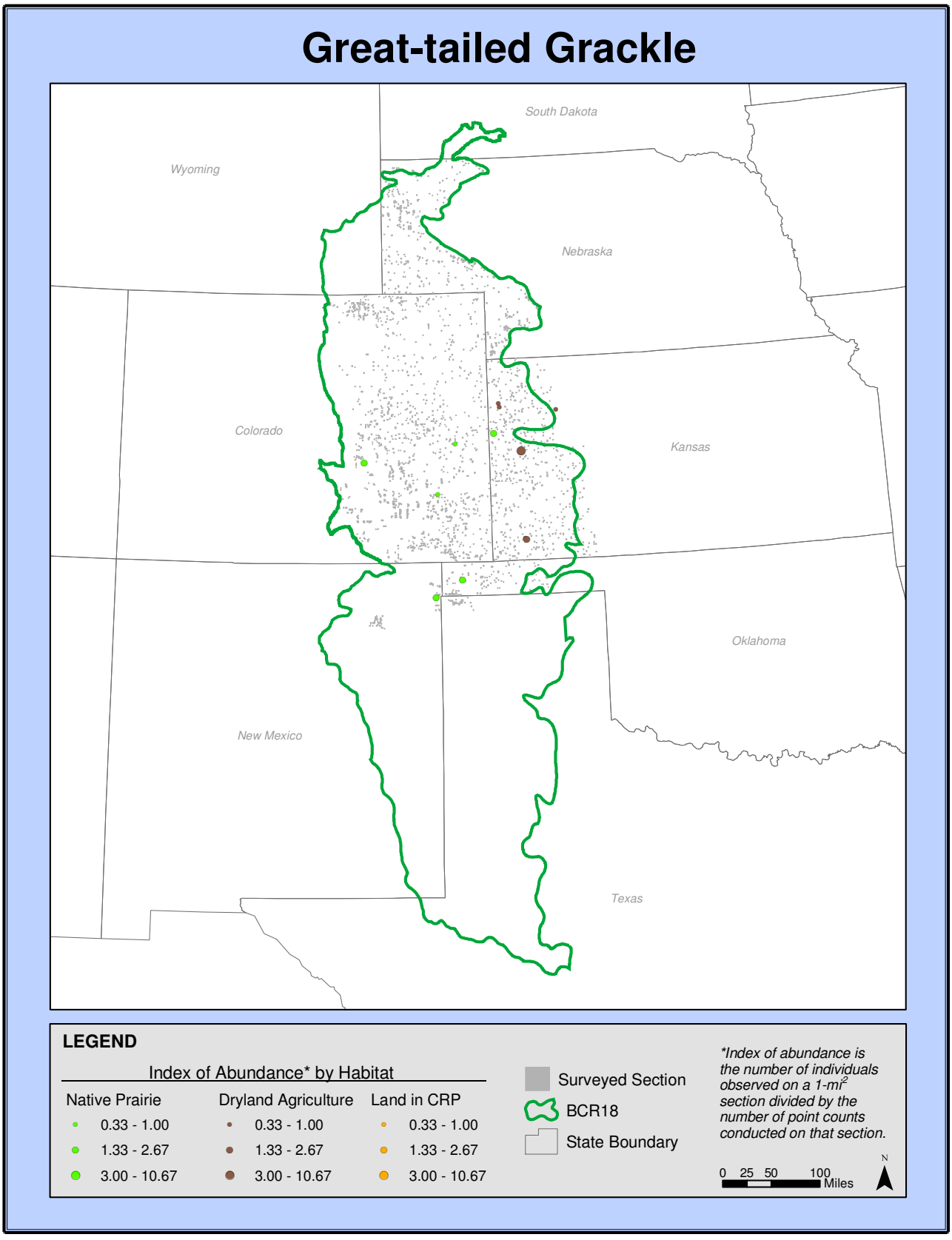


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

Great-tailed Grackle

(Quiscalus mexicanus)

In 2004, we detected 26 individuals on 20 (.01%) of the sections surveyed. The Great-tailed Grackle was mainly detected in Colorado.

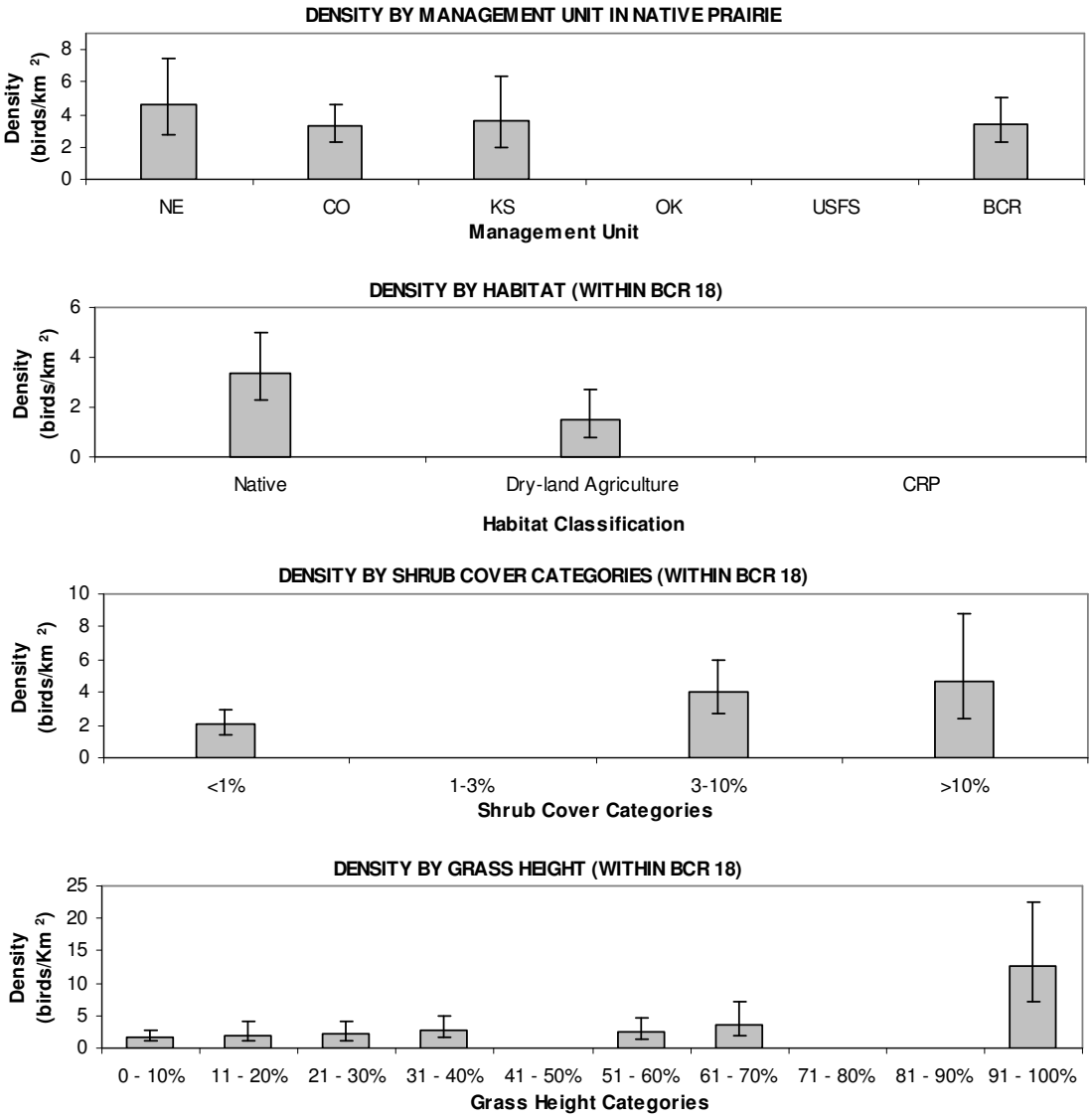


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

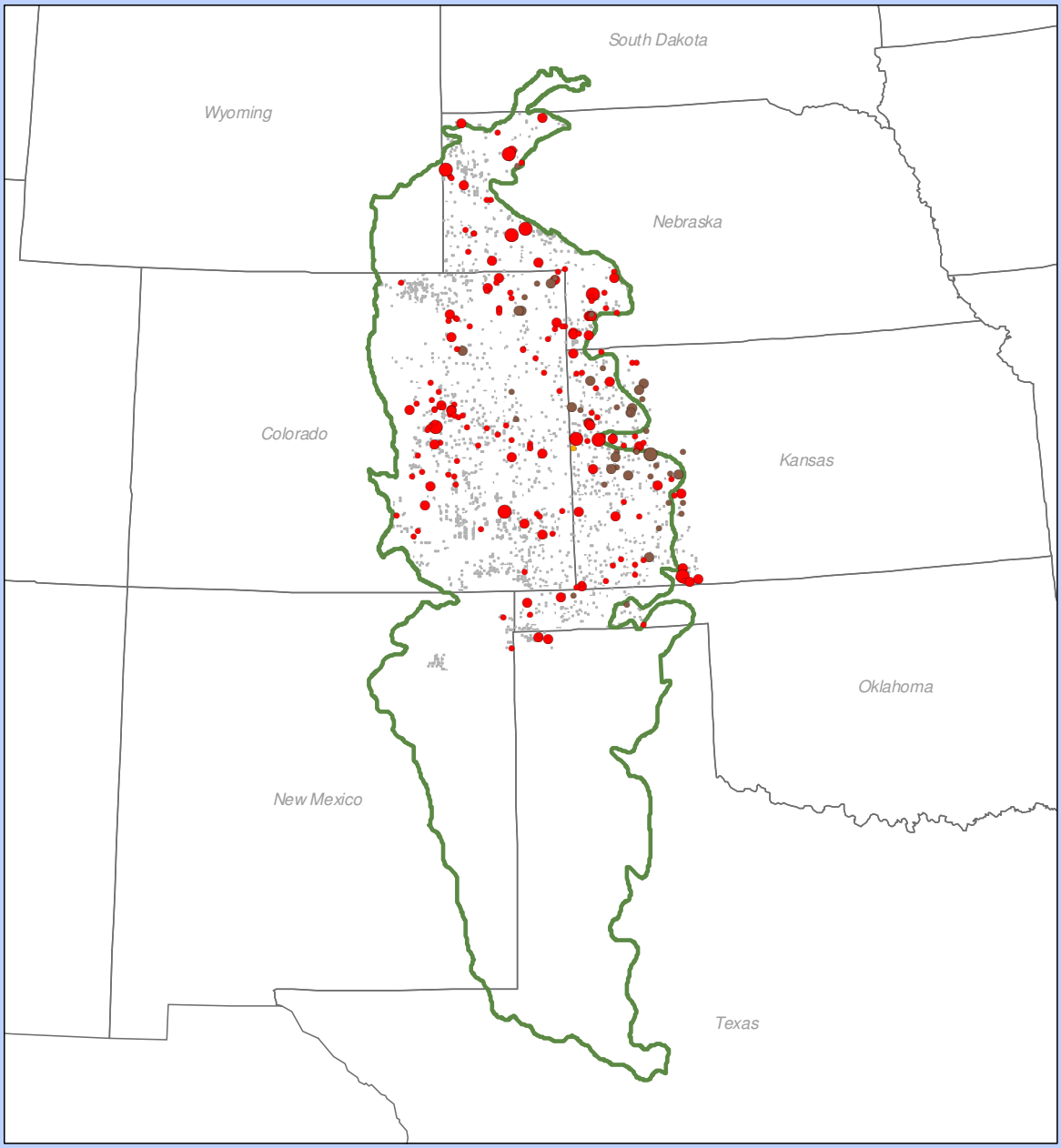
Brown-headed Cowbird

(Molothrus ater)

In 2004, we detected 343 individuals on 226 (9.4%) of the sections surveyed. The Brown-headed Cowbird was distributed throughout the Shortgrass Prairie BCR. It is associated mainly in scattered vegetation and anthropogenic habitat types, such as edges. The highest densities for this species were found in native habitats in Nebraska (D = 4.56 birds/km^2, CV = 25%, n = 36) and in shrub cover greater than 10% (D = 4.64 birds/km^2, CV = 34%, n = 24). This species had highest density estimates in 91-100% grass height (D = 12.77 birds/km^2, CV = 30%, n = 55).



Brown-headed Cowbird

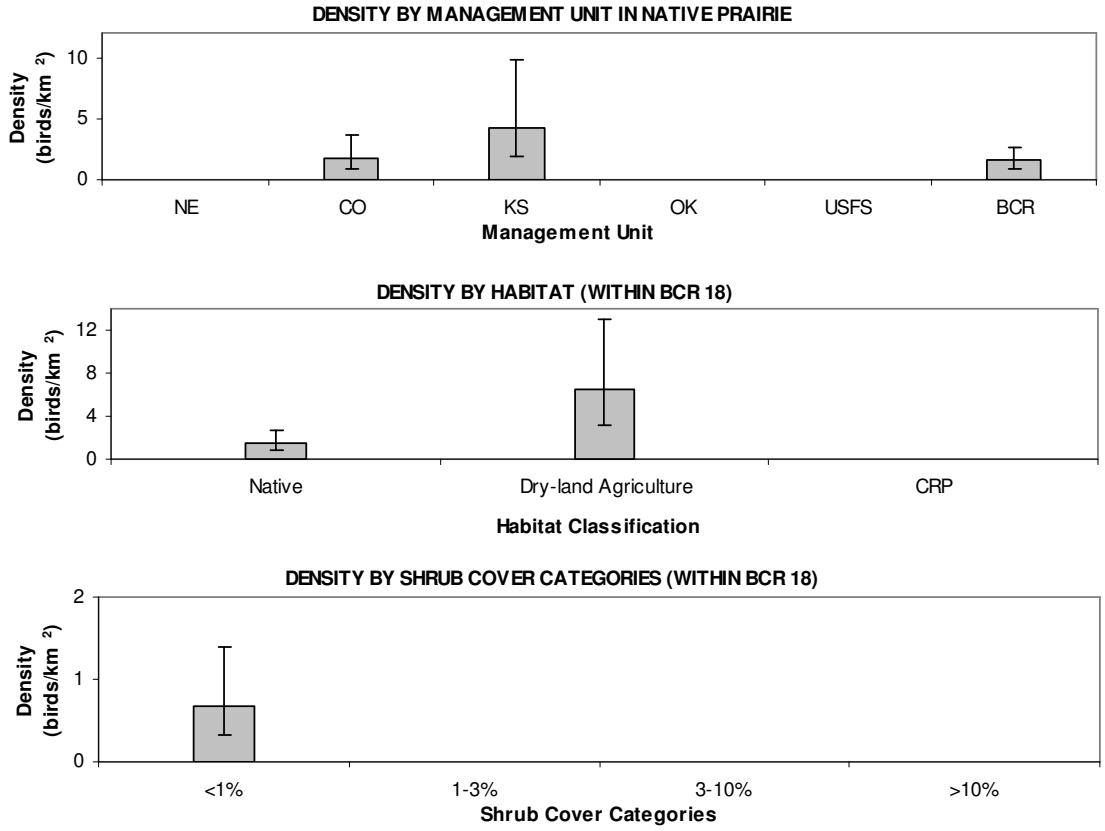


Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.

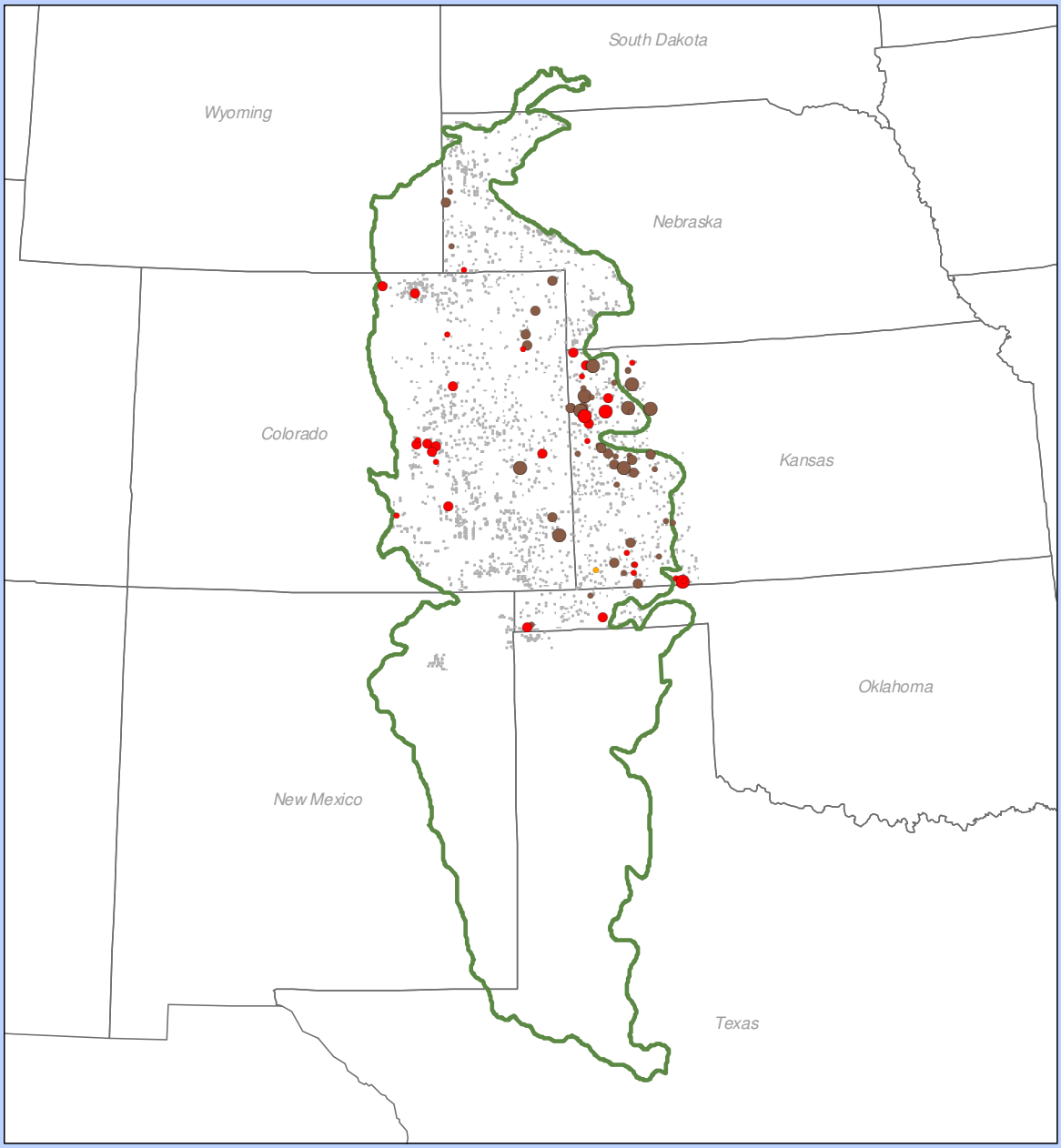
House Sparrow

(Passer domesticus)

In 2004, we detected 167 individuals on 81 (3.4%) of the sections surveyed. The House Sparrow was distributed throughout the Shortgrass Prairie BCR. It is associated mainly with anthropogenic habitats such as homesteads and farmlands. This is indicated by the highest densities of the House Sparrow occurring on sections containing dry-land agriculture (D = 6.51 birds/km^2, CV = 36%, n = 41). Based on this information, management for this invasive species should include the conversion of dry-land agriculture back to native prairie and conservation of large tracts of unfragmented habitats. In less than 1% shrub cover this species had a density estimate of .67 birds/km^2 (CV = 38%, n = 36).



House Sparrow



Distribution and index of abundance of the indicated species throughout the study area. Section-based surveys were conducted 15 May – 3 July 2004.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