NEBRASKA PRAIRIE PARTNERS PROJECT
2005 ANNUAL REPORT

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April 2006

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In Cooperation With:

ROCKY MOUNTAIN BIRD OBSERVATORY

The mission of the Rocky Mountain Bird Observatory (RMBO) is the conservation of birds of the Rocky Mountains, Great Plains, and Intermountain West, and the habitats on which they depend. *RMBO practices a multi-faceted approach to bird conservation that integrates scientific research and monitoring studies with education and outreach programs to bring bird conservation issues to the public and other conservation partners. RMBO works closely with state and federal natural resource agencies, private landowners, schools, and other nonprofit organizations. RMBO accomplishes its mission by working in four areas:*

Research*:* *RMBO studies avian responses to habitat conditions, ecological processes, and management actions to provide scientific information that guides bird conservation efforts.*

Monitoring*:* *RMBO monitors the distribution and abundance of birds through long-term, broad-scale monitoring programs designed to track population trends for birds of the region.*

Education*:* *RMBO provides active, experiential, education programs for K-12 students in order to create an awareness and appreciation for birds, with a goal of their understanding of the need for bird conservation.*

Outreach*:* *RMBO shares the latest information in land management and bird conservation practices with private landowners, land managers, and resource professionals at natural resource agencies. RMBO develops voluntary, working partnerships with these individuals and groups for habitat conservation throughout the Great Plains and Rocky Mountains.*

Suggested Citation:

Kerns, C., B. Bly, D. Hanni, R. Sparks. 2005. *Nebraska Prairie Partners Project 2005 Annual Report: 2005 Field Season Report.* Tech. Rep. PPR-NE-SWG05-01. Rocky Mountain Bird Observatory, Brighton, CO, 103 pp.

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EXECUTIVE SUMMARY

Nebraska Prairie Partners is a cooperative project of Rocky Mountain Bird Observatory and Nebraska Game and Parks Commission. The following document reports Nebraska Prairie Partners' activities for the period of January 1st to December 31st 2005.

The Mountain Plover nest-marking program protected 46 nests from cultivation activities; 80% of these hatched at least one egg. Repeat visit patch occupancy surveys for Mountain Plover yielded sightings on 11.4% of patches.

Burrowing Owl monitoring yielded sightings of 435 adults and 472 juveniles at 34 new prairie dog towns and 149 previously surveyed towns. We modified owl surveys to incorporate repeat visits, which served to eliminate some negative bias in the number of owls detected.

Airplane flights to search for Ferruginous Hawk nests yielded no new nests, but we performed ground nest checks on nests known active in 2004 and confirmed Ferruginous Hawk breeding activity in 11 nests.

During Section Surveys, we conducted 1,335 point-counts at 447 randomly selected sections. We observed 9,733 birds composed of 87 different species. Horned Lark density was the highest of all species in native grassland, followed by Grasshopper Sparrow and Western Meadowlark densities. Horned Lark density also was the highest of all species in cropland, followed by Grasshopper Sparrow and Red-winged Blackbird densities.

Public presentations, poster displays, and workshops continued to generate publicity for Nebraska Prairie Partners and foster interest in shortgrass prairie birds. These activities were complemented by habitat conservation on private lands via Ferruginous Hawk nest crib installation, stock tank ladder construction and installation, and ranch bird inventories.

NEBRASKA PRAIRIE PARTNERS DESCRIPTION

Rocky Mountain Bird Observatory (RMBO) is a nonprofit (state and federal) 501(c)(3) organization, governed by a Board of Directors, and is dedicated to the conservation of birds and their habitats throughout the Rocky Mountains, Great Plains, and Intermountain West. They accomplish their conservation goals through research, monitoring, education, and outreach. RMBO's Prairie Partners program was developed in 1998 with the ultimate goal of building a coalition of landowners and land managers across the Great Plains who are actively involved in the conservation of lands important to prairie birds. Prairie Partners' efforts focus on the North American Bird Conservation Initiative's Shortgrass Bird Conservation Region (BCR) 18 (Figure 1). Prairie Partners achieves its goal by monitoring prairie birds and their habitats, conducting outreach to increase awareness and understanding of prairie birds and their habitat requirements, providing technical assistance to landowners and land managers on how to incorporate birds into land management, and working with interested landowners and other partners to enhance bird habitat.

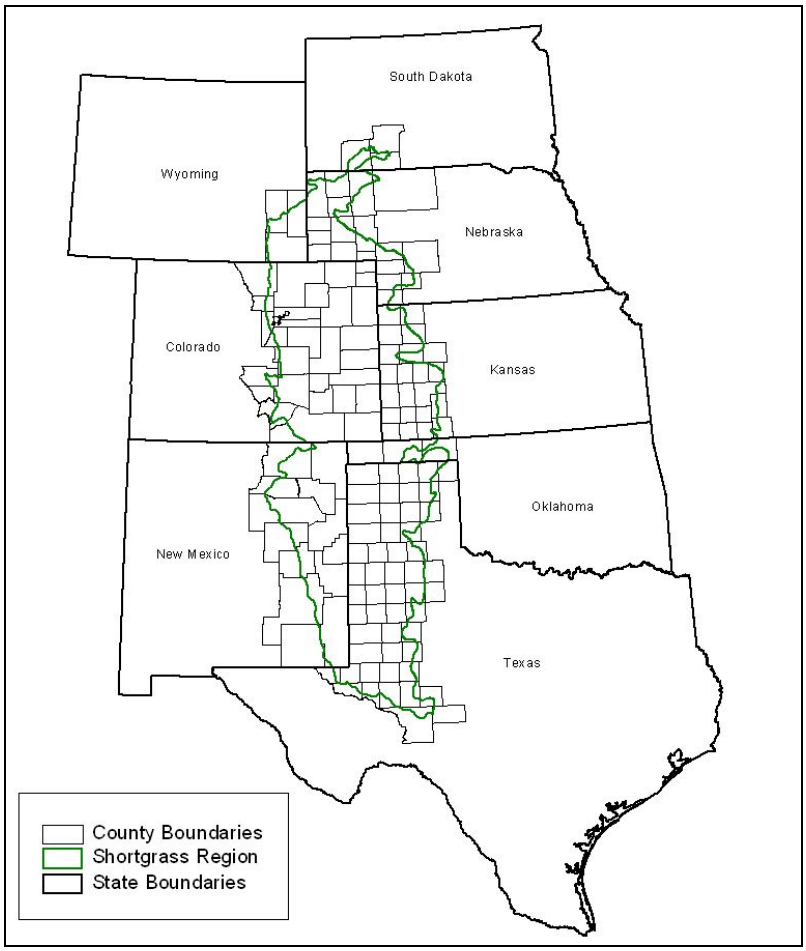


Figure 1. The Shortgrass Bird Conservation Region (BCR 18).

Nebraska Game and Parks Commission (NGPC) is a state government agency whose mission is the stewardship of Nebraska's fish, wildlife, park, and outdoor recreation resources in the best long-term interests of the people and those resources. This stewardship involves regulatory protection, overall management of species populations and habitats, advocacy of ecosystem integrity, as well as resource investigations and education.

In 2001, both RMBO and NGPC recognized a need for biological information and landowner outreach in western Nebraska in order to meet their bird conservation goals for the Shortgrass BCR and the state of Nebraska, respectively. RMBO had expertise on regional prairie bird conservation issues, field monitoring techniques, and landowner outreach developed in their existing Prairie Partners program, but they did not have the infrastructure or funds necessary for implementing these skills in Nebraska. NGPC had local infrastructure, funding, and contacts, but did not have the local personnel necessary to put these resources to work for non-game bird conservation. With their complementary attributes, RMBO and NGPC formed a partnership in May 2001 to establish Nebraska Prairie Partners. The goal of this project was to implement in western Nebraska all elements of the original Prairie Partners program.

A third partner joined in 2002. The Nebraska Environmental Trust, a beneficiary of the Nebraska Lottery, provides financial assistance to projects that implement habitat, surface and groundwater quality improvement; waste reduction; and carbon management. Nebraska Prairie Partners helps advance a number of the Trust's habitat-related priorities in western Nebraska, and has received funding to conduct and expand bird monitoring and outreach until 2007

With growing bird inventory demands and greater opportunities for public outreach events in 2003, Nebraska Prairie Partners expanded once more with the help of State Wildlife Grant funding from the U. S. Fish and Wildlife Service (USFWS), made available through NGPC. This funding allowed for the geographic expansion of all-bird and Mountain Plover surveys to the entire Shortgrass BCR in Nebraska, and for the delivery of numerous public seminars on local grassland bird conservation issues. Also in 2003, a second cooperative project between RMBO and NGPC was formed called the Nebraska Shortgrass Prairie Partnership (NSPP), which will complement the monitoring and outreach efforts of Nebraska Prairie Partners. The NSPP will be the delivery vehicle for on-the-ground habitat improvement projects funded by a USFWS Landowner Incentive Program grant to NGPC. Nebraska Prairie Partners plays a significant role in identifying priority areas for NSPP projects and assisting with the development of management practices that will benefit at-risk bird species in these areas. In addition, the groundwork laid by Nebraska Prairie Partners in terms of statewide involvement in conservation planning, landowner outreach, and interagency/organization partnerships provides a foundation from which to build a truly cooperative multi-stakeholder effort in the NSPP.

STUDY AREA

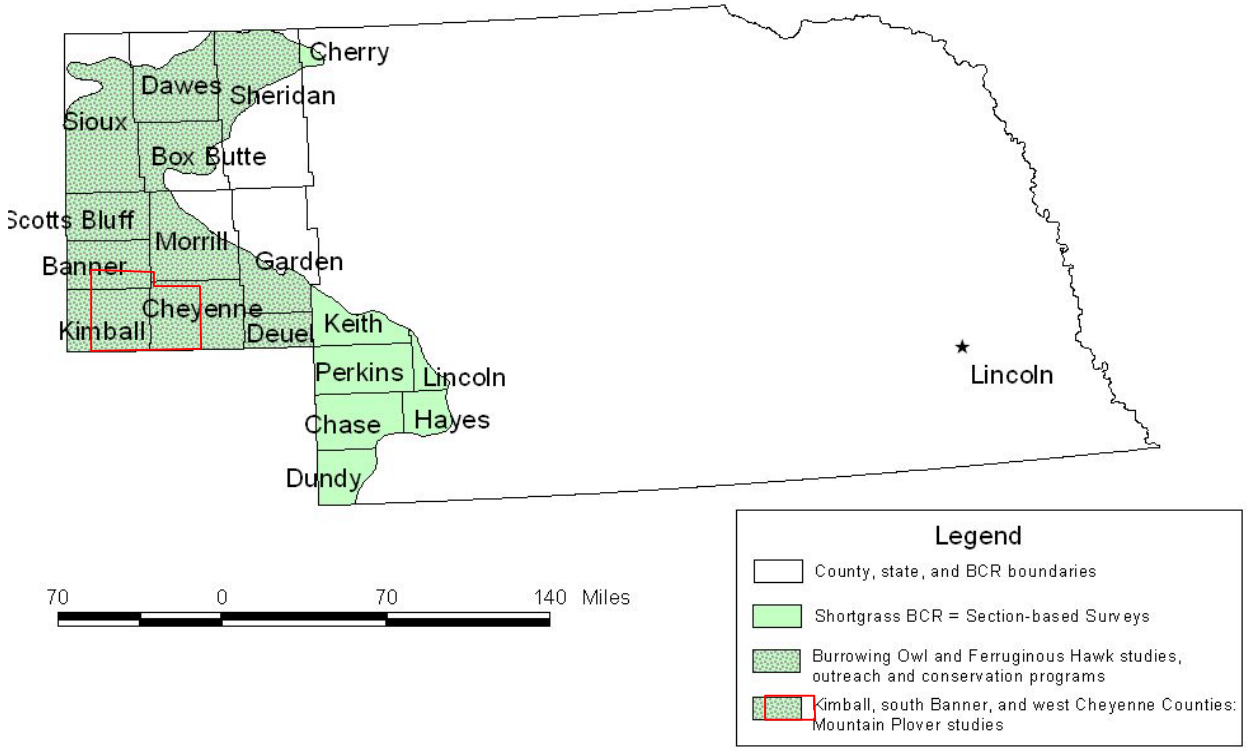


Figure 2. Nebraska Prairie Partners study areas for 2005.

Land ownership in the Nebraska panhandle is >90% private; rangeland and agriculture being the primary land uses (Figure 3). Annual precipitation averages 14" - 17", and many cropland acres are irrigated by center pivot or flood canal systems. Agricultural practices include cattle ranching, wheat and other small grain farming on dry land sites, and corn, bean and sugar beet farming on irrigated lands. Cultivated lands are prevalent in Box Butte, Chase, Cheyenne, Deuel, Dundy, Hayes, Keith, Kimball, Lincoln, Perkins, and Scotts Bluff Counties, but large expanses of grassland persist in Banner, Cherry, Dawes, Garden, Morrill, Sheridan, and Sioux Counties. The native vegetation in rangelands and protected areas of this region is almost entirely a shortgrass/mixed-grass mosaic, with some Sandhills mixed-grass on the eastern edge, sand sage prairie in the southwest, and narrow forest zones near the North Platte River, the Pine Ridge, and the Wildcat Hills. Nebraska Prairie Partners' activities are focused primarily on native prairie habitats, with the exception of Section Surveys and Mountain Plover surveys, which also encompass cultivated fields and Conservation Reserve Program (CRP) lands.

The study areas for Nebraska Prairie Partners' activities are within the Shortgrass BCR (Figure 2) in western Nebraska, including the panhandle and parts of the southwest corner of the state (Figure 2). Common plant species in the grasslands addressed by this project include: needle-and-thread (*Stipa comata*), western wheatgrass (*Agropyron smithii*), blue grama (*Boutelouca gracilis*), and buffalograss (*Buchloe dactyloides*). Threadleaf, or blackroot, sedge (*Carex filifolia*) is also a significant component on some sites. Native shrubs in these grasslands are sparse, and primarily sand sagebrush (*Artimesia filifolia*), silver sagebrush (*A. cana*), big sagebrush (*A tridentata*), snowberry (*Symphoricarpos* sp.), currant (*Ribes* sp.), and broom

snakeweed (*Guttierrezia sarothrae*). Forbs are diverse and include small soapweed (*Yucca glauca*), prickly pear cactus (*Opuntia* sp.), various thistle species (*Cirsium* sp.), fringed sagewort (*Artimesia frigida*), and many less conspicuous drought-adapted species.

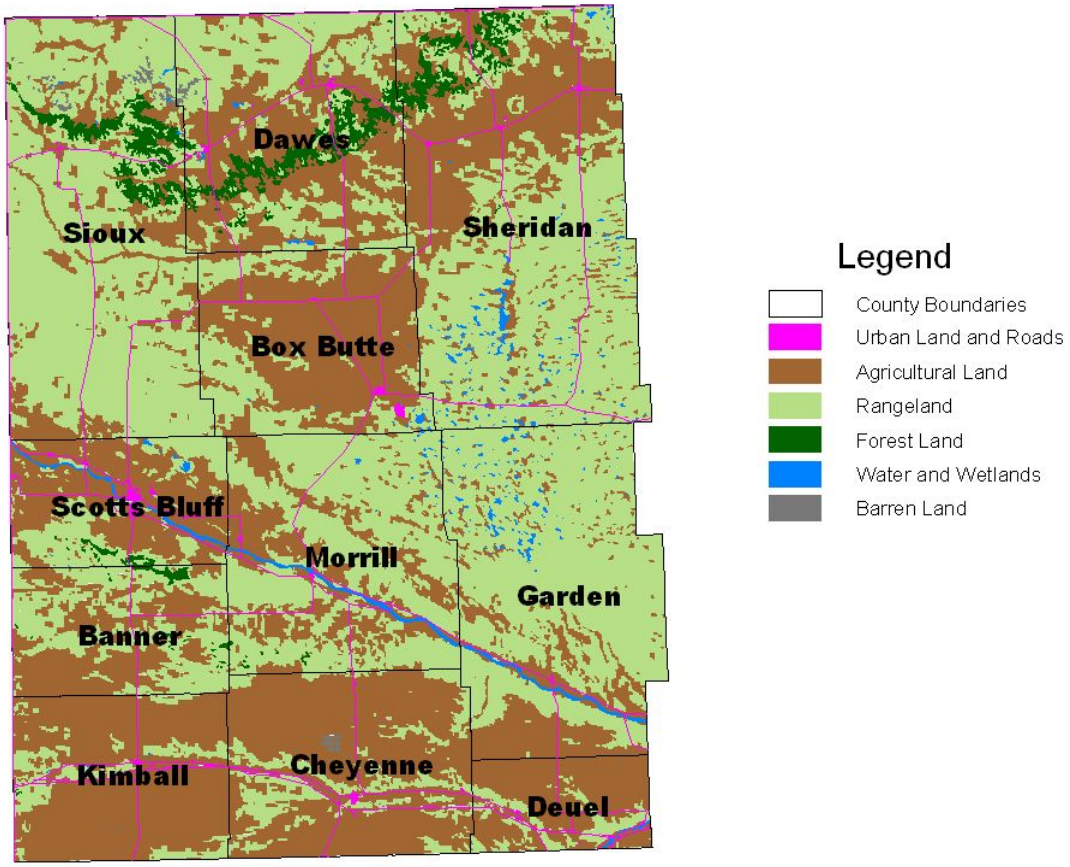


Figure 3. Land use in Nebraska's panhandle.

PRAIRIE BIRD MONITORING

Grassland birds are widely acknowledged to be a species group of conservation concern (Peterjohn and Sauer 1999, Vickery and Herkert 2001). Habitat loss on breeding and wintering grounds, degradation of remaining habitat from fragmentation, and disruption of historic disturbance regimes are primary stressors for this suite of species (Peterjohn and Sauer 1999). Additional factors such as elevated cowbird parasitism have also taken a toll on populations (Davis and Sealy 2000). Contiguous grassland remains in western Nebraska (Samson *et. al* 2004), and as such provides quality habitat for many rare and abundant species.

Monitoring of grassland birds is critical for directing management efforts and ensuring species' viability. One well-known, broad-scale monitoring effort is the Breeding Bird Survey. The BBS is an annual, nationwide effort consisting of 24.5 km routes with survey points placed every 0.8 km (Sauer et al. 2005). Since its inception in 1966, the BBS has detected significant population trends for many species. However, for species with sparse or restricted populations such as Mountain Plover (*Charadrius montanus*), Burrowing Owls (*Athene cunicularia*), and Ferruginous Hawks (*Buteo regalis*), BBS data exhibit a significant deficiency (Sauer et al. 2005). Also, an important feature of the Nebraska panhandle is the aforementioned predominance of private land (>90%). Therefore, neither the BBS nor avian surveys on public lands are adequate to assess the region's bird populations. Particularly with the evolution of our repeat visit surveys, Nebraska Prairie Partners' monitoring programs provide data that is both spatially and temporally intensive.

Nebraska Prairie Partners conduct several kinds of bird monitoring in western Nebraska. Our Mountain Plover, Burrowing Owl, and Ferruginous Hawk surveys document distribution, habitat characteristics, and productivity. RMBO Section Surveys are point counts that track the entire suite of grassland bird species. Both of these monitoring programs combine geographic comprehensiveness with intensive coverage. State and federal wildlife agencies or other entities can use such baseline population information to set criteria for the implementation of management action (e.g. - when a species reaches a certain population threshold or a specified decline is detected). Population monitoring determines species' status in Nebraska; this information can then be integrated into range-wide conservation efforts.

MOUNTAIN PLOVER

Introduction

The Mountain Plover is a shortgrass prairie endemic upland shorebird (Johnsgard 1979). The species has declined from habitat loss on breeding and wintering grounds due to urbanization and agriculture, and also from reduction in the extent of prairie dog (*Cynomus* sp.) towns and bison (*Bison bison*) grazing (Knopf 1996). The grazing of these native herbivores produced the short vegetative structure and bare ground required by this species for breeding (Knopf 1996). Mountain Plover are ranked Tier 1 in Nebraska because they are state-listed and globally imperiled (Schneider *et al.* 2005), and have also been a candidate for federal listing under the Endangered Species Act (U.S. Fish and Wildlife, Federal Register 1999).

Prior to 2001, Mountain Plover were known to inhabit (Shackford *et. al* 1999) and breed (Sharpe *et al*. 2001) in agricultural fields in the southwest Nebraska panhandle, but the extent of breeding was unknown. Nebraska Prairie Partners have subsequently documented hundreds of individuals and nests through population surveys and the nest-marking program.

Methods

Patch Occupancy Surveys

We conducted repeated measure patch occupancy surveys during the nesting season to estimate relative abundance in three habitat types known to be used by plovers. This sampling concept was adapted from Royle and Nichols (2003) for surveying Mountain Plover by researchers at the Colorado Natural Heritage Program (Drietz and Knopf 2005).

We chose patches within the species' previously known range in Nebraska, and surveyed 73 patches that were surveyed in 2004 in addition to 32 new ones. We used a list of all possible sections in our study area and the Microsoft Excel random number tool to select new sections that would each contain one patch. We attempted to sample patches in dryland agriculture and rangeland (habitat used by plovers) roughly in proportion with their availability on the landscape. We also sampled some center-pivot (n= 8) and CRP (n=1) patches because plovers have been detected in those habitats sporadically. We used a 200 x 200 m piece of land as our patch in each section surveyed. In growing wheat, we chose the flattest sites with bare or relatively bare soils, and in rangeland we chose the flattest, more heavily grazed portions. For sections not containing the assigned habitat types, or for which landowner access could not be secured, alternate sections were chosen by moving in a random direction until we found a section with suitable habitat. We oriented patches to follow rows of crops or topography such that the most suitable habitat was sampled. Patches were oriented with the nearest edge parallel to the road. We placed half the patches adjacent to a road and half 200 m from the road where we had landowner permission. We assigned each patch a 6-digit Township-Range-Section identifier and recorded the UTMs of the center of the side nearest the road with a GPS unit. We mapped the location and orientation of the patch, land use in the section, patch elevation, and estimated slope of the patch using 3 categories (0-3%, 3-8%, 8-15%).

We completed these surveys in a short time frame, 22 April to 27 May, in which Mountain Plover consistently responded to call playback. Each patch was surveyed three times during the nesting season. We conducted surveys primarily in the mornings prior to 1000 MST, and some evenings after 1700 MST. Observers approached the edge of the patch, and surveyed the patch with binoculars for 3 minutes. All Mountain Plover observed within or outside the patch during this time were noted accordingly. We then used a game caller programmed with the Mountain Plover territorial and alarm calls, and broadcast calls for 1 minute, followed by 3 additional minutes of observation and recording of all plover observed in the second scan.

In addition to patch surveys data, knowledge of the detection probability of individual Mountain Plover within a patch is required in the development and implementation of a successful monitoring program. This is especially true of a cryptic bird like the Mountain Plover whose complete ecology in the dynamic landscape of the southwestern panhandle is still being studied. Repeated measure patch surveys were used to estimate detection probabilities for Mountain Plover in the study area according to an N-mixture model. The N-mixture model is used to explicitly estimate abundance (N) and detection probability (p) where temporally replicated counts of organisms are collected at a number of locations in space, and unlike many other models does not require unique identification of organisms (Royle 2004). Otherwise stated, the number counted (n) at a site (i) and time (t) will depend on the true abundance at that site (N_i) and the probability of detection of each individual (p_{it}) at each site and time. The detection and abundance estimates are calculated according to the following:

$$L\left(\lambda, p \mid \{n_{i1},....,n_{iT}\}\right) = \prod_{i=1}^{R}\left(\sum_{N=\max_t n_{it}}^{\infty} \frac{\lambda^N e^{-\lambda}}{N!} \prod_{t=1}^{T}\binom{N}{n_{it}} p^{n_{it}}(1-p)^{N-n_{it}}\right).$$

Nest Marking

Nest marking focused on cultivated lands. With landowner cooperation, fields were searched between 10 April and 24 June to find and monitor nests. We conducted preliminary scouting surveys when possible to ascertain 1) which sections appeared suitable based on topography and cover type, and 2) which contained birds. Sections meeting one or both criteria were prioritized for nest searching. Timing of nest searching was intended to coincide with incubation and minimize farming disturbance by searching a few days prior to tillage or planting operations. We found nests by systematically driving all-terrain vehicles in farm field strips at 10-15 miles per hour while scanning the field ahead, pausing, and visually scanning ahead again at 200 m intervals. When a plover was flushed we continued past the nesting site, then stopped and observed the area for 15 - 30 minutes until the bird returned to the nest. If birds did not go to a nest in that time frame, observers left the site and returned later. Late morning through late afternoon searches were most effective because adults return to the nest more quickly during portions of the day when solar radiation is highest.

After a nest was located, the site was revisited for marking. The nest was marked with fluorescent painted wooden lath approximately 3 meters away on all four sides, oriented parallel and perpendicular to crop rows to ensure visibility from the front and sides, and we informed any persons farming the ground of the nest location. We were unable to float and age eggs because of permit delays, but nests were revisited at intervals (ideally every 5 days, but with much variation due to personnel logistics) until hatch. At each nest we recorded habitat type (summer fallow, growing wheat, rangeland), location (using Garmin *etrex* GPS units), presence and behavior of adults, number of eggs or young, and evidence of fate (*i.e.*, pipping chips, broken eggs, predator tracks, abandoned or infertile eggs, etc.).

Nest Site Landscape Analysis

We assessed whether Mountain Plover selected or avoided certain landscape features as evidenced by nest site placement, using a logistic regression use-availability framework. We used the Farm Service Agency's high-resolution, multi-spectral, 2003 aerial imagery in GIS to quantify the landscape surrounding nests (n=58). We assigned land cover within two radii (a 14 ha^2, territory-scale circle, and a larger, 1-mile radius circle) to four cover classes: rangeland, dryland agriculture, CRP, or irrigated agriculture. We calculated the percent cover of these classes within the two radii by dividing the acreage of each class by the total acreage. We also measured the distance to two features we hypothesized might be avoided by plover when selecting nest sites, roads and human structures likes houses. We also measured the distance to rangeland, which we considered suitable habitat that may be selected for as a potential breeding site. Because Mountain Plover are thought to preferentially inhabit flat, open areas (Knopf 1996), the final metric we calculated was a slope index. To characterize the slope of each site, we placed four 500 m lines radiating in the four cardinal directions from each nest and random location (Figure 4). We then counted the total number of times the lines intersected 10 m contour intervals. The same metrics were calculated for a set of random locations (n=56) we generated with the Animal Movements ArcView GIS Extension. To ensure that these locations were available to plover and comparable to the nest sites we have monitored, we used only those located in dryland agriculture, within the observed range of the Mountain Plover in Nebraska. We then fit a nominal logistic regression model in the statistical analysis program JMP IN (SAS

Institute 2001) to model the influence of these features on the probability that a location was a random point or nest location. We set the level of statistical significance for parameter estimates at $\alpha<0.10$.

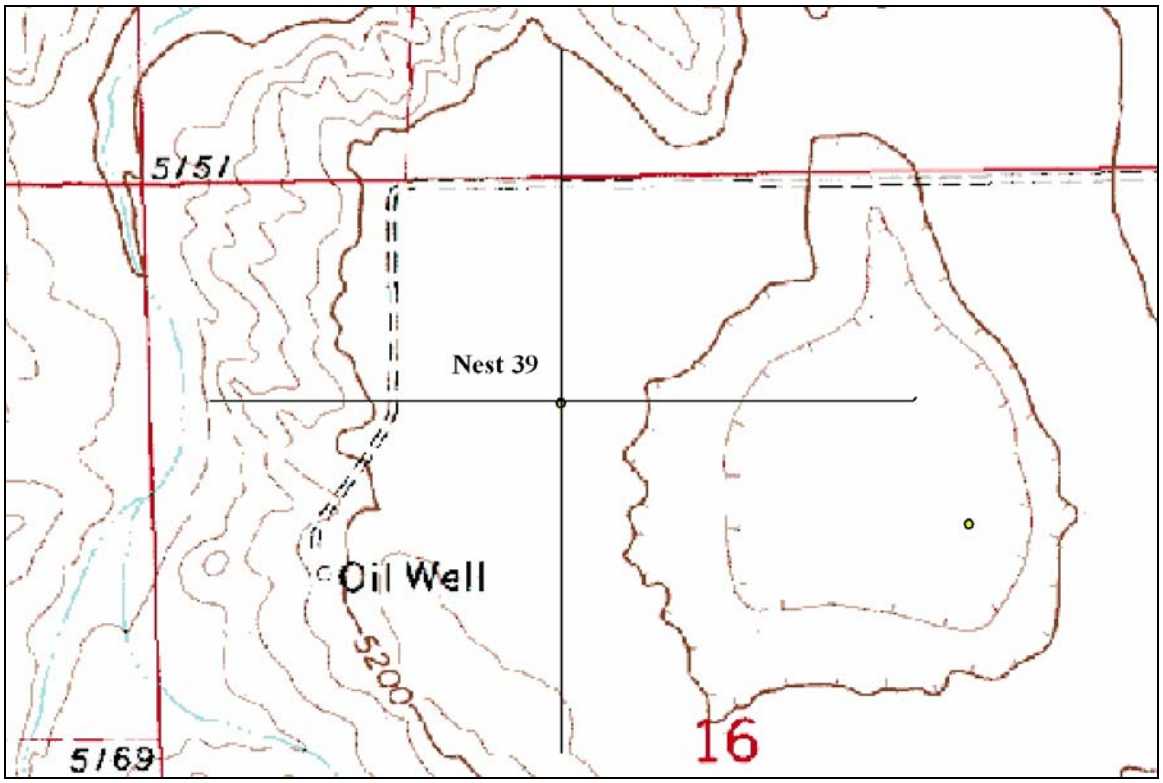


Figure 4. In our landscape analysis, we used the number of topographic interval lines crossing four, 500m line segments radiating from nest sites to characterize slope.

Results

Patch Surveys

A total of 105 patches were surveyed for Mountain Plover occupancy (Figure 5). Sixty-nine sites were located in dryland agriculture, 27 were rangeland, 8 under irrigated center-pivots, and 1 was low-stature CRP. Twelve (11.4%) of these patches contained adult Mountain Plover (Table 1), and we observed a total of 17 individuals. We observed plover on 5 of 69 (7.2 %) dryland agriculture patches, 4 of 27 (14.8%) rangeland patches, and 2 of 8 (25%) center pivot patches, and none on CRP patches.

Table 1. Mountain Plover patch surveys where we observed plovers.

County	# Adult plovers	Habitat description
Banner	3	tilled pivot
Kimball	2	rangeland
Kimball	2	summer fallow, growing wheat
Kimball	2	summer fallow
Kimball	2	rangeland
Kimball	1	summer fallow, growing wheat
Cheyenne	1	rangeland
Kimball	1	summer fallow
Kimball	1	tilled pivot
Kimball	1	rangeland
Kimball	1	summer fallow, growing wheat

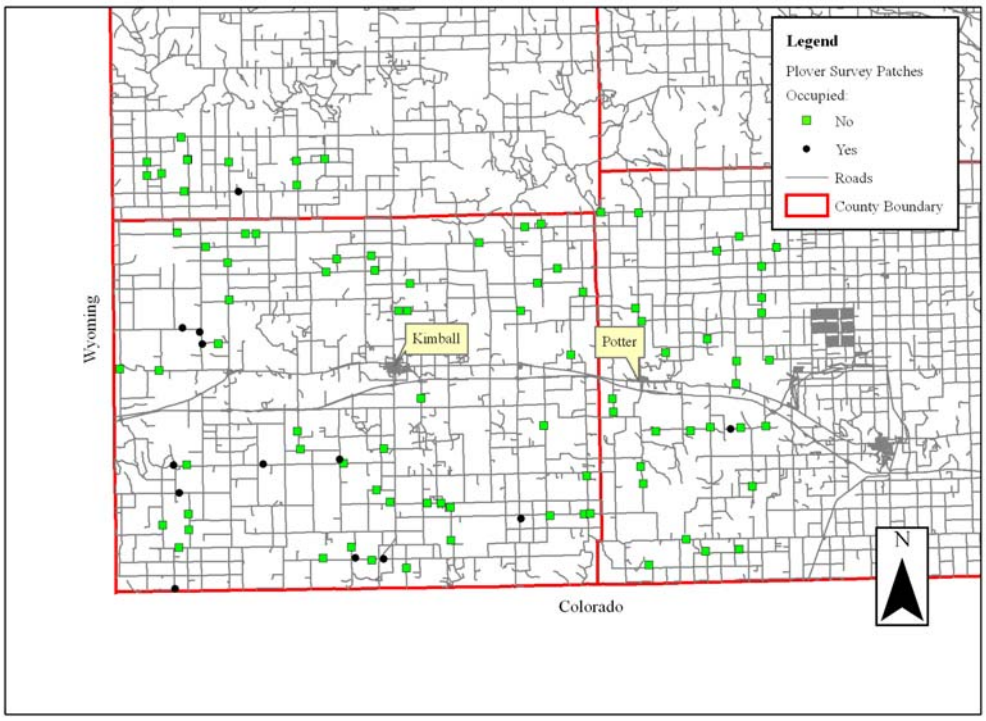


Figure 5. Plover patch survey occupancy.

Patch survey data, supplemented by incidental sightings and locations observed during nest searching, provide a snapshot of adult plover distribution in the 2005 breeding season. Taking all methods into account, a total of 126 adult Mountain Plover were recorded in Banner, Cheyenne and Kimball Counties during the breeding season. Of these sites, seventeen were incidental sightings or re-checks of previous sightings, ninety-two were located during nest

searching, and seventeen were observed during patch surveys. Seven birds sighted on patch surveys were likely associated with nearby nests, so a more conservative estimate is 119 plover.

Detection estimates for Mountain Plover before call playback were low (0.07), meaning that if it were known that a patch only harbored one plover, an observer had a 7% chance of detecting it without the playback on one visit (Table 2). Detectability increased with the use of the call playback (0.27), but is still a small enough percentage that repeated surveys are required to properly monitor this elusive bird (Table 2). Additional visits yield higher detectability estimates through the following equation:

$$P = 1 - (1 - D)^n$$

where P is your probability of detecting a bird after repeat surveys, D is your detectability estimate, and n is the number of repeat surveys. For example, if we knew there was one bird in our patch, and our detectability estimate was 0.27 and we did three repeat surveys, our probability of detecting the bird now improves to 0.61 instead of 0.27. This provides us with a significantly greater detectability estimate that is needed to properly monitor this bird.

Table 2. Parameter estimates from N-mixture model for Mountain Plover. Abundance is the number of birds using a site, detectability is the probability an individual bird on a site is detected. For plovers, detectability is a function of whether a call was played first or not. Values on the linear predictor scale use a log link for abundance and a logit link for detectability.

Mountain Plovers	Estimate (Linear Predictor Scale)	SE	Estimate (Response Scale)	Lower 95% CI	Upper 95% CI
Abundance	-1.33	0.21	0.26	0.17	0.40
Det(After Call)	-0.99	0.28	0.27	0.18	0.39
Det(Before Call)	-1.59	0.35	0.07	0.04	0.13

Nest Marking

We located 47 mountain plover nests on 23,485 acres, owned by 22 landowners (Table 3, Figure 6). All nests but 1 (on native rangeland) were located in dryland agricultural fields, where surveys were concentrated. Only 2 nests completely failed, 1 from depredation and 1 from accidental tillage, giving an apparent success rate of 80%. At 1 nest, we found 2 chicks that drowned or were suffocated by mud while hatching. The third chick apparently hatched during this storm and likely had a low probability of survival; however, because one chick hatched the nest was considered a success.

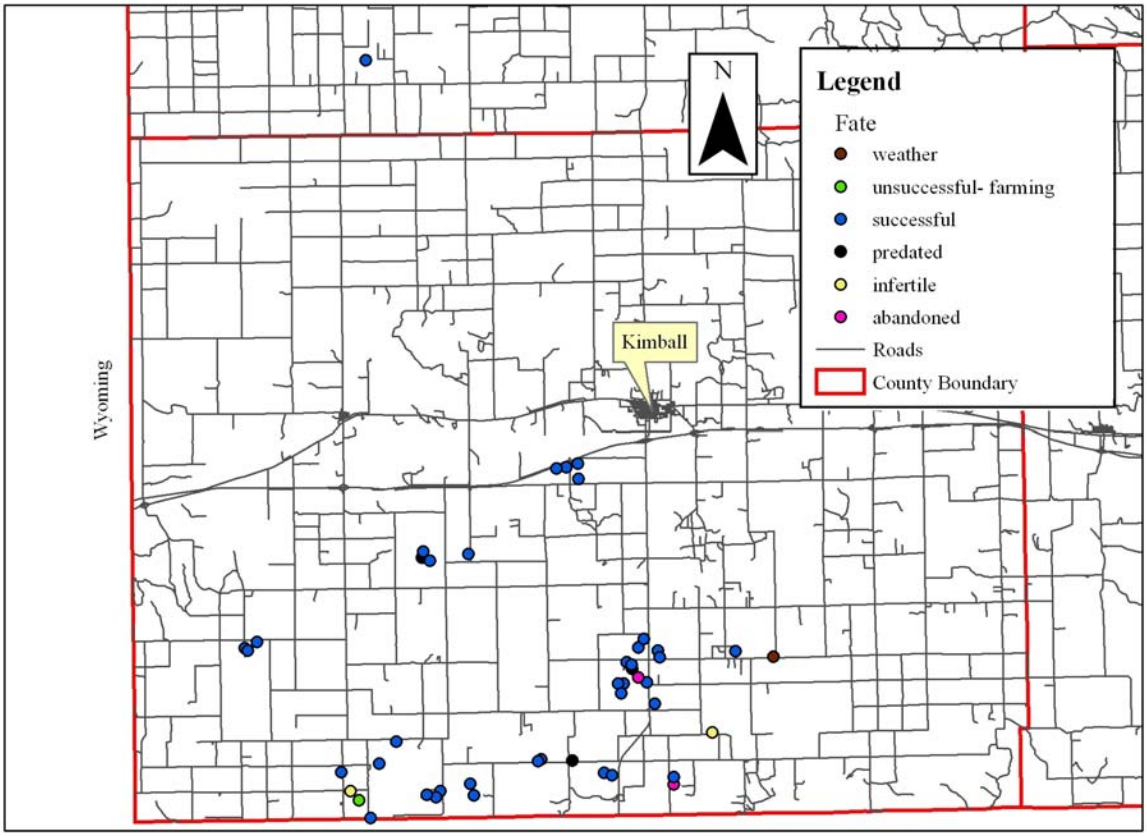


Figure 6. Plover nests located in 2005, with fates.

County	Nests Located		# Eggs Hatched	Number and Fate of Unsuccessful Nests				
	# Nests	# Successful		Abandoned	Predated	Rain	Cultivated	Unknown
Kimball	46	38	103	4	3	0	1	0
Banner	1	1	3	0	0	0	0	0
TOTAL	**47**	**39**	**106**	**4**	**3**	**0**	**1**	**0**

Table 3. Number of Mountain Plover nests located, hatching success, and fate of unsuccessful nests, 2005.

Nest Site Landscape Analysis

Nests were (mean ± SD) 583.5 ± 497.7 m from roads, 1116.2 ± 597.4 m from human habitation, and 835.6 ± 550.6 m from rangeland. Minimum distances to these features were 15 m from roads, and 185 m from human habitation, but the maximum distance of a nest from rangeland was 2169 m. The significant parameters were slope index and distance to human habitation (Table 4). Of interest was the direction of the association with nest sites and distance to human features, with nest sites on average being located farther from human habitation than random sites.

Table 4. Parameter estimates from logistic regression, use-availability and landscape-level analysis.

Term	Estimate	Std. Error	Chi Square	Prob>ChiSq
intercept	-1.6918	0.8763	3.73	0.0535
% range 14 ha	-0.0066	0.0949	0.00	0.9440
% irrig. 14 ha	-0.2024	0.2799	0.52	0.4697
% CRP 14 ha	0.0044	0.0274	0.03	0.8727
% range 1 mi.	-0.0007	0.0009	0.51	0.4749
% irrig. 1 mi.	0.0009	0.0021	0.20	0.6537
% CRP 1 mi.	-0.0009	0.0006	2.13	0.1440
slope index	**0.1652**	0.0589	7.85	**0.0051**
dist. to road	-0.0002	0.0005	0.14	0.7076
dist. to human	**0.0007**	0.0004	3.25	**0.0715**
dist. to range	0.0000	0.0004	0.01	0.9381

Discussion

Patch Surveys

Dryland agriculture patches harbored the lowest proportion of plovers among the three suitable habitat types (excluding CRP). The high proportion of pivots occupied is interesting, and warrants further investigation. However, our sample size of center pivots was limited, and therefore it is possible that the rate of use we observed was not representative. In most cases when selecting survey patches, flat areas of dryland agriculture were preferentially selected over center pivots, based on a previous supposition that plover seldom used center pivots. Plover may be using center pivots because these sites are often tilled and quite flat. Several plover were observed on rangeland patches where topography was more rolling than the topography associated with typical nest sites. It is uncertain whether plover merely forage under pivots and in rolling rangeland, or are also using these sites as nesting areas. These questions are something we wish to address in upcoming field seasons.

No plover were detected on only the third visit, suggesting that survey initiation was not too early in the season, and that three visits appear adequate for detecting Mountain Plover presence. The increased proportion of occupied patches (6.8% in 2004 vs. 11.5% in 2005) could be attributed to several different components, including more experienced observers, more plover inhabiting the area, quadrupled patch area in 2005, or random chance. It is difficult given the small number of occupied patches to determine which, if any, of these factors is influential.

The lack of aerial imagery before the 2005 field season made site selection less efficient, and reduced the number of patches we were able to sample. By using this imagery and topographic GIS layers in 2006, we will reduce the need for pre-survey ground-truthing, and thus perform more surveys in the same timeframe. Also, no plover were detected in northeast (north of I-80 and east of Highway 71) Kimball County or northwest (north of I-80) Cheyenne County. We have only detected two plover in this area in all previous years of surveying, so by excluding this area from 2006 surveys, we will allocate more effort in areas more likely to harbor plover.

Nest Marking Surveys

With two staff surveying fields instead of one person, we found more than double the number of nests. Extra staff and preliminary surveys was the likely cause of this nest marking increase, through the prioritization of acreage known to harbor plover for nest searching. It is believed that the majority of these nests would have failed as a result of farming-related disturbance. While 46% of Mountain Plover nests in Colorado agricultural fields survived a tillage event (Dreitz 2005), most operators in southwest Nebraska panhandle thoroughly work the topsoil, resulting in the surface being completely turned under and mixed with lower layers. We have not relocated the few Nebraska plover nests that have been farmed over, though broken nest marking lath was found and the former nest site searched thoroughly.

Nest Site Landscape Analysis

The results of our landscape analysis were not surprising, and reaffirmed the assertions of others (Graul 1975, Shackford 1991, Knopf 1996) that plover select flat, open areas for nesting. We currently do not feel confident enough to exclude areas for surveying based on this result, as it only indicates the direction of the effect, and not a specific suitability threshold value. The indication of an effect of proximity to human habitation is not presently addressed in existing literature, and should be re-examined when more data are accumulated.

Future Directions

For patch surveys, habitat suitability complicates survey site choice. While we can assess a potential survey location ahead of time via aerial imagery or ground-truthing, because of the high cost of diesel fuel many sites are not tilled during April or May, and thus never become suitable for plover. However, some sites are tilled and do become suitable. We will try to address this in 2006 by asking landowners whether they plan to use chemical fallow or mechanical tillage, when we ask for permission to conduct patch surveys.

Because our knowledge is lacking in regards to the precise habitat requirements for Mountain Plover in agricultural fields (*i.e.*, apparently suitable habitat is often vacant), and it is problematic to estimate the amount of acreage tilled or rangeland that possesses the necessary short vegetative structure, it is difficult to estimate the total amount of suitable habitat. Without this estimate it is difficult to calculate an estimate of Mountain Plover number by extrapolating observed densities to the larger landscape. However, it is possible to compare relative abundances among habitats. We intend to continue the nest-marking program, and also perform surveys on interior portions of rangeland to assess the extent of the plover population there. More suitable rangeland sites (than those present near roads) may exist on large rangeland parcels in southern and northwestern Kimball County, which we have not yet surveyed because of lack of road access.

We will also collect nest site vegetation for future analyses. Percent, height, and type of vegetative cover at the nest site, distance to growing wheat and to the nearest road are some measurements that are of interest for future analyses, since nest site characteristics often vary (Figures 7 and 8). While some nests end up surrounded by tall vegetation that was not likely present when the bird initiated the nest; this may obscure views of approaching predators. As the sample size of nests increase, nest site data will help us model nest survival and target fields with

optimal cover characteristics for the marking program. Our current sample of nests is heavily weighted with successful nests, which inhibits our ability to detect effects when modeling how nest location and landscape features influence the probability of nest predation. Another aspect of habitat suitability that could be easily evaluated is invertebrate prey sampling across habitats. An inexpensive technique using adhesive and small wooden stakes has been used to quantify invertebrate prey in different habitats for piping plovers (*Charadrius melodius*) (J. Kumer, personal communication).

Figure 7. Mountain Plover Nest #2 with binoculars as a reference object. Tall, dense volunteer clover surrounds the nest (between the 2 orange lath segments).

Figure 8. In contrast, Nest #8 (also between orange lath segments) has very sparse vegetation.

In 2006, we hope to age nests by floating eggs, which will allow us to calculate a Mayfield (Mayfield 1975) nest success estimate. The Mayfield method yields a more accurate estimate of nest success than apparent success based solely on nests found. Apparent success estimates are biased higher than the true success rate, because more successful nests have a higher probability of being found (because they are exposed longer) than nests that fail early.

BURROWING OWLS

Introduction

The Burrowing Owl is listed as a Tier 1 species in Nebraska because the species is imperiled or vulnerable in nearly all its range (Schneider *et al.* 2005). Burrowing Owls primarily inhabit black-tailed prairie dog (*Cynomys ludovicianus*) colonies in Nebraska (Desmond *et al.* 2000) and elsewhere (Plumpton and Lutz 1993, Murphy *et al.* 2001, Sidle *et al.* 2001, VerCauteren *et al.* 2001). These colonies have been reduced in over 90% of their historic continental range by eradication and introduced sylvatic plague (Miller et al. 1994). In Nebraska, Burrowing Owls breed and are most abundant across the entire panhandle (Sharpe *et al.* 2001).

Methods

Burrowing Owl surveys were primarily conducted from public roads in all 10 Nebraska panhandle counties- Banner, Box Butte, Cheyenne, Dawes, Deuel, Kimball, Morrill, Scotts Bluff, Sheridan, and Sioux. Approximately two-thirds of our previously (before 2005) known sites were surveyed, primarily those on which owls were observed in 2003 and/or 2004. Those survey sites were located by observations during other surveys and commutes, talking to local residents,

and from NGPC/University of Nebraska prairie dog records. Burrowing Owls were mainly surveyed at prairie dog colonies, but we also monitored some other mammal burrow complexes.

After surveys of previously known sites were complete, we used three GIS layers of prairie dog towns to target new locations in under-surveyed counties (Figure 11). These layers were compiled by the U.S. Forest Service, Nebraska Game and Parks personnel, and from aerial survey data. We used GIS maps to target areas where 1) the strongest evidence for a town or cluster of towns existed and 2) any extant towns were likely visible from public roads. We haphazardly drove public roads in late mornings and afternoons between owl surveys to locate new colonies, and when we located an active prairie dog town we returned to that location at a proper time and conducted a survey for Burrowing Owls.

Surveys were conducted in the mornings from sunrise to 1000 MST, and in the evenings from 1700 MST to sunset. Mornings and evenings correspond to the periods of greatest activity of Burrowing Owls around nest burrows (Haug and Oliphant 1990). We surveyed from 23 June (when juveniles began to be reliably detected above ground) to 22 July, when fledglings were seen flying well away from nest burrows. Weather conditions were recorded and surveys were postponed during heavy rains, dense fog and/or winds > 25 km/hour.

At each survey site, we navigated to previously selected points along the road that afforded the best visibility of the prairie dog town. For large colonies, we used multiple points to observe non-overlapping portions. Points were geo-referenced using Garmin etrex handheld Global Positioning System (GPS) units. At each point, we scanned the colony for owls using a spotting scope and/or binoculars for three minutes. We broadcasted a combination territorial and alarm calls for one minute, after which the colony was rescanned and any additional owls were recorded. Playbacks have been shown to increase Burrowing Owl detectability during point counts (Haug and Didiuk 1993, Conway and Simon 2004). We recorded all owls as either single or paired adults, or juveniles. In previous years we counted prairie dogs as a measure of activity, but it was observed that near dawn and dusk all prairie dogs on a site can be underground, while the next day there can be hundreds present on the same site. Therefore, numbers of active prairie dog mounds (as evidenced by raised, bare soil at the entrance) were recorded as a more reliable index of prairie dog activity. We also recorded the number of nest burrows based on adults going underground or clusters of juveniles present at one burrow.

An important modification to our protocol this year was the addition of repeat visits to a subsample (n=66) of our sites. All previous Burrowing Owl data was based on single visits, and we wanted to assess the variability between visits. We visited 60 sites twice, and 6 sites that had several adults but no juveniles the first 2 visits, 3 times. These repeated measure surveys were used to develop detectability and relative abundance estimates with the same N-mixture model used in developing the Mountain Plover detectability estimates.

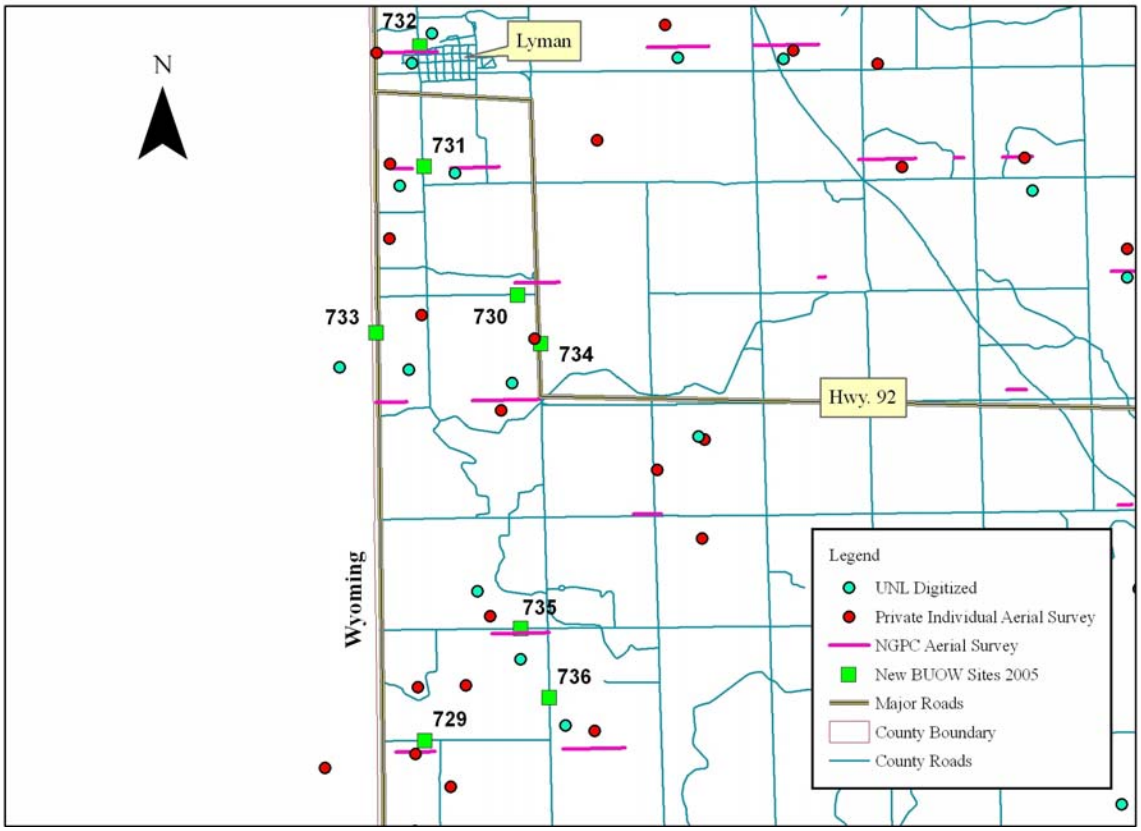


Figure 11. Portion of Scotts Bluff County where 3 layers of prairie dog geospatial data were used to locate new burrowing owl sites.

Burrowing Owl Site Visibility Assessment

Because Burrowing Owl survey points are nearly all roadside, we wished to ascertain the amount of area of sites we were unable to observe from the road. The inability to see large portions of a site could have important consequences for detectability of owls, such as an unknown quantity of false zeroes (recording a colony as harboring no owls, when it was really occupied).

For this assessment, we used 2003 Farm Services Agency aerial imagery and 2003 Burrowing Owl survey data to ensure temporal consistency. We first digitized the prairie dog town boundary in GIS, creating a polygon for each site. Based on our observations, 500 m is the maximum distance at which an observer can differentiate juvenile from adult owls. Therefore, a 500 m buffer was placed around our survey points. By intersecting this buffer with the prairie dog town polygons, we calculated the acreage of the town visible from our survey points. We then calculated the percentage of each site visible from the survey points by dividing the amount of the prairie dog town within the buffer by the total acreage of the site. We assigned sites into categories based on the percentage visible from our survey points: 0-25% (Category 1), 25-50% (2), 50-75% (3), 75-95% (4), 95-100% (5).

A qualification is that 2003 imagery was used, and that the prairie dog towns have likely changed since then. However, there is no reason to believe the change is nonrandom with respect to roads, so we feel this assessment is reasonably representative of current visibilities. The

estimates are also generous because they do not incorporate topography, where hills, drainages, and depressions limit visibility on many sites well short of 500 m.

Results

Burrowing Owl Surveys

We surveyed 183 sites for Burrowing Owls in 2005, 150 of which were previously surveyed in one or more years from 2001 to 2004. These sites were distributed among eight western Nebraska counties (Table 5), and nearly all of the sites were prairie dog colonies of varying activity levels, including abandoned or extirpated colonies. We observed 435 adults and 472 juveniles within these 183 sites. Notably, 17% of our sites harbored 58% of the owls.

Table 5. Results of 2005 Burrowing Owl surveys.

County	Adults	Juveniles	Juvenile-Adult Ratio	Number of Sites
Banner	9	12	1.33	4
Box Butte	83	60	0.72	40
Cheyenne	35	69	1.97	17
Dawes	36	22	0.61	11
Deuel	23	32	1.39	6
Garden	16	46	2.88	6
Kimball	12	18	1.50	5
Morrill	103	87	0.84	51
Sheridan	11	14	1.27	4
Scotts Bluff	74	88	1.19	27
Sioux	33	24	0.73	12
Total	435	472		183

An index of productivity is the observed juvenile-adult ratio. While counties have arbitrary political boundaries with no biological significance, they do provide a basis for regional comparisons. The two highest juvenile-adult ratios were observed in Cheyenne and Garden Counties, contiguous counties in the south-central panhandle where we had smaller numbers of sites. Much lower ratios (<1.0) were observed in Box Butte, Morrill, Sioux, and Dawes Counties. Box Butte and Morrill counties are contiguous counties in the central panhandle where roughly half our sites are located; Dawes and Sioux counties form the northwest corner of the panhandle and each have few sites. Therefore, we observed the highest productivity in the southern panhandle, with productivity decreasing with latitudinal increases. However, this does not take the number of sites into account, and our large sample size from Box Butte and Morrill Counties may be a more reflective ratio.

Results of the N-mixture model for adult and juvenile Burrowing Owl detection suggest that this species is more easily detected than Mountain Plover. Adult owls (0.60) were more easily detected than juvenile owls (0.42); however, when juveniles were detected at a site they were on average more abundant than adult owls (Table 6). Repeat surveys are again important for monitoring this species, because of issues related to detectability of juvenile owls (e.g. taller vegetation structure, increased time below ground, etc). In order to achieve more accurate productivity measures it is critical that we perform repeat surveys on these sites, since accurate

productivity estimates will allow us to meaningfully identify what biological, spatial, and landscape characteristics are important for increased Burrowing Owl productivity.

Table 6. Parameter estimates from N-mixture model for Burrowing Owl. Abundance is the number of birds using a site, detectability is the probability an individual bird on a site is detected. Values on the linear predictor scale use a log link for abundance and a logit link for detectability.

Adult Owls	Estimate (Linear Predictor Scale)	SE	Estimate (Response Scale)	Lower 95% CI	Upper 95% CI
Abundance	1.33	0.07	3.78	3.28	4.35
Detectability	0.42	0.15	0.60	0.53	0.67
Juvenile Owls					
Abundance	1.56	0.08	4.76	4.08	5.56
Detectability	-0.32	0.12	0.42	0.36	0.48

Figure 9 summarizes percentages of adults and juveniles over the last three years on all sites. Adults were observed on 70% of 183 sites in 2005, compared to 59% of 207 sites in 2004, 59% of 207 in 2003, and 70% of 155 in 2002. Juveniles were observed on 41.5% of the same sites in 2005, compared to 40% in 2004, 27.5% in 2003, and 44.5% in 2002. It is important to note the percentage with adults and juveniles may be skewed positively this year because of our decision to prioritize surveys on sites where we observed owls in 2003, 2004, or both, and also because we used the maximum number of owls seen on those with repeat visits.

Because not all sites are monitored each year, data from sites that have been visited in all 3 years yield the best comparisons. Figure 10 shows adult and juvenile numbers from sites monitored each year from 2003-2005.

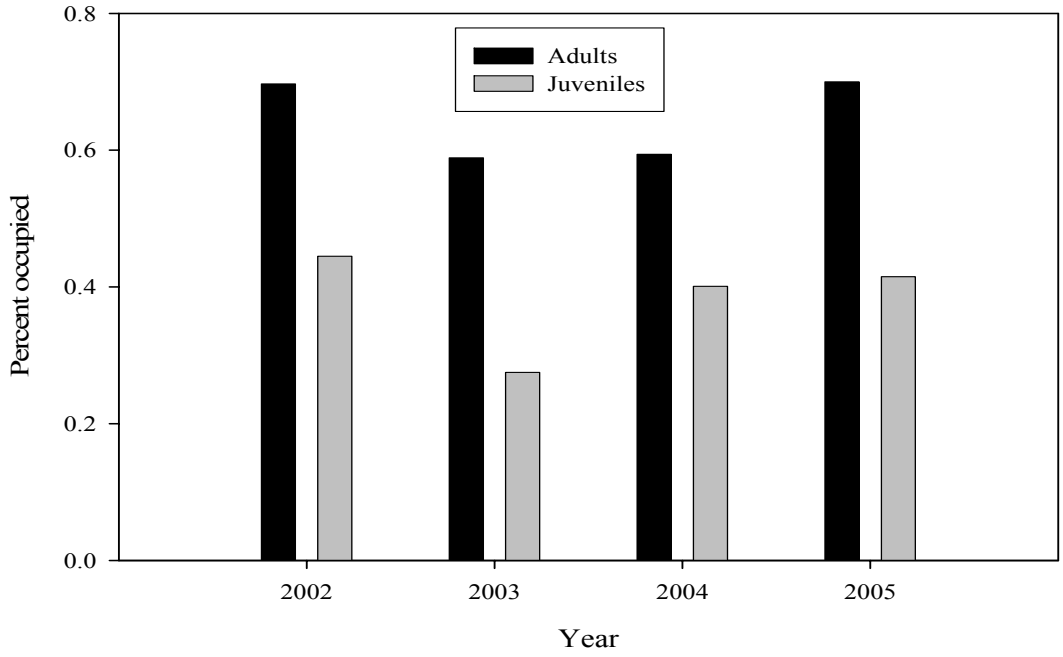


Figure 9. Percent adult and juvenile occupancy of all sites monitored in each year.

Of 142 sites where we observed Burrowing Owls in 2004 and revisited in 2005, 61.3% were reoccupied, compared to 80% from 2003-2004, and 69% from 2002-2003. Of 68 sites that were apparently vacant of owls in 2004 and surveyed in both 2004 and 2005, 10% (14) were newly occupied (or "colonized") in 2005, compared to a 31% "colonization" rate from 2003 to 2004. Of 94 sites that were monitored each year from 2002-2005, we detected owls on 46% (43) each year, 29% (27) in three of the four years, 10% (9) in two years, 12% (11) in one year. Only 4% (4) did not provide evidence of owl occupancy on any of the visits.

In addition to reoccupation of sites by Burrowing Owls, we investigated reoccupation of colonies by prairie dogs. Of 123 colonies that were active in 2004 and revisited in 2005, we considered 16% (20 towns) to have been extirpated since the last breeding season. The majority of these colonies were in two counties: 10 in Box Butte County and 6 in Morrill County. Of colonies active in 2003 and revisited in 2004, 14.5% were considered to be extirpated, and 12% were lost from 2002 to 2003 breeding season. Thirty-five percent of sites extirpated since the previous breeding season were still occupied by Burrowing Owls, compared to 50% in 2004 and 29% in 2003.

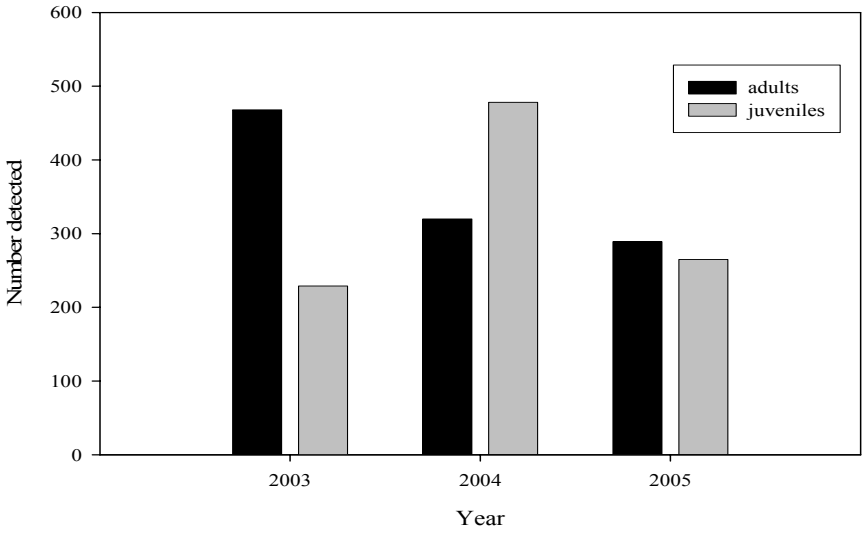


Figure 10. Adult and juvenile Burrowing Owl totals on 132 sites with 2003-2005 data.

New Sites

We surveyed 33 previously unknown sites, primarily by using prairie dog GIS layers to target areas of previously documented prairie dog towns. These news sites were distributed among 7 panhandle counties as follows: Cheyenne (3), Dawes (7), Deuel (6), Garden (5), Morrill (1), Scotts Bluff (9), and Sheridan (2). We sighted 78 adults and 136 juveniles on these sites, but nine of these sites were unoccupied at the time of our visit.

Burrowing Owl Site Visibility Assessment

The percent of a site visible from the road declined as the size of the town increased (Figure 12). Only 2 of 49 sites in the best visibility category (95%-100) were >100 ac. In the three lower visibility categories, 52 sites were >100 ac, and 20 were >300 ac. This indicates our measurement error, and thus abundance estimate variance, is higher for larger sites and lower for smaller sites.

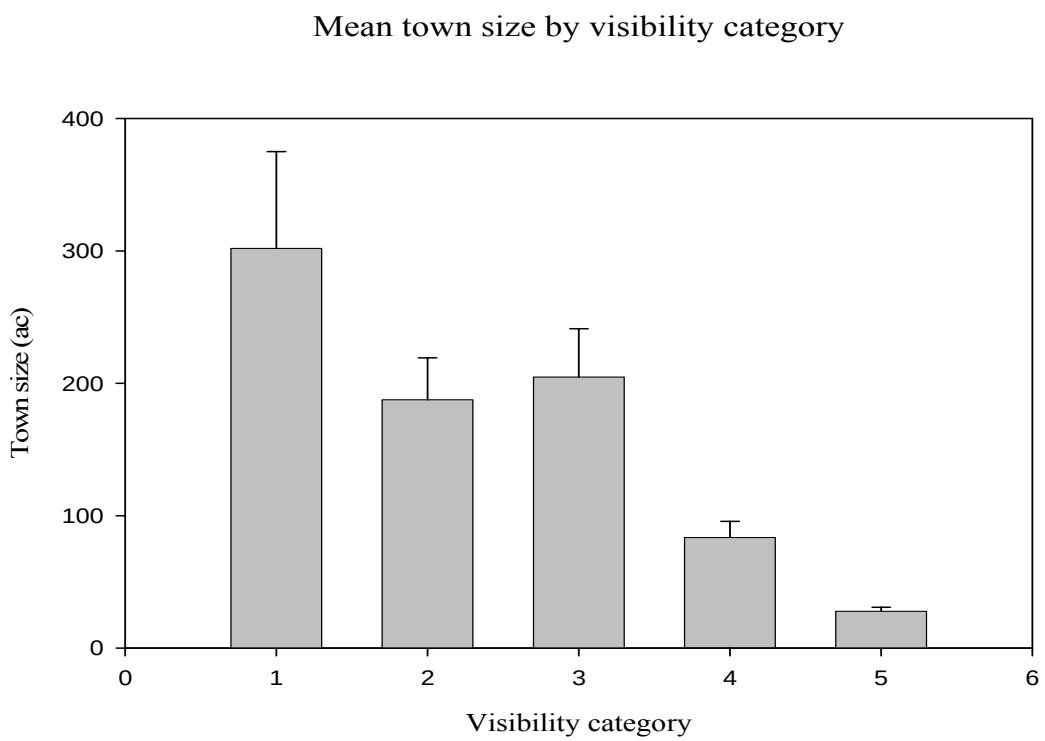


Figure 12. Distribution of town size by visibility categories.

Discussion

Burrowing Owl Surveys

Nebraska Prairie Partners Burrowing Owl surveys have been encouraging because we continue to see widespread use, and re-use, of prairie dog colonies by both adults and juveniles. Only a small fraction of the sites we have monitored over four years have never produced owl sightings. Also, nearly half of our sites are used every year. This may suggest that owls are exhibiting site fidelity, or that sites have favorable characteristics that attract owls each year. Burrowing Owls exhibit geographically variable site fidelity (Haug *et al*. 1993) and their tendencies in Nebraska are unknown.

Interpretation of abundances across sites is less straightforward because of the dramatic increase in precipitation in 2005 compared to previous years. This increase produced a corresponding increase in vegetation height. We noted at several sites that when adult Burrowing Owls landed in the grass they became obscured, and that any juveniles present could have been missed. This was a marked contrast to our monitoring in the previous 4 drought years (C. Carnine, pers. comm.), when vegetation was much shorter. In addition, prairie dogs were much more difficult to detect on some sites than others, and in some cases prairie dogs were only visible when sitting upright. Therefore, they too may have been present at sites but obscured.

In 2004 juvenile abundance was almost twice what it was in 2003, and we hoped this would produce a corresponding increase in adult abundance in 2005. However, this did not seem to occur (Figure 10). This may be related to a number of factors: wintering ground conditions, poor nesting conditions early in the season, or a shift to unsurveyed breeding sites. Other

possible causes are lower detectability from increased vegetation height in 2005, or variation due to different observers in each of the three years.

Our 59.4% occupancy rate is quite similar to that observed in other Burrowing Owl studies on prairie dog colonies. Sidle *et al*. (2001) found Burrowing Owls occupied 55% of their sites on Forest Service lands throughout the Great Plains, and Ekstein (1999) recorded occupancy of 59% on 97 colonies in western Nebraska in 1996-97.

Burrowing Owl Landscape Assessment

Results indicate we have been obtaining more accurate data from portions of towns near roads, or sites entirely visible from roads. This could negatively or positively influence the numbers we are seeing, depending if Burrowing Owls prefer or avoid these parts of towns. Otherwise stated, a positive or negative road bias may exist. Burrowing Owls were frequently observed perched on fence posts (which often border roadsides), and automobile collision during nocturnal hunting forays has been cited as a significant source of mortality (Haug et al. 1993).

Future Directions

Aerial imagery is crucial when planning surveys, so we can visualize the full extent of towns and add new points if needed. Parts of some sites were accessible but unknown, and at some sites it appears an adjacent road would provide an additional or better vantage point. Interior access to prairie dog towns would allow us to 1) get more accurate estimates of owl numbers 2) accurately measure town size, vegetation height, and other local variables 3) accomplish outreach simultaneously and 4) quantify road bias, which is an important methodological consideration for surveying Burrowing Owls on private lands range-wide. In addition, multiple visits are necessary to accurately quantify the numbers of adult and juvenile owls inhabiting a given town.

In 2006, we plan to conduct a subset of interior versus roadside surveys for Burrowing Owl to quantify road bias and help address our concerns about not seeing the entire town and documenting false zeros. We will also conduct repeated visits to these towns. More accurate information on town use will help us better quantify local and landscape variables that may be influencing Burrowing Owl use and productivity. We also plan to conduct more extensive analyses on towns that have been occupied since Burrowing Owl surveys were initiated through this partnership in 2002.

We recommend in the future visiting a subset of Burrowing Owl sites in April to see how many pairs establish nesting territories, and compare that to how many are present in late June-July. It is not known if adult Burrowing Owls that are unsuccessful before we visit the sites in late June or July are still present, or have moved off the site. If unsuccessful adults move off site, our productivity (juvenile-adult ratio) estimates will be biased high. For example, if two pairs started the season but one pair was unsuccessful and left, and the remaining pair (which we observed) produced 4 young then the juvenile-adult ratio would be 2:1 instead of 1:1.

FERRUGINOUS HAWK

Introduction

Ferruginous Hawks are listed as a Tier 1 species in Nebraska because the species is imperiled or vulnerable in nearly all of its range (Schneider *et al.* 2005). The species is thought to be declining in many regions, but data are insufficient to estimate a range-wide trend (Bechard and Schmutz 1995). Nebraska Prairie Partners has been tracking many current and historical Ferruginous Hawk nest sites for five years. Landowner outreach is performed in association with these surveys to encourage nest stewardship and to learn of new nest locations.

Methods

In 2005, we took a new approach to Ferruginous Hawk nest inventories, opting to search new areas for birds rather than visit many currently inactive sites. We chose a flight path over previously unsurveyed locations in Box Butte, Sheridan, Morrill, Scotts Bluff and Sioux Counties. Flights were conducted from 0830-1100 on May 24 and June 7. The passenger was the primary nest searcher and the pilot assisted. When a nest was sighted, we recorded its coordinates and made another pass at a closer distance to examine it more carefully. An important addition to this year's monitoring was the georeferencing of the flight path. During the flights, we recorded points at intervals with a handheld GPS unit so the flight path could be reconstructed in GIS (Figure 13). Also, because Ferruginous Hawks can nest on the ground (Bechard and Schmutz 1995) and have recently done so in the Nebraska Sandhills (M. French, pers. comm.), we also searched hilltops for nests. In addition to flights, we performed ground checks on all Ferruginous Hawk nest sites known to be active in 2004. We walked or drove near each nest (but at least 200m away to avoid disturbance) and recorded presence of adults or chicks.

Ferruginous Hawk Nest Site Characterization

While we have quantified nest sites of Ferruginous Hawks based on on-the-ground estimates, we wished to more formally quantify the nest sites based on aerial imagery. We used the aforementioned 2003 FSA imagery to calculate percentage of rangeland and agriculture within one mile of nest, presence of prairie dog towns within one mile of the nest, and distance to roads and human habitation for recently (within the past 2 years) active nests. Two recently active nests straddle the Colorado border, and since we do not have imagery for Colorado, those nests were excluded from this exercise.

Results

Ferruginous Hawk Surveys

We observed a very low density of all raptor species' nests during flights, and could not confirm any new Ferruginous Hawk nests, despite the apparent suitability of much of the habitat. We located two Swainson's Hawks and one Golden Eagle nest, while two other nests were unoccupied at the time of the on-the-ground follow-up visits.

As a result of ground nest checks of active Ferruginous Hawk nests in 2004, 12 were confirmed active (Table 7), with 8 likely successful, since they had chicks close to fledging in late June. At least one nest was confirmed to have failed when the nest blew from a tree. These numbers are similar to past years, despite the addition of new nesting areas to our surveys.

Ferruginous Hawk Nest Site Characterization

The mean percentage of rangeland within 1 mile of nests was 86.9% ± 5.3, mean distance to a road was 1423.8m ± 227.3, and mean distance to human habitation was 2055.2m ± 228.4. As noted in previous years, most nests are in a landscape matrix of >90% rangeland. Five nests had greater amounts of agriculture within a mile of the nest, ranging from 18.1% for a Dawes County nest to 73.4% for a Kimball County nest. All nests but one were at least 1 km from human habitation. Nest sites were less clearly situated with regard to roads, where six were within a kilometer of a road, and 4 were less than 0.5 km from a road (Table 8).

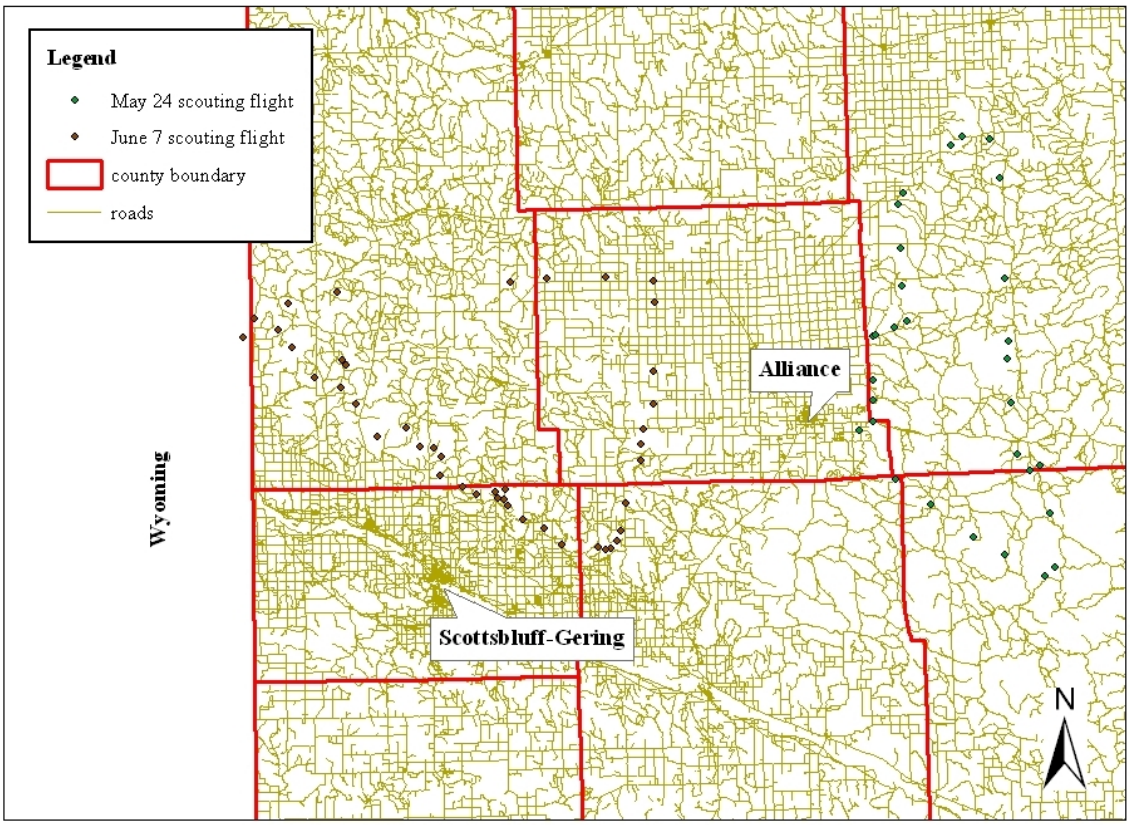


Figure 13. The flight paths of our 2005 raptor nest searching flights.

Table 7. Ferruginous Hawk nests checked in 2005.

Nest #	County	Substrate	Status
FH114	Box Butte	Rock outcrop	Active with chicks
FH305	Dawes	Lone tree	Unknown if FEHA; access not secured
FH306	Dawes	Lone tree	2 adults and older chicks
FH502	Kimball	Lone tree	1 adult, 2 chicks
FH508	Kimball	Lone tree	1 adult, ≥1 chick
FH520	Kimball	Lone tree	1 adult, 3 chicks
FH521	Kimball	Lone tree	2 adults present
FH523	Kimball	Lone tree	Active with chicks
FH524	Kimball	Lone tree	**New nest**; active in May

FH601	Morrill	Lone tree	Occupied by Great Horned Owls
FH602	Morrill	Lone tree	Active with ≥2 chicks
FH603	Morrill	Lone tree	2 adults; no chicks observed
FH604	Morrill	Lone tree	Active with 3 chicks near fledging
FH923	Sioux	Lone tree	Active but blew from tree; unsuccessful
FH929	Sioux	Rock outcrop	Active; 1 adult, 1 chick
FH934	Sioux	Rock outcrop	Inactive

Table 8. Characteristics of panhandle Ferruginous Hawk nest sites.

Nest #	County	% range 1 mile	% agr. 1 mile	distance to road (m)	road type	distance humans (m)
FH114	Box Butte	50.7%	49.3%	126	paved	737
FH305	Dawes	71.2%	28.8%	1768	unpaved	1881
FH306	Dawes	95.7%	4.3%	210	paved	1722
FH502	Kimball	97.8%	2.2%	2550	unpaved	1629
FH508	Kimball	77.3%	22.7%	1538	unpaved	1258
FH523	Kimball	81.9%	18.1%	927	unpaved	2525
FH524	Kimball	26.6%	73.4%	1188	unpaved	1855
FH601	Morrill	100.0%	0.0%	1787	unpaved	1311
FH602	Morrill	100.0%	0.0%	2710	paved	3787
FH603	Cheyenne	100.0%	0.0%	546	paved	1369
FH605	Morrill	100.0%	0.0%	1685	paved	1689
FH905	Sioux	98.5%	1.5%	427	unpaved	3608
FH923	Sioux	95.5%	4.5%	474	unpaved	1481
FH926	Sioux	100.0%	0.0%	2392	unpaved	3359
FH929	Sioux	96.8%	3.2%	1597	unpaved	1702
FH934	Sioux	98.7%	1.3%	2856	unpaved	2970

Discussion

Ferruginous Hawk Surveys

Of the 3 species Nebraska Prairie Partners monitors, Ferruginous Hawks exhibit the lowest population density. Research on other Ferruginous Hawk populations indicates suitable nest sites and food are probably the most limiting factors on breeding grounds (Schmutz and Hungle 1989, Bechard and Schmutz 1995). Fledging success and even the decision by pairs of whether or not to nest was tied to prey cycles (Bechard and Schmutz 1995). The relative importance of various prey species to Ferruginous Hawks in Nebraska is unknown. Knowledge is also lacking in what constitutes a suitable nest site, what threshold of human disturbance causes nest abandonment, and what densities of prey species are necessary for successful reproduction.

The low sample size of active, known nests in any given year precludes meaningful analyses of factors affecting productivity at this time. While sighting chicks in the nest is a

favorable indication it is no guarantee of fledging success. We are unsure of the current, relative impacts of predation, weather-related mortality (including heat stress), accidental poisoning, or cannibalism/fratricide on this species' fledging success in Nebraska. Carlson (unpubl. report) documented ≥35% chick mortality at northern panhandle nests in 1984 from various causes.

Spatial and temporal variation in Ferruginous Hawk abundance, distribution, and productivity cannot be well understood without understanding prey dynamics. Prey availability has been shown to be extremely important in other parts of the species' range, where Schmutz and Hungle (1989) found Ferruginous Hawk breeding population density and fledging success positively correlated with ground squirrel abundance, and Smith and Murphy (1978) reported that 89% of pairs nested with high prey availability, but only 43% nested with low prey availability.

Prey remains were collected at 38 panhandle nests by NGPC personnel from 1976-1986 (Table 9). Remains were classified as pocket gopher (likely plains pocket gopher, *Geomys bursarius*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), western meadowlark, jackrabbit (*Lepus* spp.), eastern cottontail (*Sylvilagus floridanus*) and lagomorph (*Lepus* or *Sylvilagus* sp.). Two mice/voles, 10 passerine, and 3 reptile remains were also found, but not included below because they are small items with difficult-to-estimate biomass. For mass estimates, we used midpoint of the range given for each species in Whitaker (1997) except for western meadowlark (from Lanyon 1994). Lagomorph mass is average of cottontail and jackrabbit estimates.

Table 9. Biomass of prey items taken from panhandle Ferruginous Hawk nests in the 1970-1980s.

Species	**Mass (g)**	**Frequency**	**Total biomass (g)**
Plains pocket gopher	240	20	4800
Thirteen-lined ground squirrel	190	15	2850
Western meadowlark	102	7	714
Lagomorph sp.	2200	4	8800
Cottontail	1350	3	4050
Black-tailed prairie dog	1130	3	3390
Jackrabbit (*Lepus* spp.)	3050	2	6100

An initial conclusion is that pocket gophers and ground squirrels are the most important dietary component; however, much of the total biomass is provided by rabbits. It would be useful to understand what influences populations of important prey species, which in turn likely affect Ferruginous Hawk productivity.

Ferruginous Hawk Nest Site Characterization

Our previous assessment of Ferruginous Hawk nests was accurate. Nests typically are located in landscapes with high proportions of rangeland, and far from human habitation. Nests seem to be more variable in terms of placement with regard to roads.

Future directions

Limiting factors for Ferruginous Hawks in the panhandle may be related to prey availability and nest sites. We are directly aiding with the conservation of nest sites by

prolonging the life of known nest trees with nest tree cribs (described in the Habitat Conservation section), and informing landowners of the species' vulnerability to disturbance during incubation.

Prey availability is something we currently know little about in western Nebraska, yet that knowledge is crucial to understanding the ecology of any raptor. The collection of prey remains would be informative. Previous NGPC data consist of 1-5 items per nest- a small fraction of the total consumed. We are unsure if this number could be improved upon with post-breeding visits; scavengers may carry off or consume remains. However, any more current sample would be useful for informal comparisons among nests of varying types- those in a matrix with a substantial agriculture component, those in the Sandhills, and those in large, contiguous areas of non-Sandhills rangeland.

SECTION SURVEYS

Introduction

Conservationists should devote attention to species that are currently relatively common to ensure they remain such. This idea is an explicit component of the Partners in Flight (PIF) mission (Rich et al. 2004). The most widespread surveys we conduct are Section Surveys, which target common bird species that use grassland and agricultural habitats during the breeding season (May-June).

The Section Survey design is simple to implement logistically because the majority of land in the Great Plains is divided and mapped by section, and country roads tend to be built along the edges of sections. Data collection by section is also conducive to management, since most land holdings correspond to section boundaries. Section surveys are useful for identifying the distribution and relative abundance of conspicuous species. They are also an important means of locating breeding areas for numerous shortgrass prairie birds of concern including: Swainson's (*Buteo swainsonii*) and Ferruginous Hawks, Upland Sandpiper (*Bartramia longicauda*), Long-billed Curlew (*Numenius americanus*), Loggerhead Shrike (*Lanius ludovicianus*), Brewer's (*Spizella breweri*) and Grasshopper (*Ammodramus savannarum*) Sparrows, and McCown's (*Calcarius mccownii*) and Chestnut-collared (*C. ornatus*) Longspurs.

Methods

Section Surveys were conducted on native shortgrass prairie (n = 406) and dryland agriculture (n = 44) habitats in eighteen northwestern counties of Nebraska (Figure 14). The sample unit for surveying grassland birds was the section (approximately 259 ha). The 44-dryland agriculture sections are hereafter collectively referred to as "cropland". The number of sections to survey was determined mainly by funding constraints and expected species composition for the two habitat types (based on earlier prairie Section Surveys in Nebraska and preliminary cropland surveys in Colorado). Funding allowed for the hiring of 2 technicians, and 450 was the estimated total number of sections that they could complete. The majority of sections were placed in native habitats due to greater species richness in this habitat. A lower number of samples were allocated to cropland habitats because of lower species richness, while maintaining a large enough sample to obtain an adequate number of detections for density analyses.

Candidate sections for surveys were identified in ArcView GIS (Geographic Information System, ESRI Inc. 1999) using digital maps of land-use/land-cover, multi-resolution land characteristics, native vegetation, and public land surveys acquired from the United States Geological Survey and the Conservation and Survey Division of the University of Nebraska. Sections were considered candidates for surveys if they contained 243 – 283 ha of native shortgrass prairie, shortgrass/mixed-grass mosaic, or shrubs. This size range allowed for odd-shaped sections to be included and those that contained lakes, buttes, or other small anomalies inside. Surveyed sections were randomly selected from these candidates using programming in Quattro Pro and Excel. Because Section Surveys are road-based, any random section without a road on its perimeter could not be used. In addition, after ground-truthing, some random sections contained large areas (> 16 ha) of cultivation, CRP (ungrazed, usually non-native, CRP fields), or forests. In these cases, the closest suitable candidate section was used as an alternate. The number of sections surveyed in each county was roughly proportional to the amount of shortgrass prairie that was present and its accessibility (counties with higher road density generally allowed

for greater proportions of candidate sections to be surveyed). In 2001, 180 sections were surveyed in five counties. These same sections were surveyed in 2002, as well as 45 additional sections in three new counties. In 2003, 451 randomly selected sections were surveyed, including 135 from previous years (410 native shortgrass prairie sections and 41 cropland sections). In 2004, 450 sections were surveyed.

In 2005, 447 sections were surveyed in 18 counties including: Banner, Box Butte, Chase, Cherry, Cheyenne, Dawes, Deuel, Dundy, Garden, Hayes, Keith, Kimball, Lincoln, Morrill, Perkins, Scotts Bluff, Sheridan, and Sioux. Sections were surveyed from 15 May through 3 July 2004, to encompass the main period of breeding activity in grassland birds. The start date was determined by the widespread arrival and courtship displays of late-breeding species like Lark Buntings. Surveys were terminated when birds started congregating in post-breeding flocks and the frequency of courtship displays was notably reduced. Each section was surveyed using three roadside point counts, with five minutes of observation time at each point. Hanni (2001) determined that three point counts was optimum for grassland bird surveys. Point locations were at tenths of a mile, between 0.1 and 0.9 miles, along a section line, and were determined using random-number tables. The minimum distance between points was 0.2 miles (320m) to maximize independence of observations. The geographic coordinates for each point were determined using a Garmin etrex global positioning system (GPS) unit.

Surveys were conducted from sunrise to 1000 MST when bird activity, and thus detectability, was highest. Weather conditions were recorded and surveys were postponed during heavy rains, dense fog and/or winds > 29 km/hour. All birds seen or heard within the survey section (180 degree field of view from the observer) during the five-minute period were recorded, along with their distance from the observer (measured using a Bushnell Yardage Pro 500 Rangefinder) and the habitat they were using at first sighting (including ground, shrub, fence, road, tree, homestead, stock tank, or flying). A departure in the bird data collection protocol from previous years was that starting in 2004, we now treat 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. 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. The observer then looks over to that bird, and as a result, detects a second individual. The resulting observation is recorded as one detection with a cluster 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. Local vegetation conditions at each point were quantified by estimating the percent cover of grass in two height categories thought to be important to prairie birds (> and < 15cm) in the section and the ditch, the percent cover of all shrubs, and the dominant shrub species.

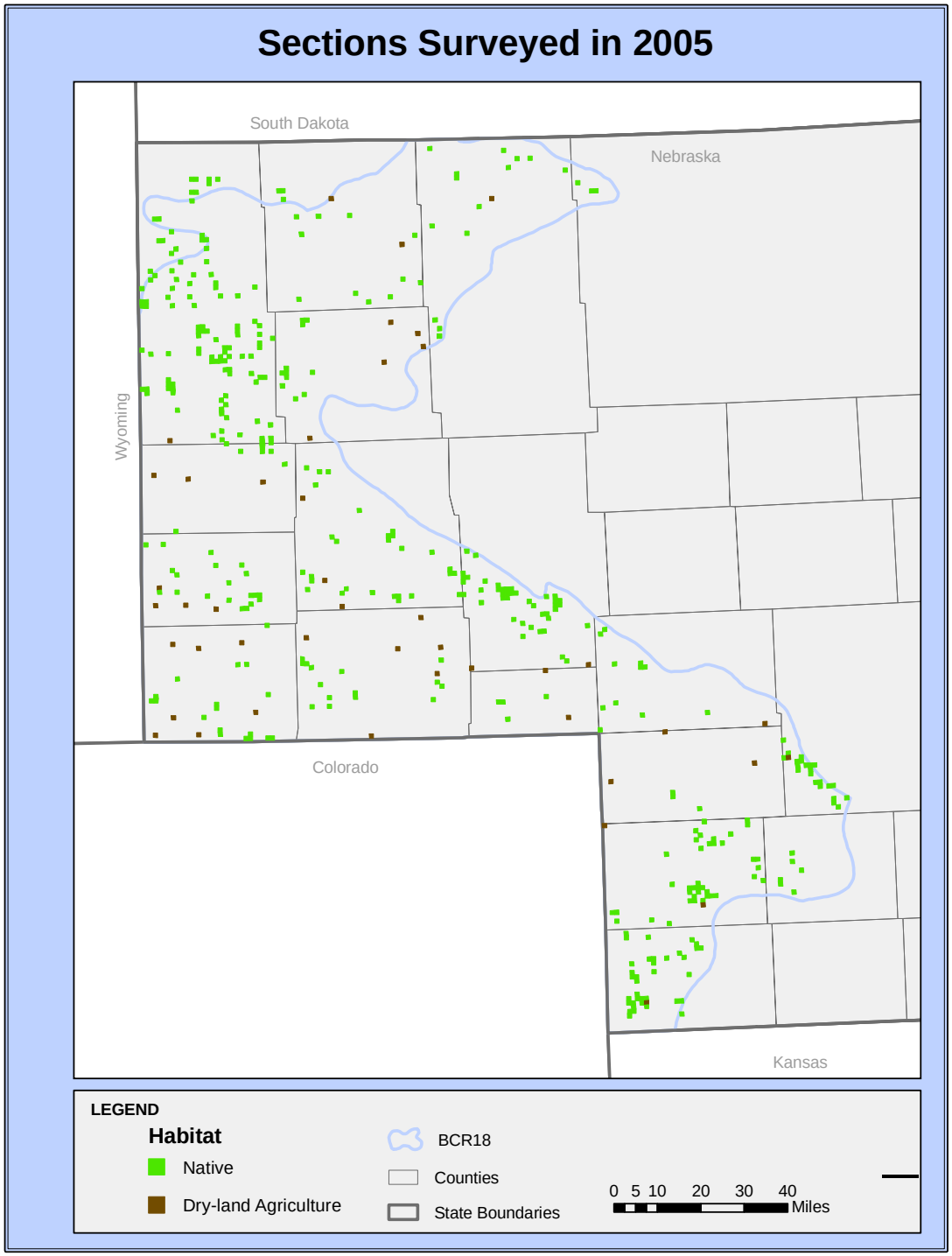


Figure 14. Sections surveyed in 2005.

Section Survey data were entered into an Access database and densities were estimated using Program Distance 5.0 software (Thomas 1998-99). Buckland et al. (1993) developed the notation, concepts, and analysis methods of Distance, which assigns a unique detection function

to each species dataset, thus avoiding some potential problems associated with traditional analyses of point counts (e.g. varying detectability among habitats, species, and years). No flyover detections were used in the DISTANCE analysis [except for swallows, raptors and common night hawk (*Chordeiles minor*)]. In 2004 and 2005 density estimates were obtained using cluster analysis. We evaluated the fit of detection models using uniform, half-normal and hazard-rate key functions with cosine, simple polynomial, and hermite polynomial parameter adjustments. Assumptions for density analyses using DISTANCE are: 1) all birds at distance = 0 are detected; 2) distances to birds close to points are measured accurately; and 3) birds do not move in response to the observer's presence. For our analyses, densities were calculated only for those species that had a minimum of 20 observations, or had a coefficient of variation less than 50%, indicating robust data. Species distribution and relative abundance were assessed using maps created in Arc Map. These data were incorporated into a larger shortgrass prairie bird database maintained by RMBO, and were also submitted to the Nebraska Natural Heritage Program.

Results

We surveyed 447 random sections in 2005, totaling 1,335 point-counts (Figure 4). These sections were slightly clustered in some counties because of road availability or limited amounts of native prairie. We observed 9,733 birds of 87 species (Table 8). We provide density estimates for 35 species in native grassland habitats and 7 species in cropland habitats (Figures 15-17). Horned Lark density was overall the highest in native grassland, followed by Grasshopper Sparrow and Western Meadowlark densities. Horned Lark density again was overall the highest in cropland, followed by Grasshopper Sparrow and Red-winged Blackbird densities.

Table 8. Bird species and the number of individuals observed on 447 sections (403 shortgrass prairie and 44 cropland) during 2005 Section Surveys.

Common Name	Scientific Name	Prairie	Cropland	Total
Wood Duck	*Aix sponsa*	2	1	3
Gadwall	*Anas strepera*	0	2	2
Mallard	*Anas platyrhynchos*	13	6	19
Blue-winged Teal	*Anas discors*	0	1	1
Northern Pintail	*Anas acuta*	0	3	3
Green-winged Teal	*Anas crecca*	1	0	1
Ring-necked Pheasant	*Phasianus colchicus*	73	10	83
Greater Prairie-Chicken	*Tympanuchus cupido*	8	0	8
Wild Turkey	*Meleagris gallopavo*	2	0	2
Northern Bobwhite	*Colinus virginianus*	7	0	7
Great Blue Heron	*Ardea herodias*	1	0	1
Turkey Vulture	*Cathartes aura*	14	0	14
Northern Harrier	*Circus cyaneus*	8	0	8
Cooper's Hawk	*Accipiter cooperii*	1	0	1
Swainson's Hawk	*Buteo swainsoni*	14	3	17
Red-tailed Hawk	*Buteo jamaicensis*	23	1	24
Ferruginous Hawk	*Buteo regalis*	2	0	2
Golden Eagle	*Aquila chrysaetos*	3	0	3
American Kestrel	*Falco sparverius*	38	2	40

Peregrine Falcon	*Falco peregrinus*	1	0	1
Prairie Falcon	*Falco mexicanus*	1	0	1
Killdeer	*Charadrius vociferus*	42	20	62
American Avocet	*Recurvirostra americana*	0	1	1
Lesser Yellowlegs	*Tringa flavipes*	0	1	1
Willet	*Catoptrophorus semipalmatus*	2	3	5
Upland Sandpiper	*Bartramia longicauda*	38	1	39
Long-billed Curlew	*Numenius americanus*	34	0	34
Wilson's Phalarope	*Phalaropus tricolor*	0	1	1
Rock Pigeon	*Columba livia*	2	10	12
Mourning Dove	*Zenaida macroura*	823	140	963
Great Horned Owl	*Bubo virginianus*	1	0	1
Burrowing Owl	*Athene cunicularia*	30	1	31
Common Nighthawk	*Chordeiles minor*	35	0	35
Chimney Swift	*Chaetura pelagica*	0	4	4
Broad-tailed Hummingbird	*Selasphorus platycercus*	2	0	2
Red-headed Woodpecker	*Melanerpes erythrocephalus*	8	1	9
Northern Flicker	*Colaptes auratus*	2	1	3
Western Wood-Pewee	*Contopus sordidulus*	3	0	3
Say's Phoebe	*Sayornis saya*	21	2	23
Cassin's Kingbird	*Tyrannus vociferans*	11	0	11
Western Kingbird	*Tyrannus verticalis*	222	19	241
Eastern Kingbird	*Tyrannus tyrannus*	71	7	78
Loggerhead Shrike	*Lanius ludovicianus*	28	12	40
Warbling Vireo	*Vireo gilvus*	1	0	1
Blue Jay	*Cyanocitta cristata*	0	1	1
Black-billed Magpie	*Pica hudsonia*	2	1	3
American Crow	*Corvus brachyrhynchos*	8	3	11
Horned Lark	*Eremophila alpestris*	1936	280	2216
Tree Swallow	*Tachycineta bicolor*	1	0	1
Violet-green Swallow	*Tachycineta thalassina*	3	0	3
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	21	3	24
Bank Swallow	*Riparia riparia*	24	1	25
Cliff Swallow	*Petrochelidon pyrrhonota*	110	5	115
Barn Swallow	*Hirundo rustica*	89	9	98
Rock Wren	*Salpinctes obsoletus*	27	2	29
House Wren	*Troglodytes aedon*	6	1	7
Mountain Bluebird	*Sialia currucoides*	2	0	2
American Robin	*Turdus migratorius*	30	20	50
Northern Mockingbird	*Mimus polyglottos*	19	1	20
Sage Thrasher	*Oreoscoptes montanus*	1	0	1
Brown Thrasher	*Toxostoma rufum*	9	1	10
European Starling	*Sturnus vulgaris*	59	12	71
Yellow Warbler	*Dendroica petechia*	3	0	3
Spotted Towhee	*Pipilo maculatus*	1	0	1
Cassin's Sparrow	*Aimophila cassinii*	51	0	51
Brewer's Sparrow	*Spizella breweri*	3	3	6

Field Sparrow	*Spizella pusilla*	1	0	1
Vesper Sparrow	*Pooecetes gramineus*	19	0	19
Lark Sparrow	*Chondestes grammacus*	421	11	432
Lark Bunting	*Calamospiza melanocorys*	689	47	736
Grasshopper Sparrow	*Ammodramus savannarum*	604	29	633
McCown's Longspur	*Calcarius mccownii*	37	4	41
Chestnut-collared Longspur	*Calcarius ornatus*	158	0	158
Blue Grosbeak	*Passerina caerulea*	19	4	23
Dickcissel	*Spiza americana*	50	14	64
Bobolink	*Dolichonyx oryzivorus*	13	2	15
Red-winged Blackbird	*Agelaius phoeniceus*	115	84	199
Western Meadowlark	*Sturnella neglecta*	2097	97	2194
Brewer's Blackbird	*Euphagus cyanocephalus*	27	2	29
Common Grackle	*Quiscalus quiscula*	129	67	196
Brown-headed Cowbird	*Molothrus ater*	216	14	230
Orchard Oriole	*Icterus spurius*	43	1	44
Bullock's Oriole	*Icterus bullockii*	35	0	35
Baltimore Oriole	*Icterus galbula*	6	0	6
House Finch	*Carpodacus mexicanus*	5	0	5
American Goldfinch	*Carduelis tristis*	18	3	21
House Sparrow	*Passer domesticus*	16	12	28

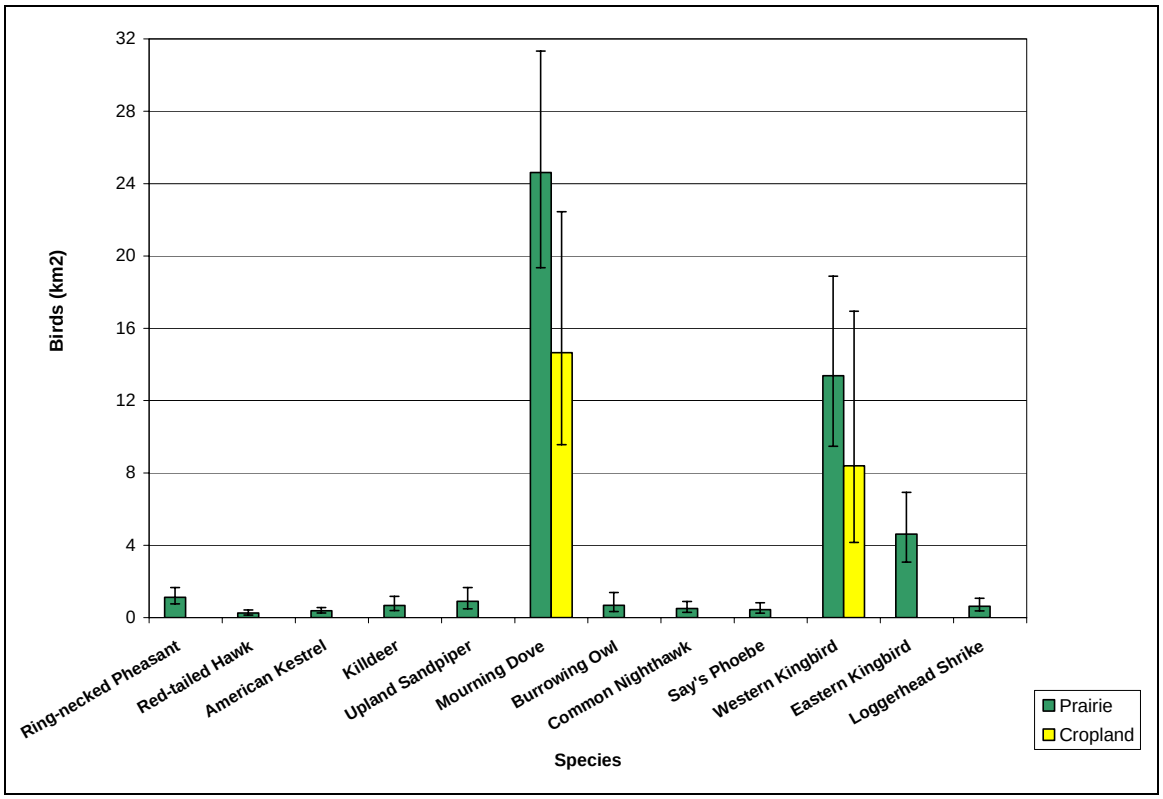


Figure 15. Densities, by habitat type, of species detected on Section Surveys.

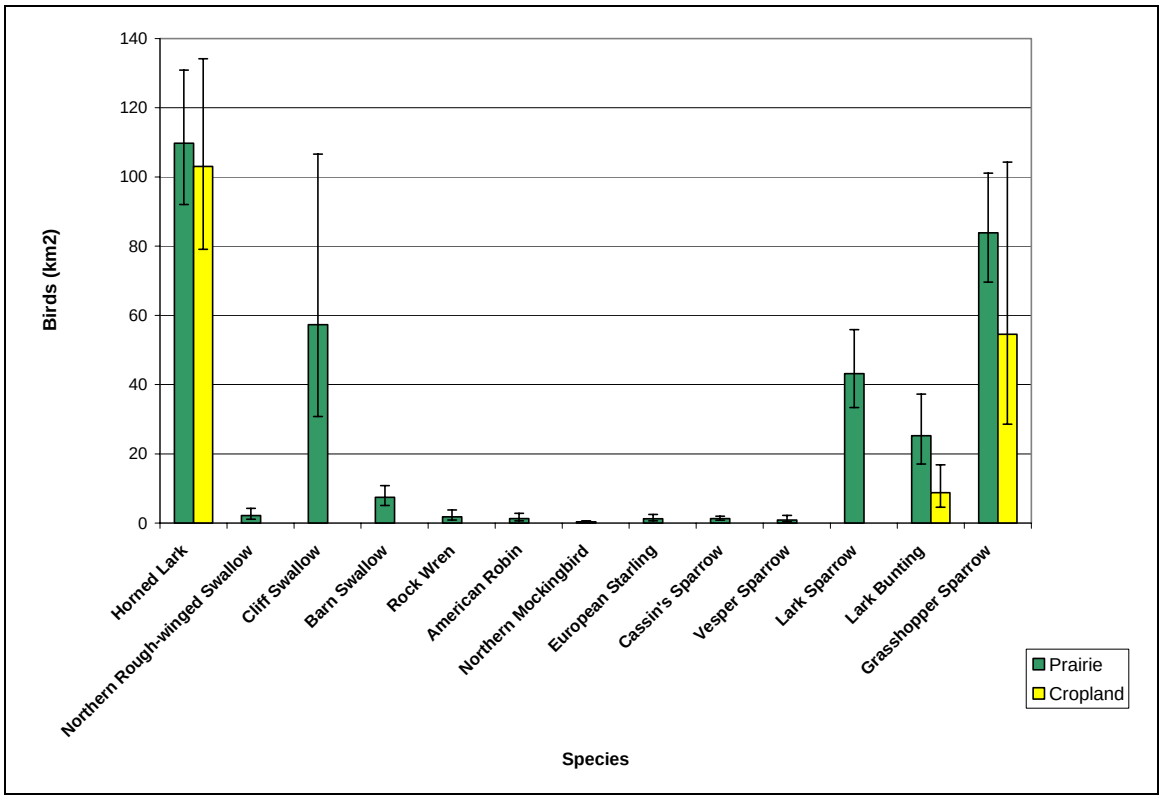


Figure 16. Densities, by habitat type, of species detected on Section Surveys.

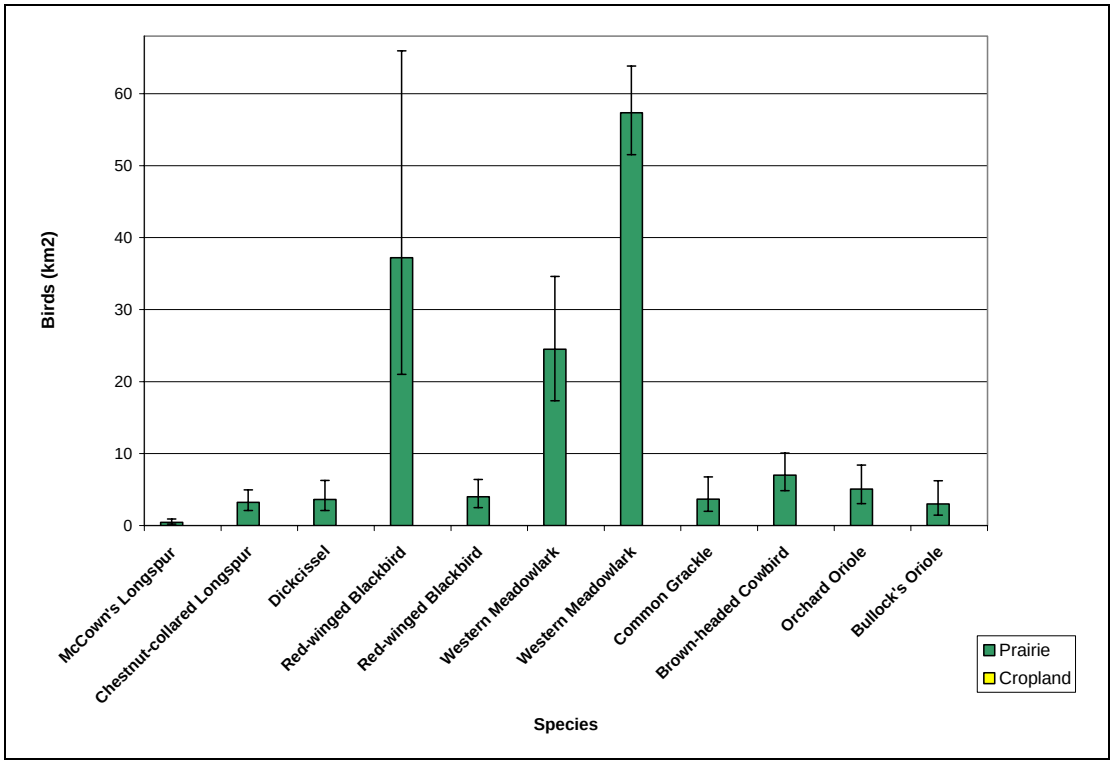
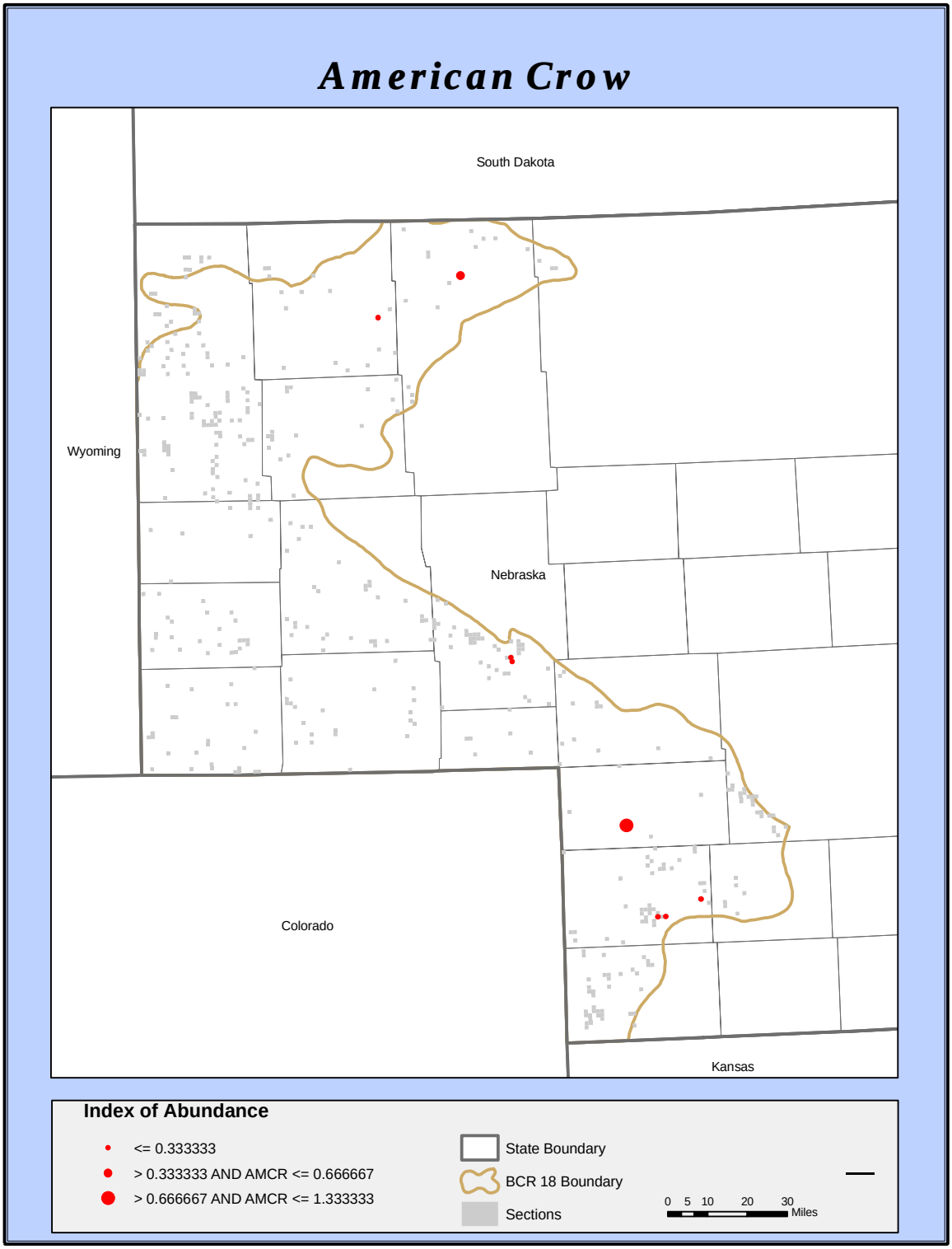
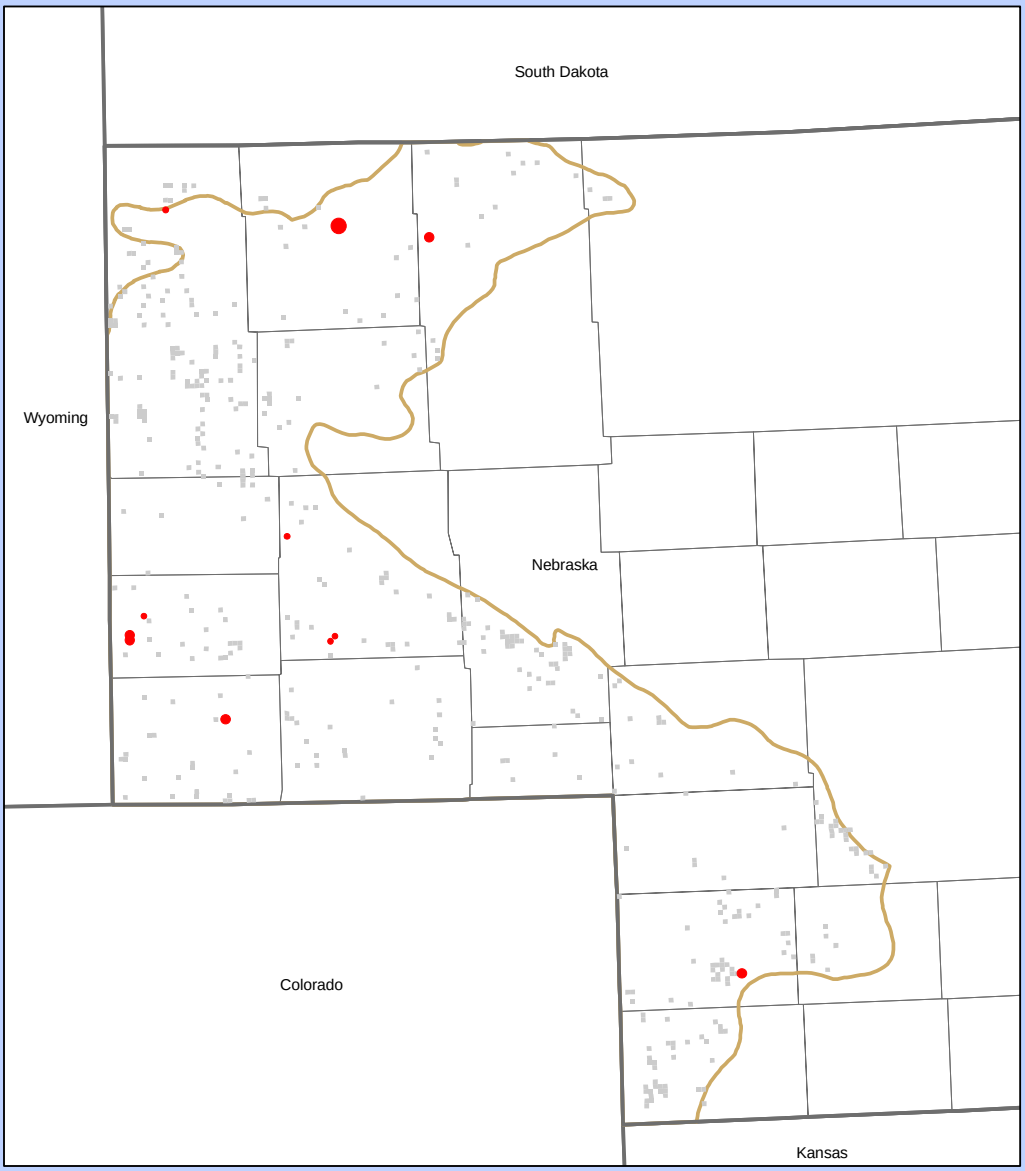


Figure 17. Densities, by habitat type, of species detected on Section Surveys.

American Crow



American Goldfinch



Index of Abundance

- <= 0.333333
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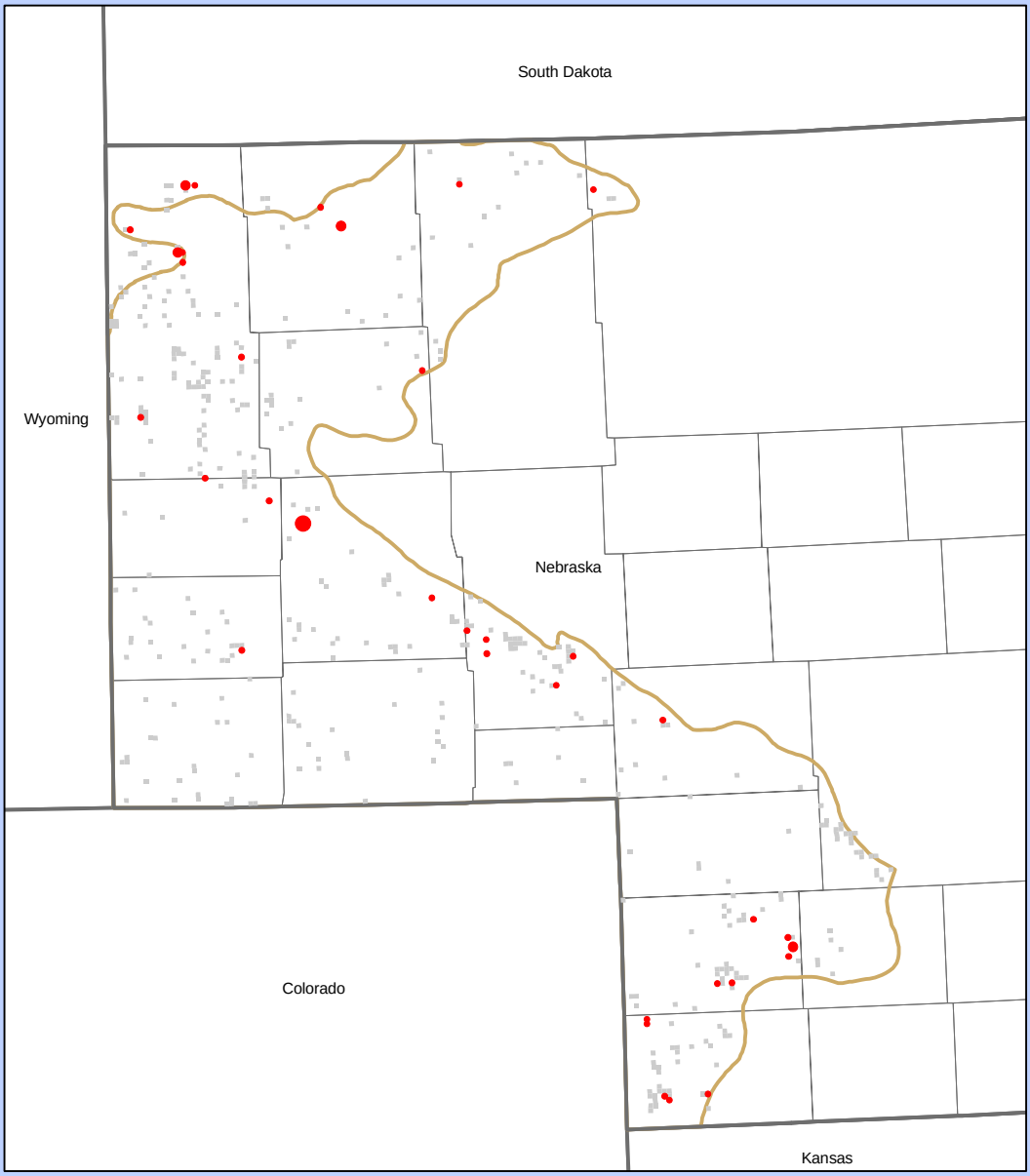
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

American Kestrel



Index of Abundance

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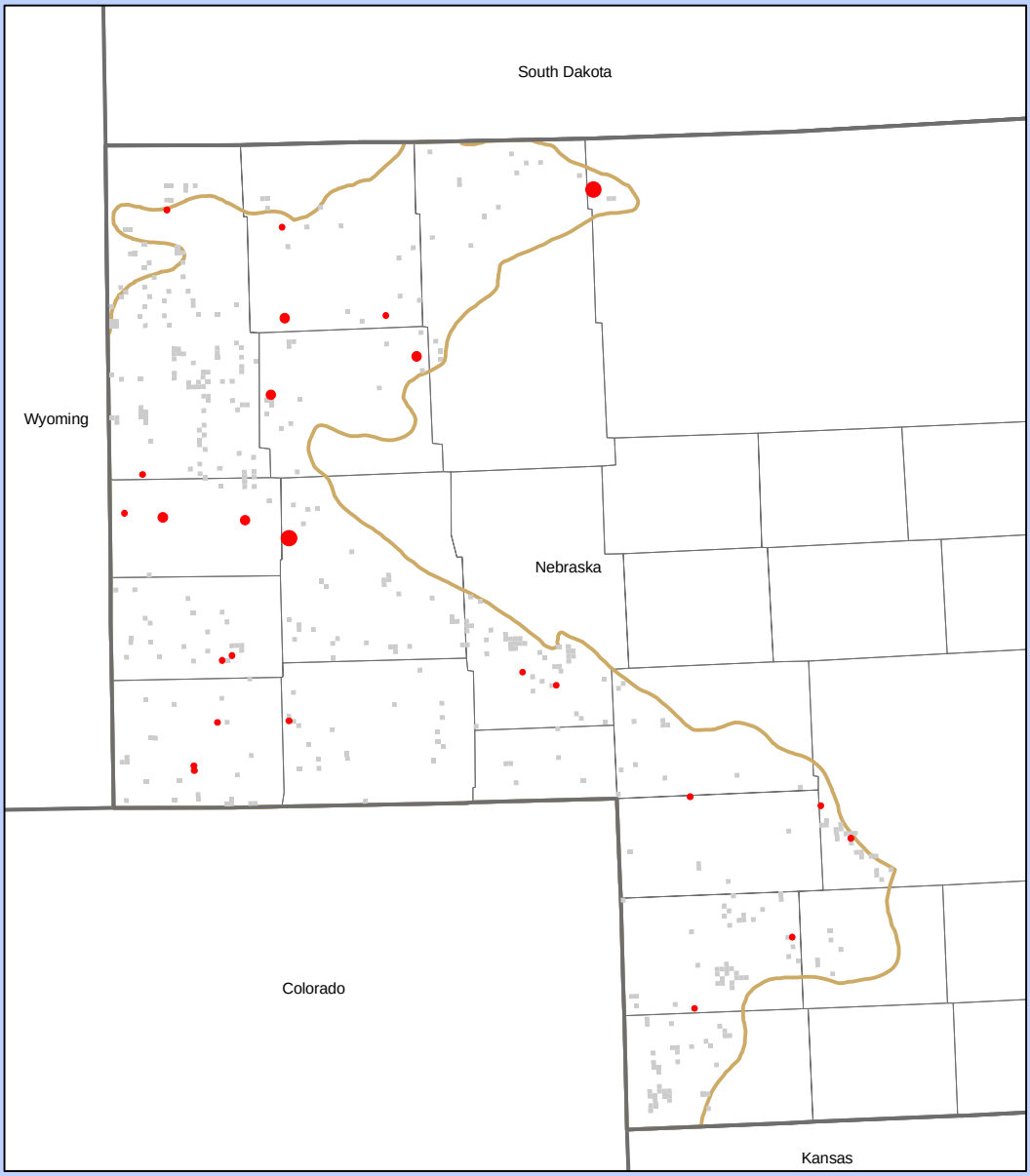
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

American Robin



Index of Abundance

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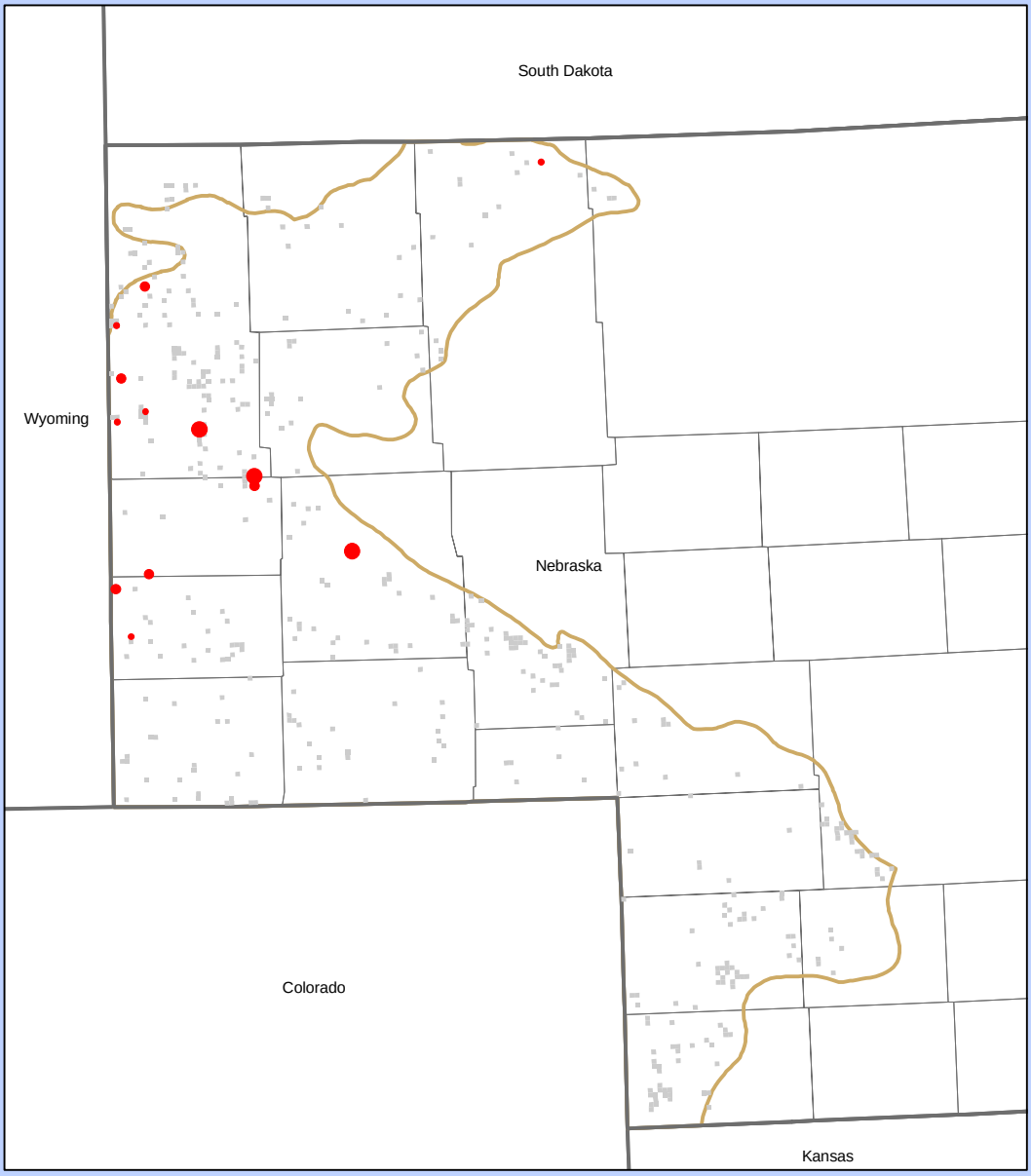
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Bank Swallow



Index of Abundance

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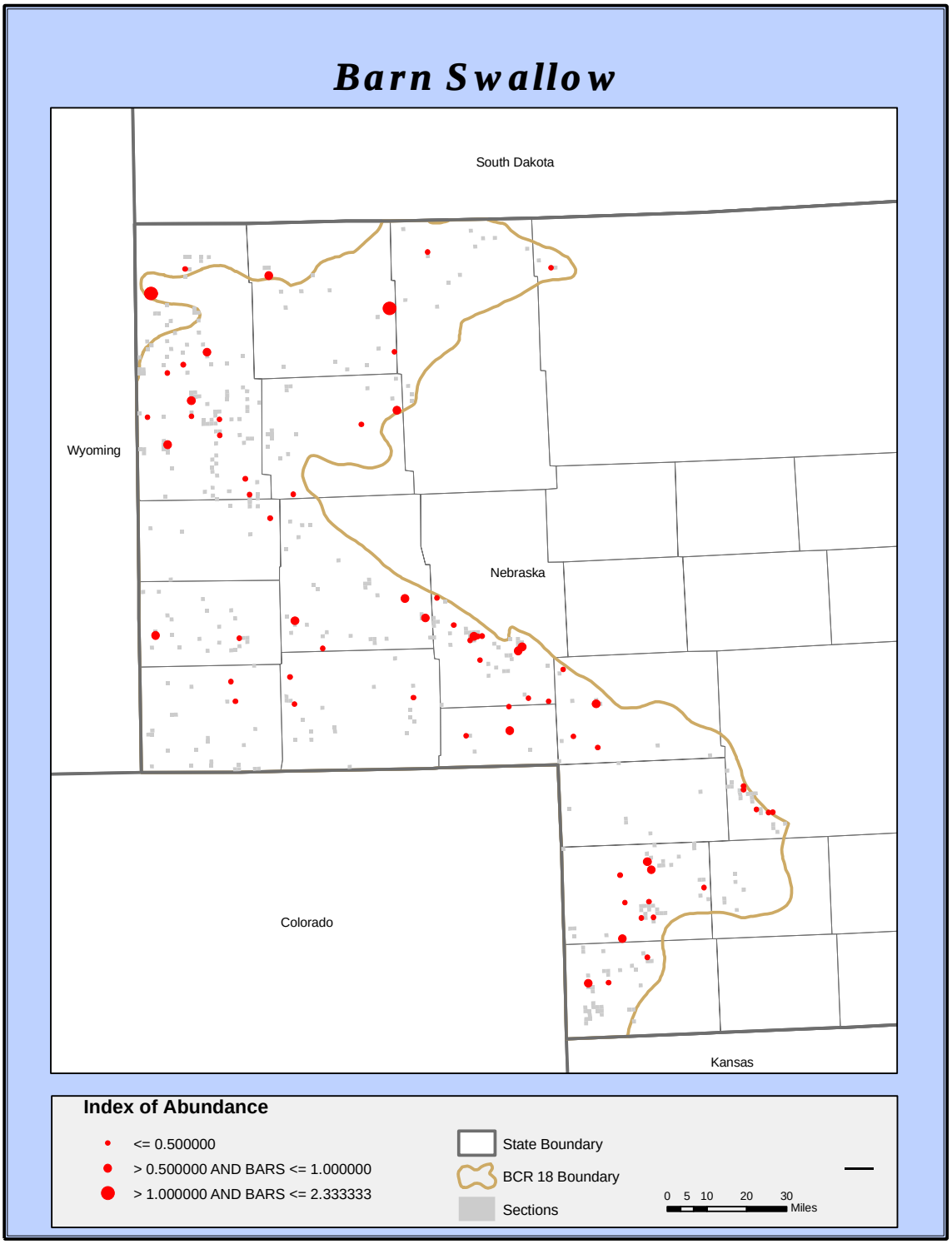
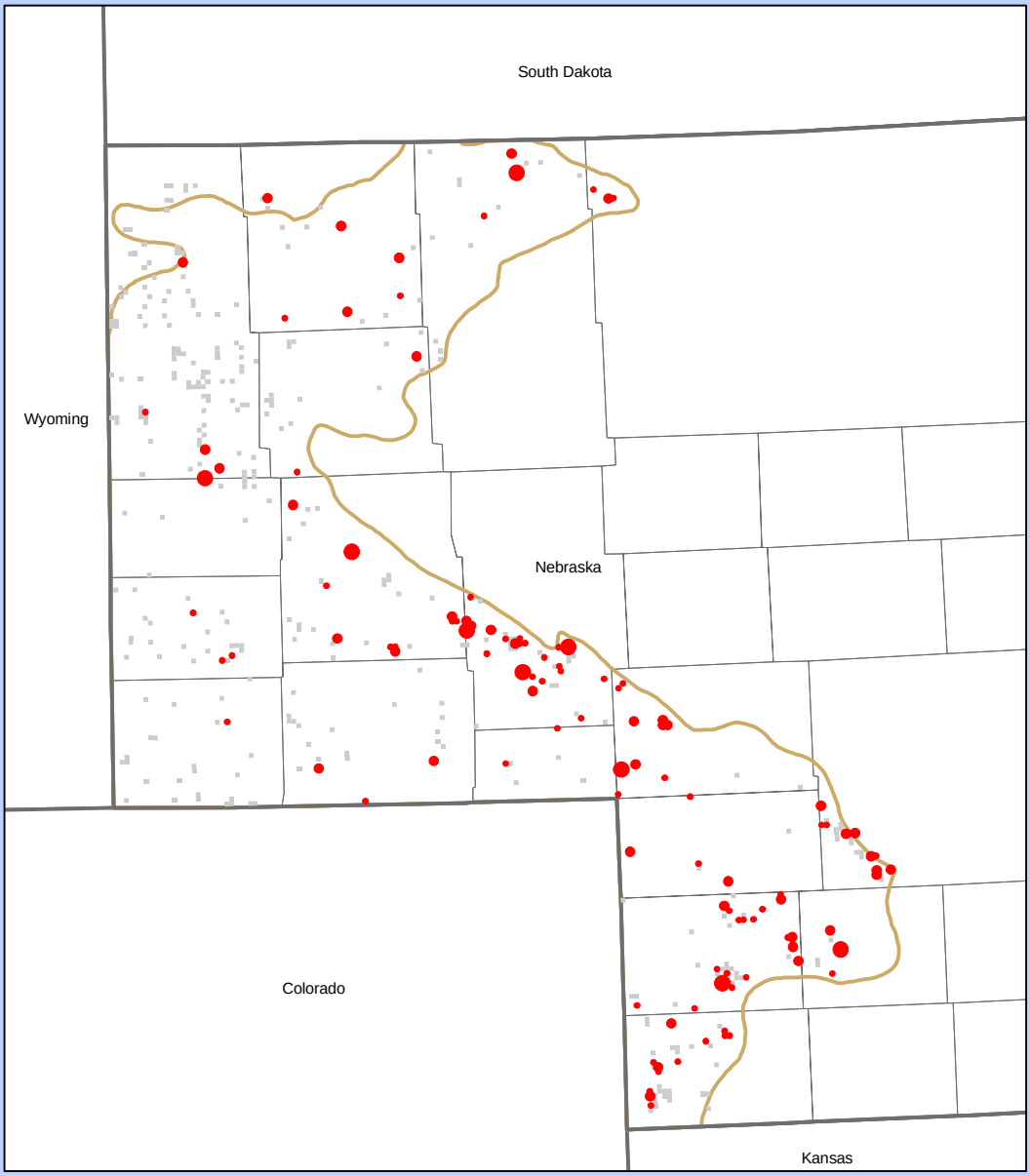
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Barn Swallow



Brown-headed Cowbird



Index of Abundance

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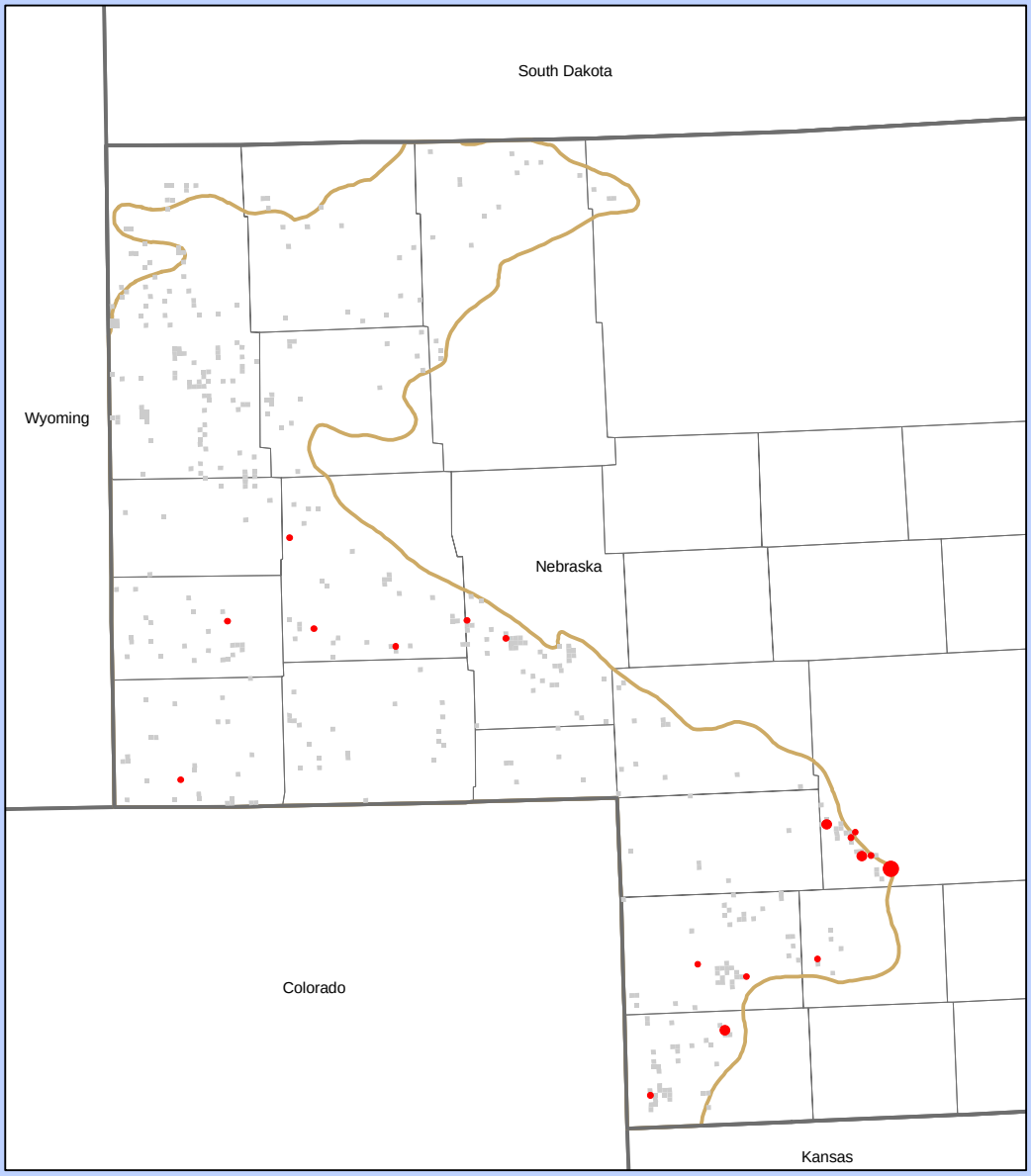
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Blue Grosbeak



Index of Abundance

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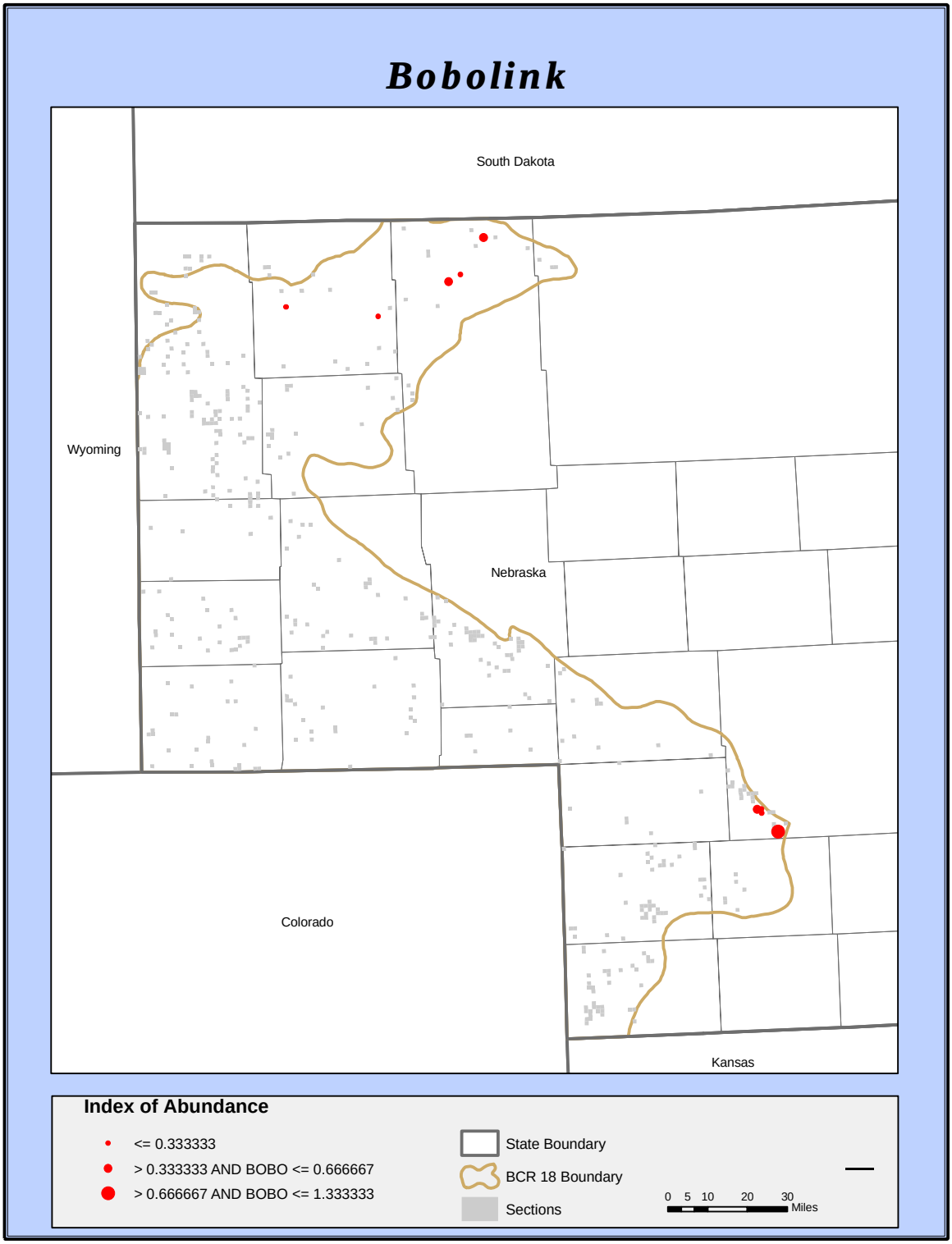
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Bobolink


South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
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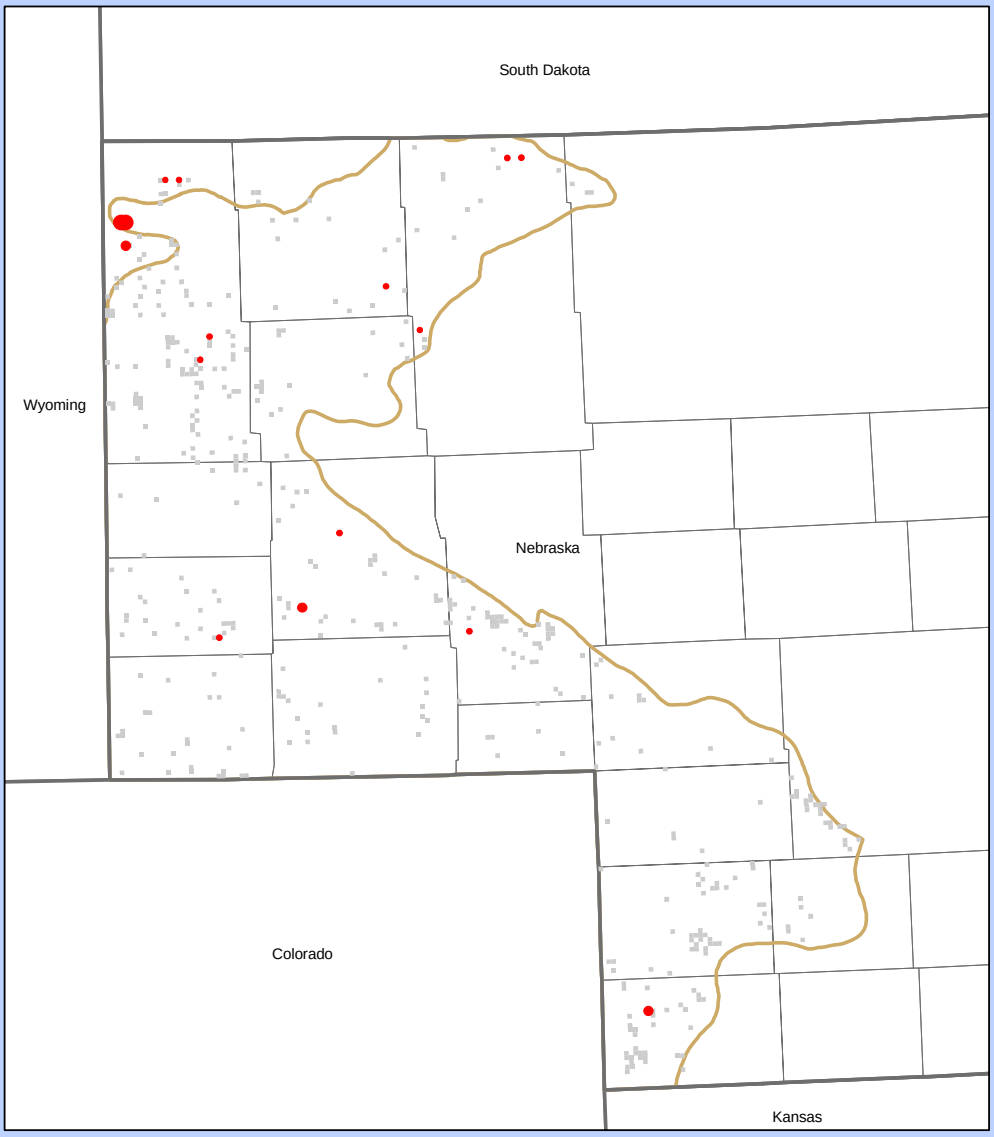
> 0.666667 AND BOBO <= 1.333333
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Brewer's Blackbird



Index of Abundance

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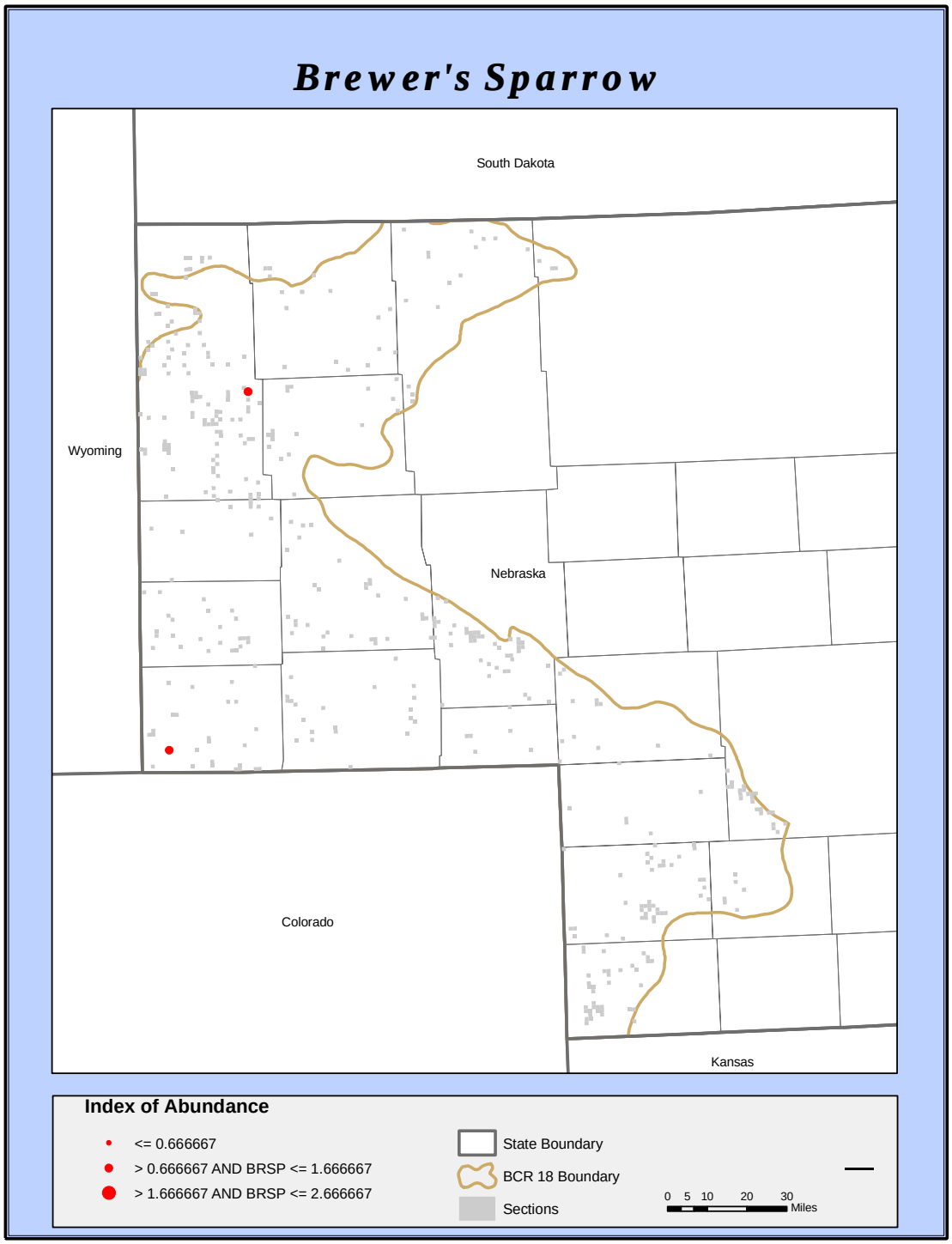
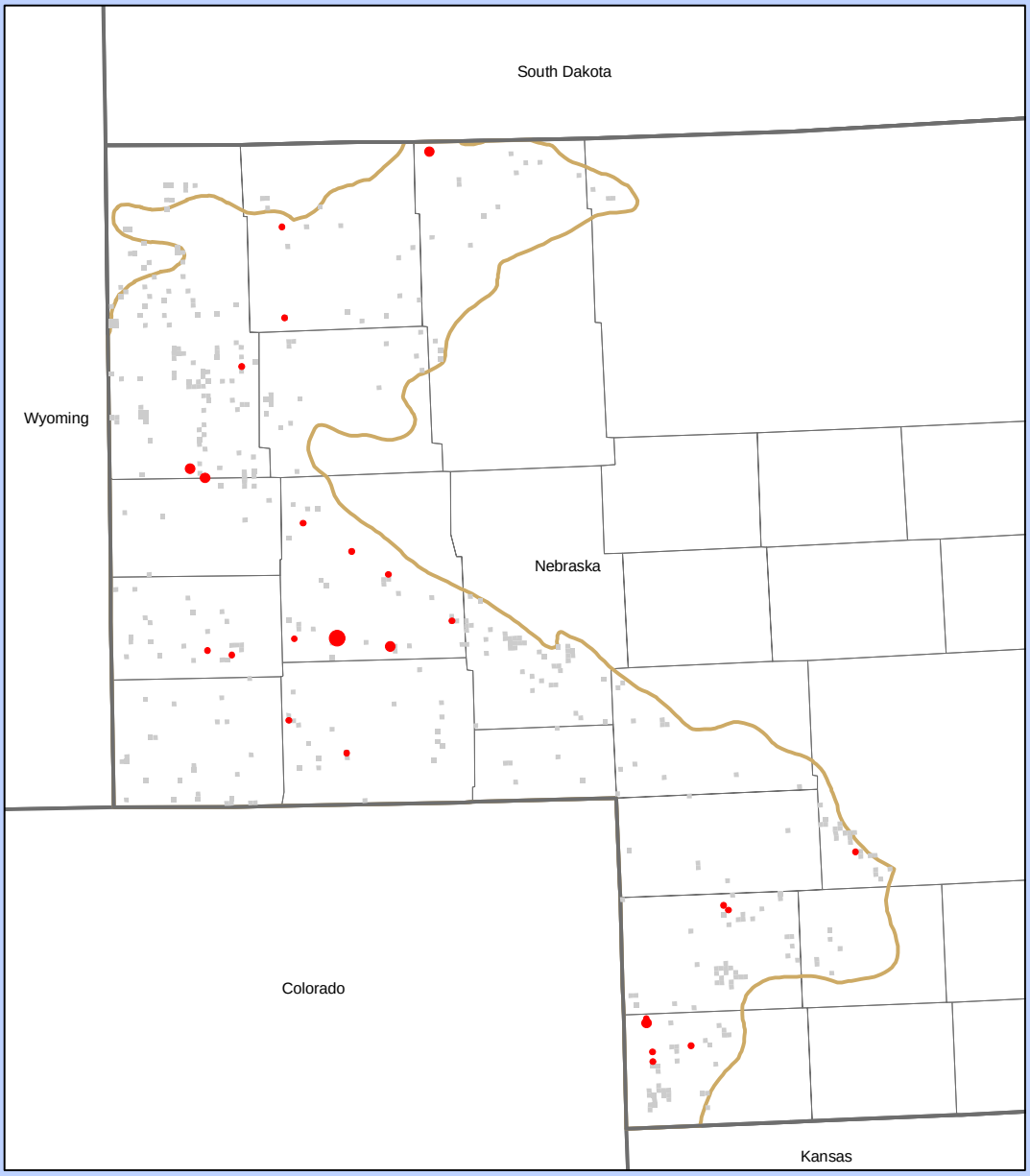
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles


Brewer's Sparrow
South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.666667
> 0.666667 AND BRSP <= 1.666667
> 1.666667 AND BRSP <= 2.666667
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Bullock's Oriole



Index of Abundance

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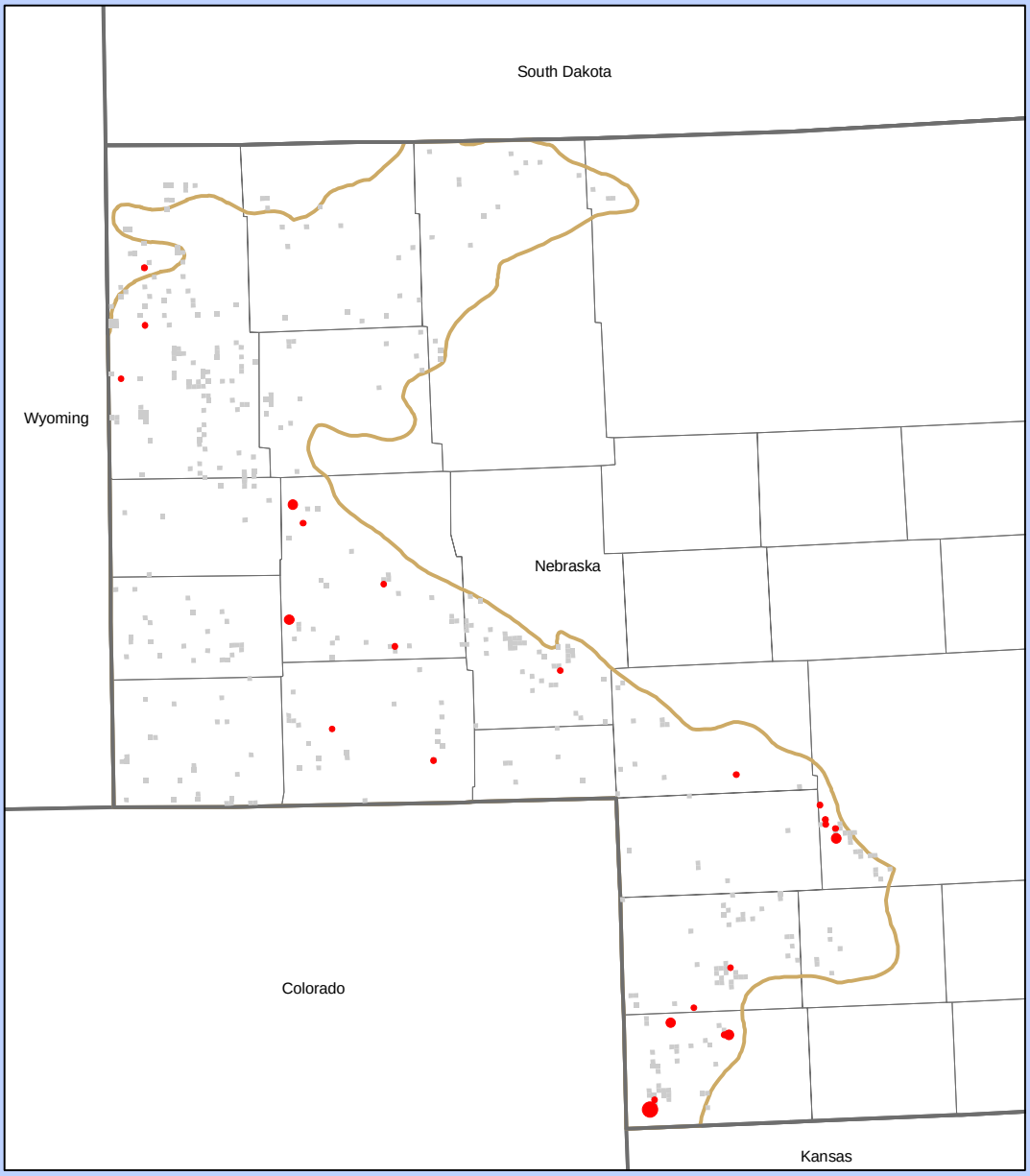
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Burrowing Owl



Index of Abundance

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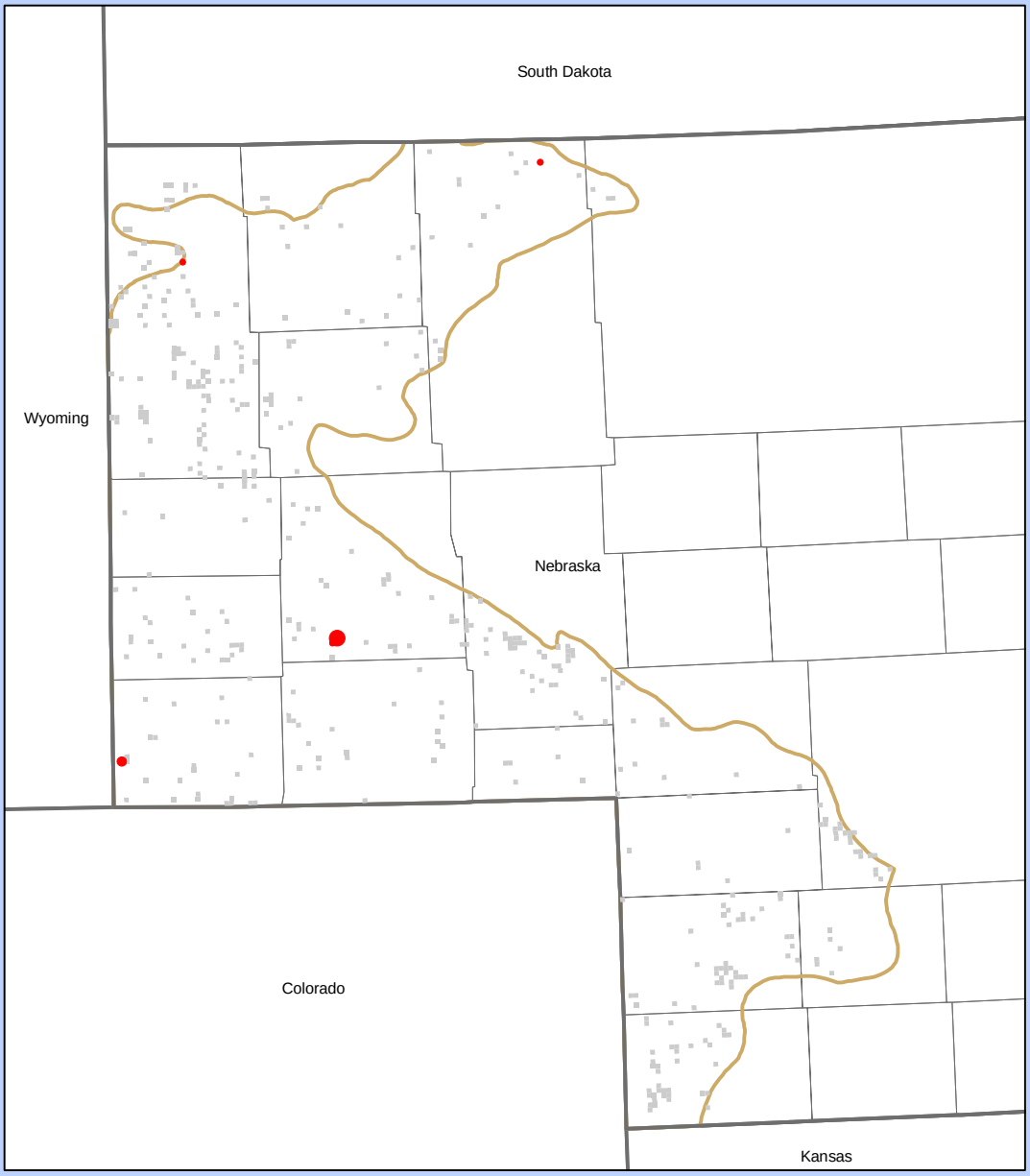
- > 0.666667 AND BUOW <= 1.666667

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Cassin's Kingbird



Index of Abundance

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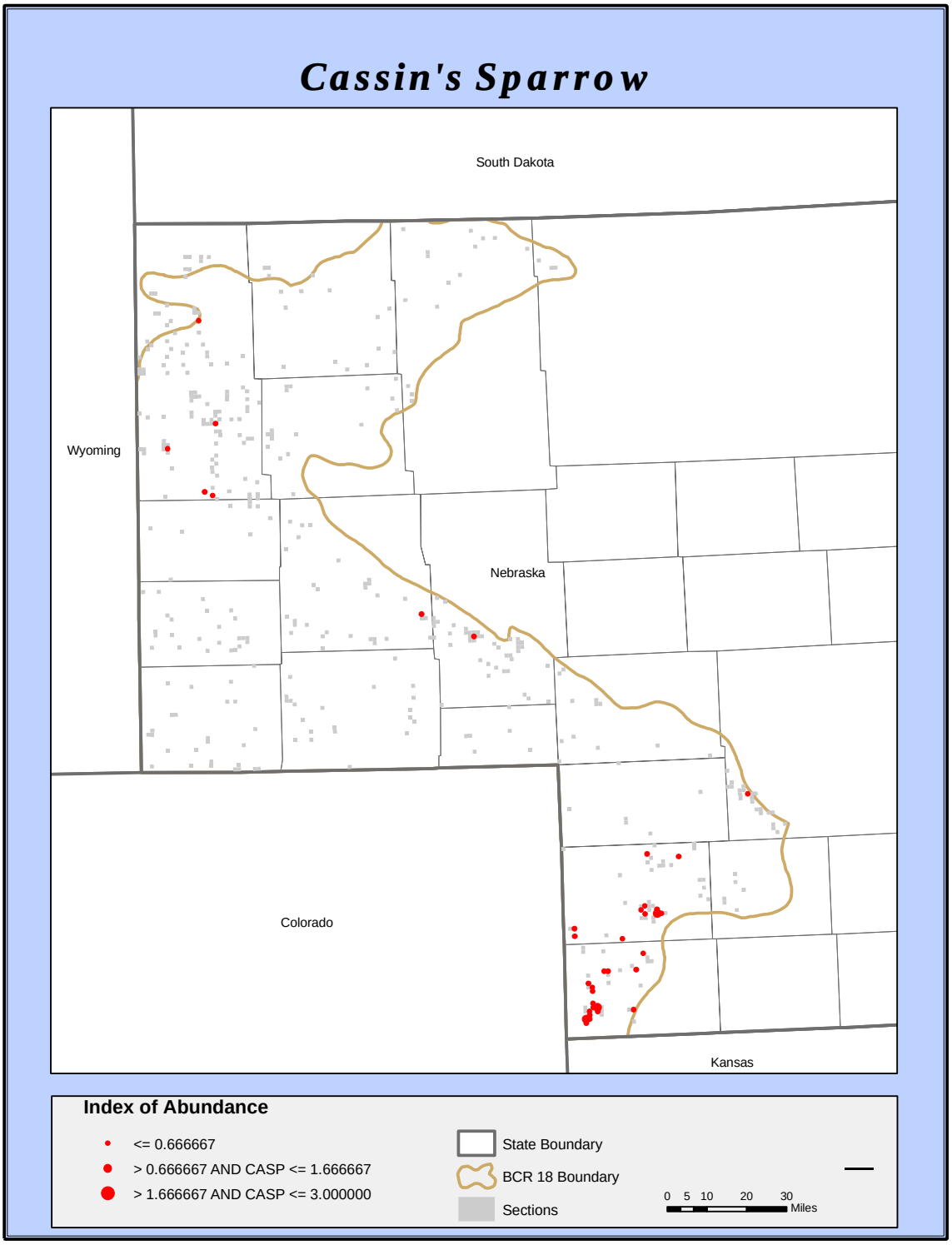
State Boundary

BCR 18 Boundary

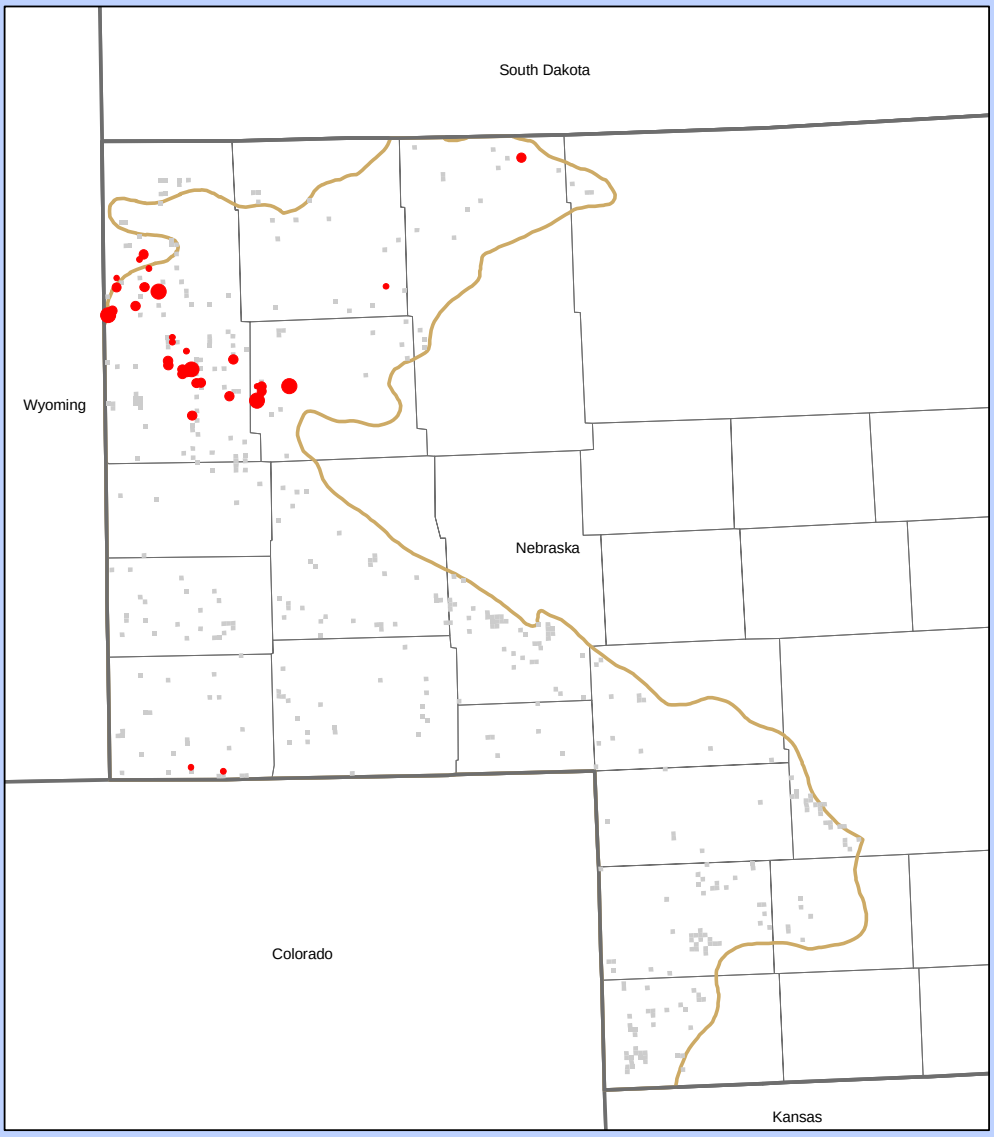
Sections

0 5 10 20 30 Miles

Cassin's Sparrow



Chestnut-collared Longspur



Index of Abundance

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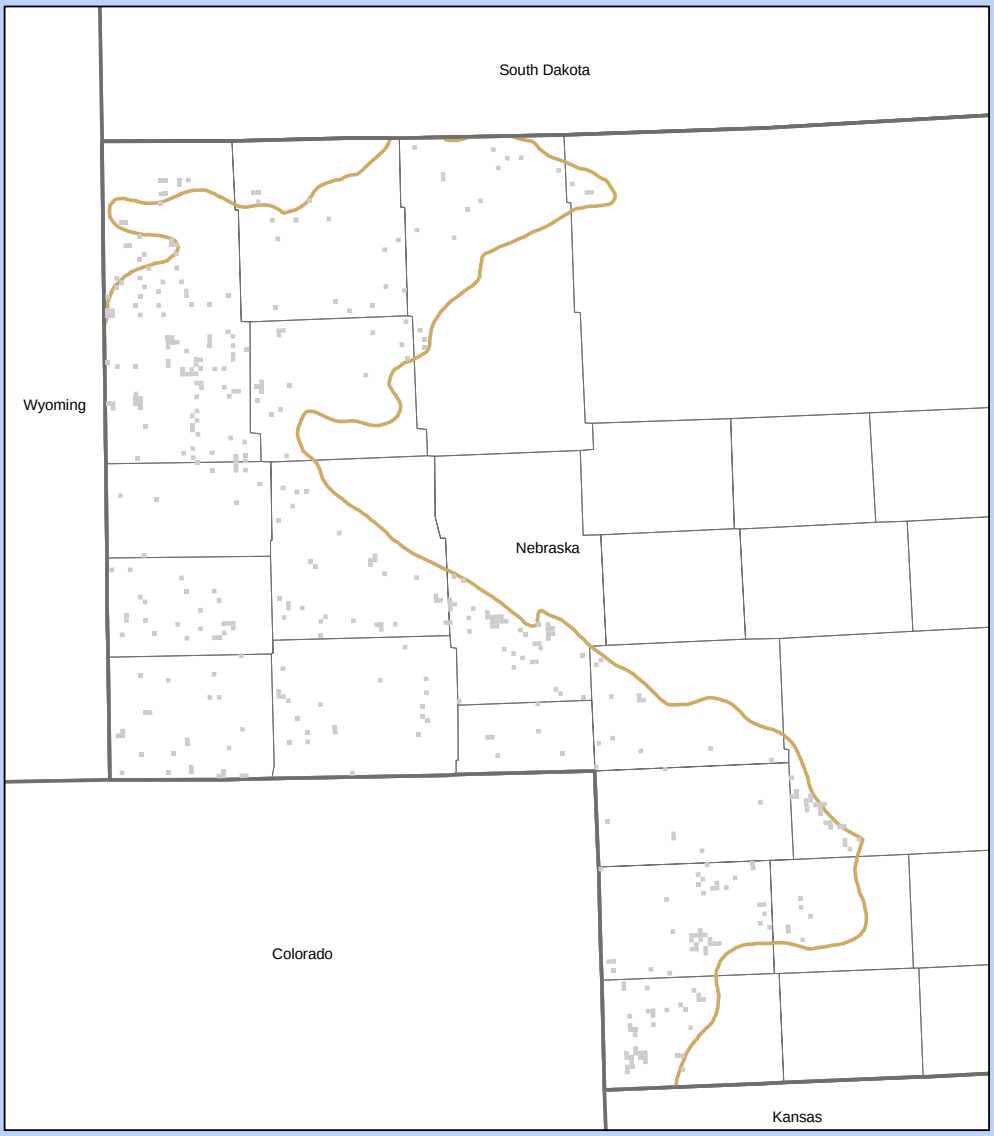
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Chipping Sparrow



Index of Abundance

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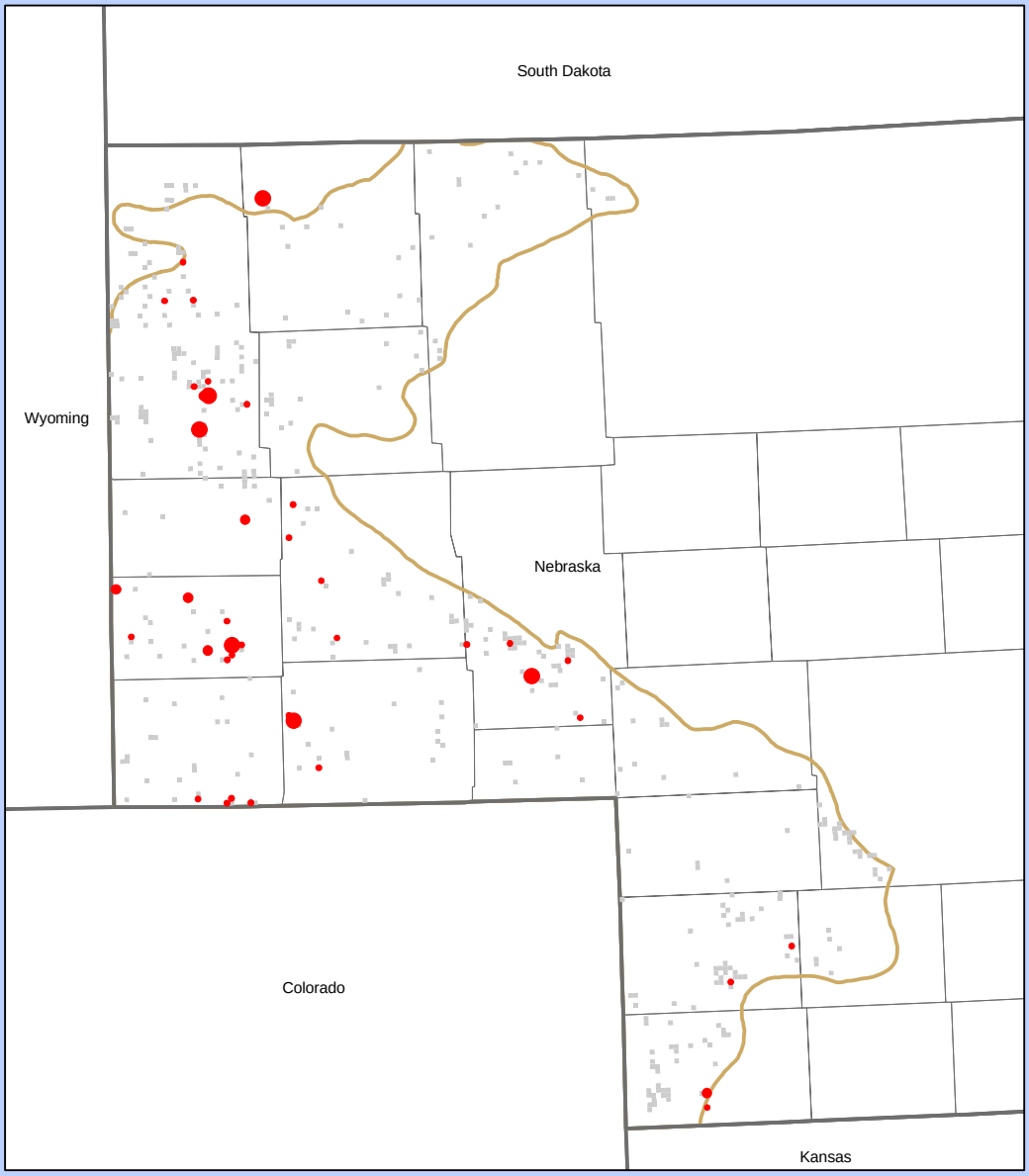
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Cliff Swallow



Index of Abundance

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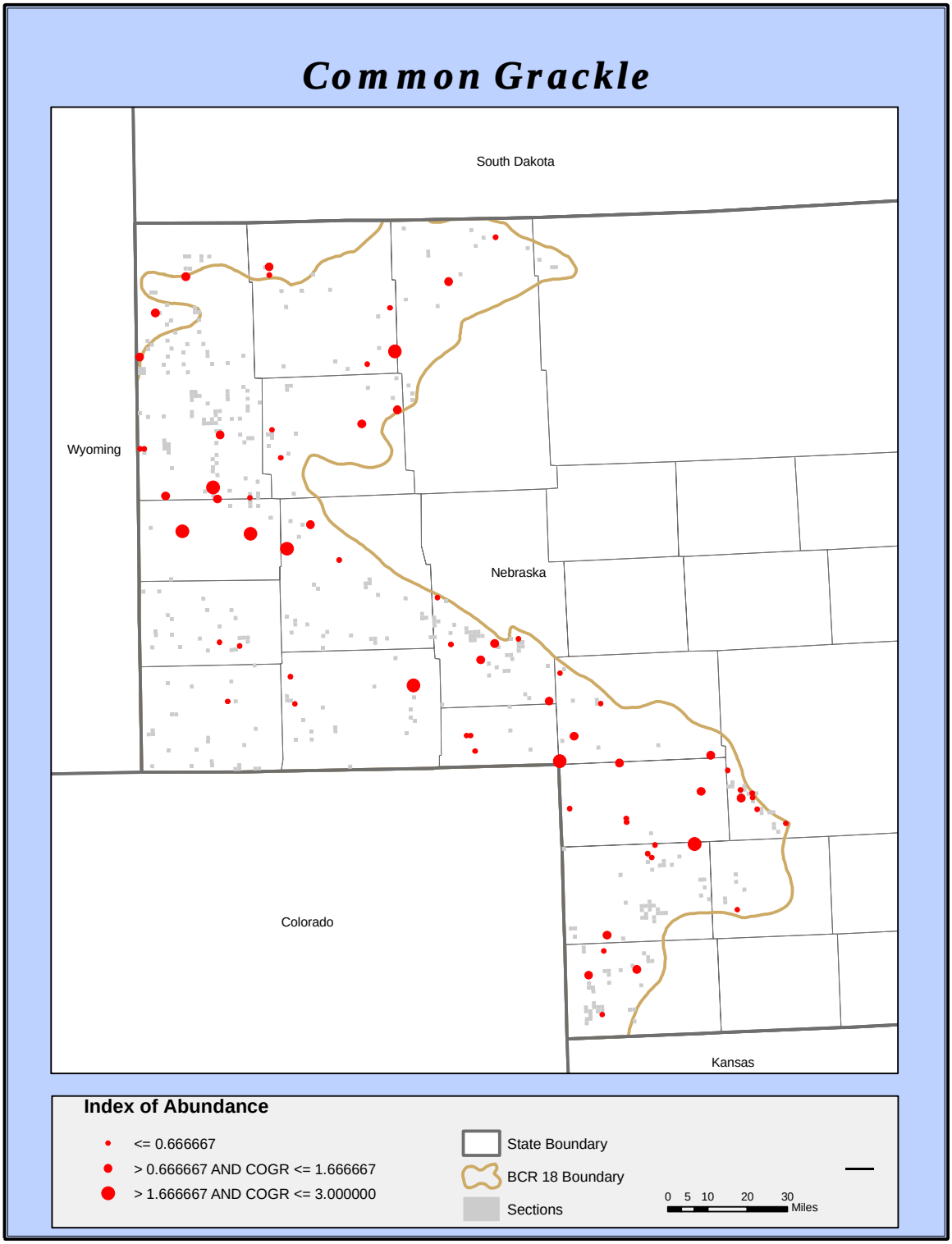
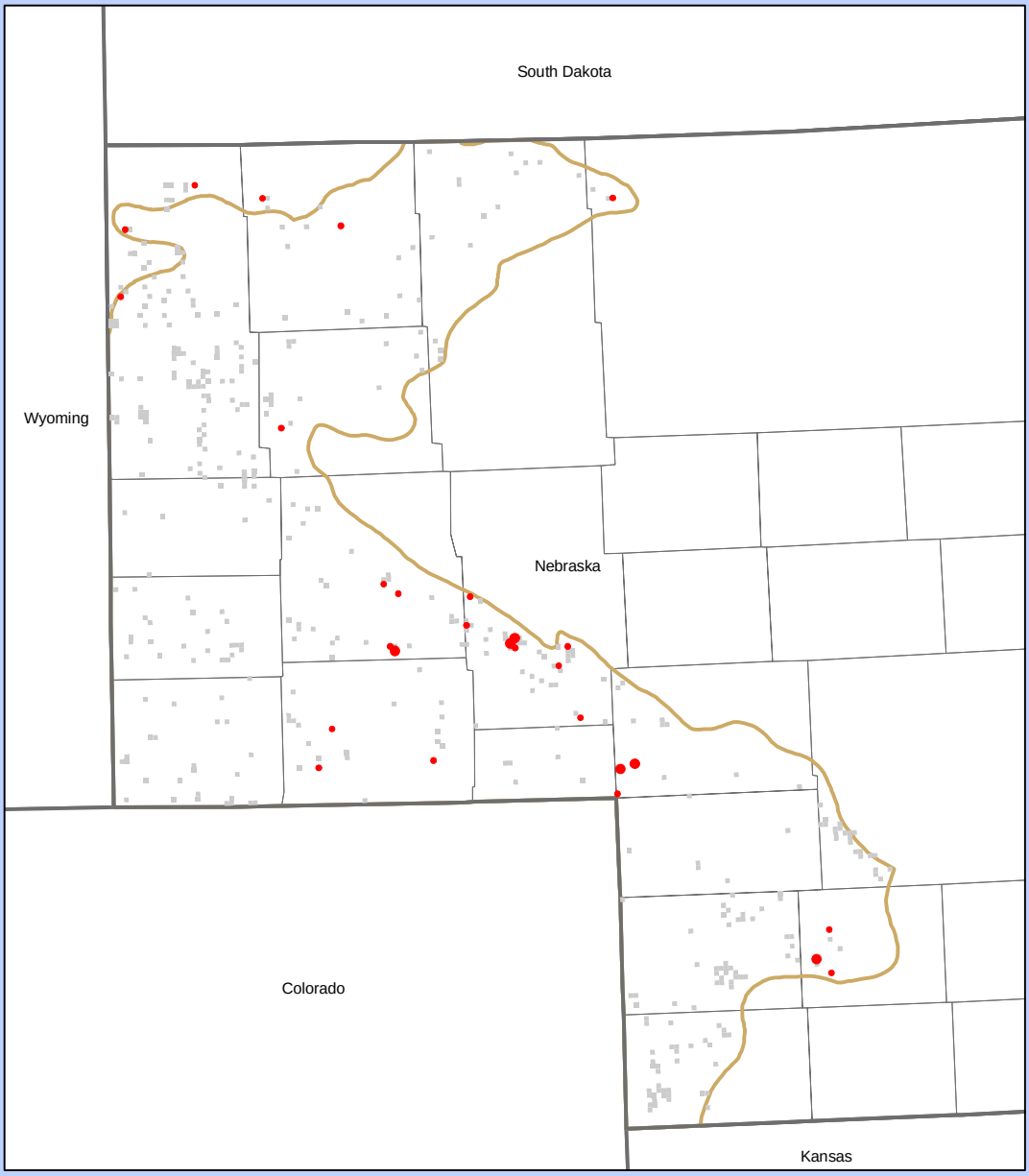
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Common Grackle



Common Nighthawk



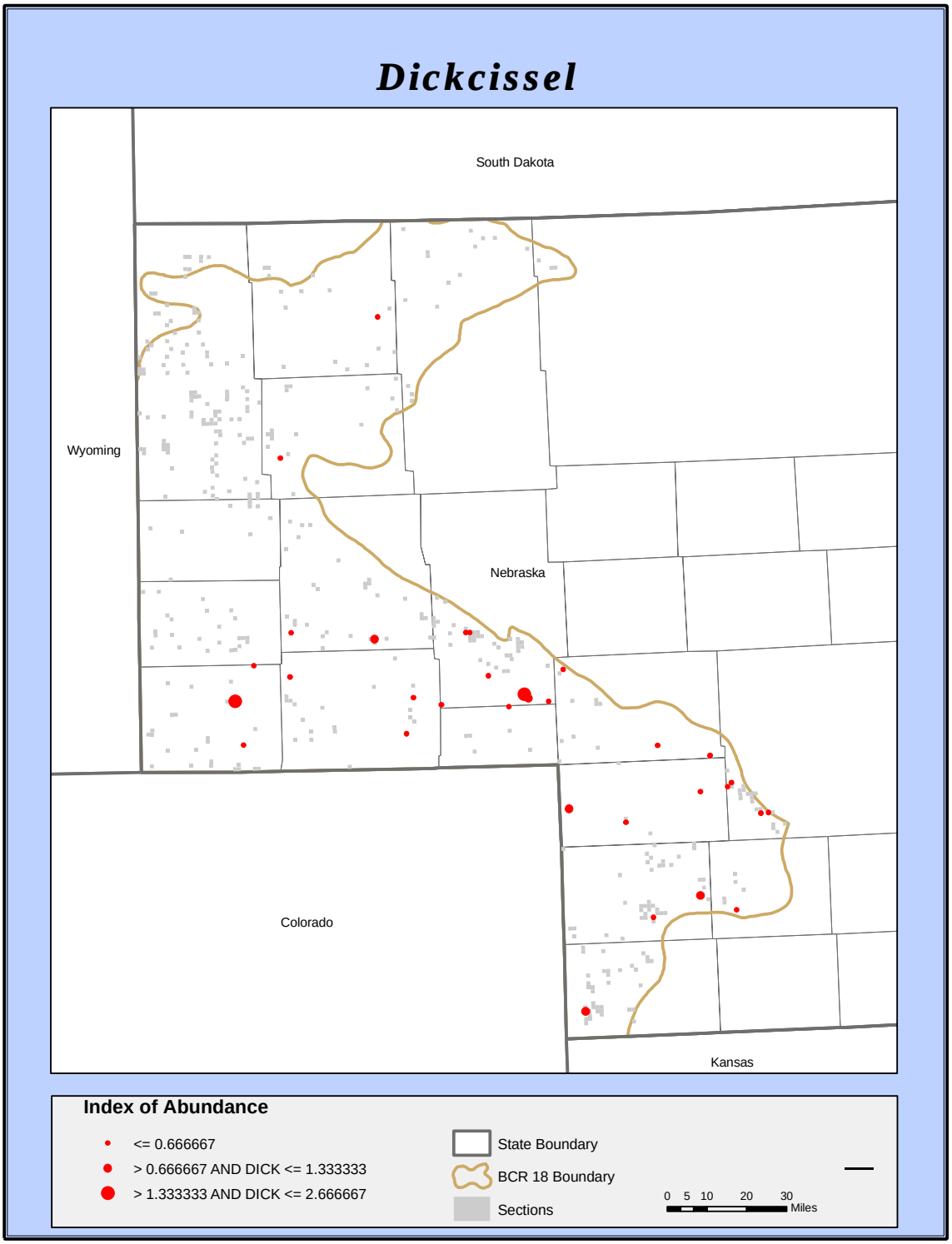
Index of Abundance

- <= 0.500000
- > 0.500000 AND CONI <= 1.000000
- > 1.000000 AND CONI <= 2.000000

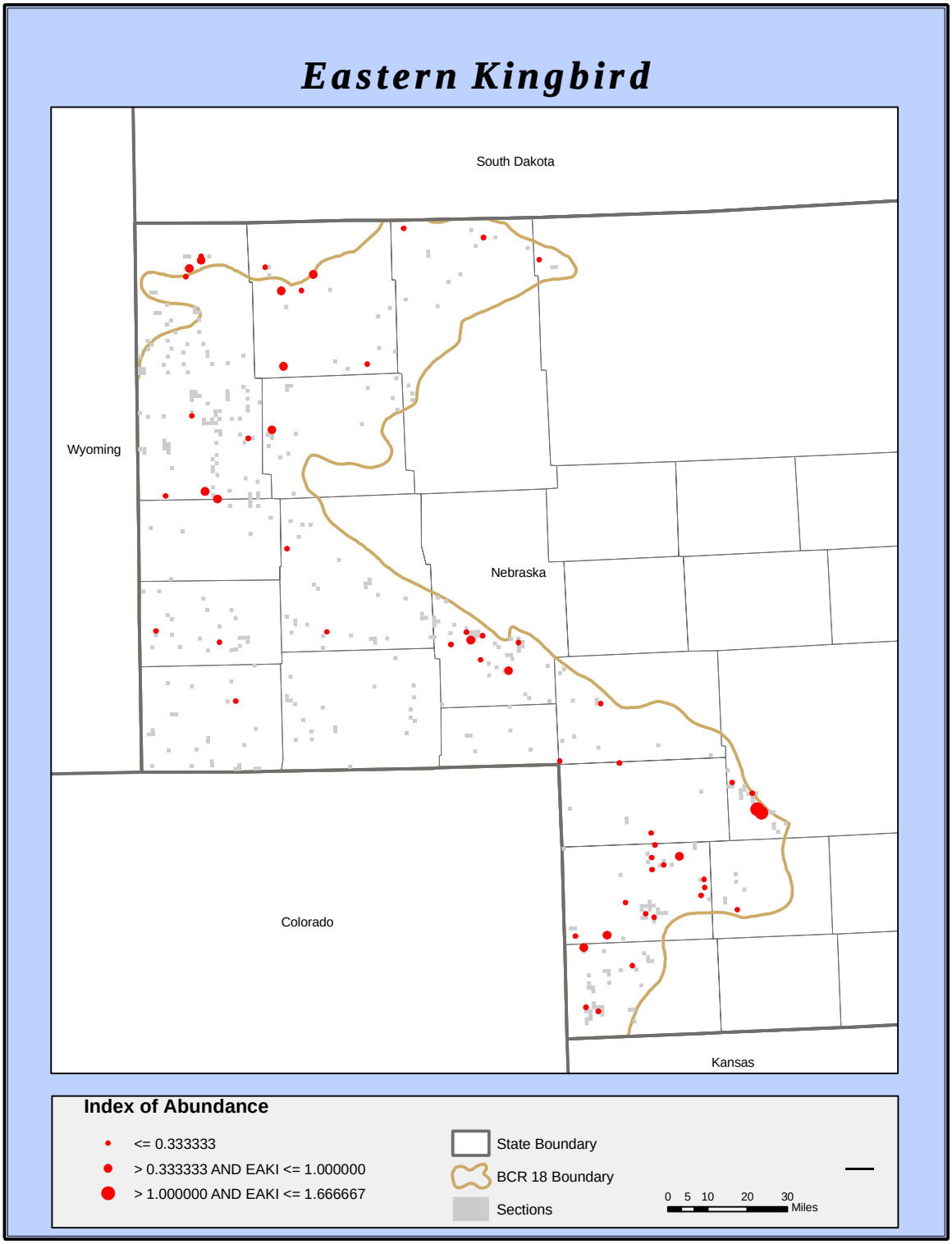
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

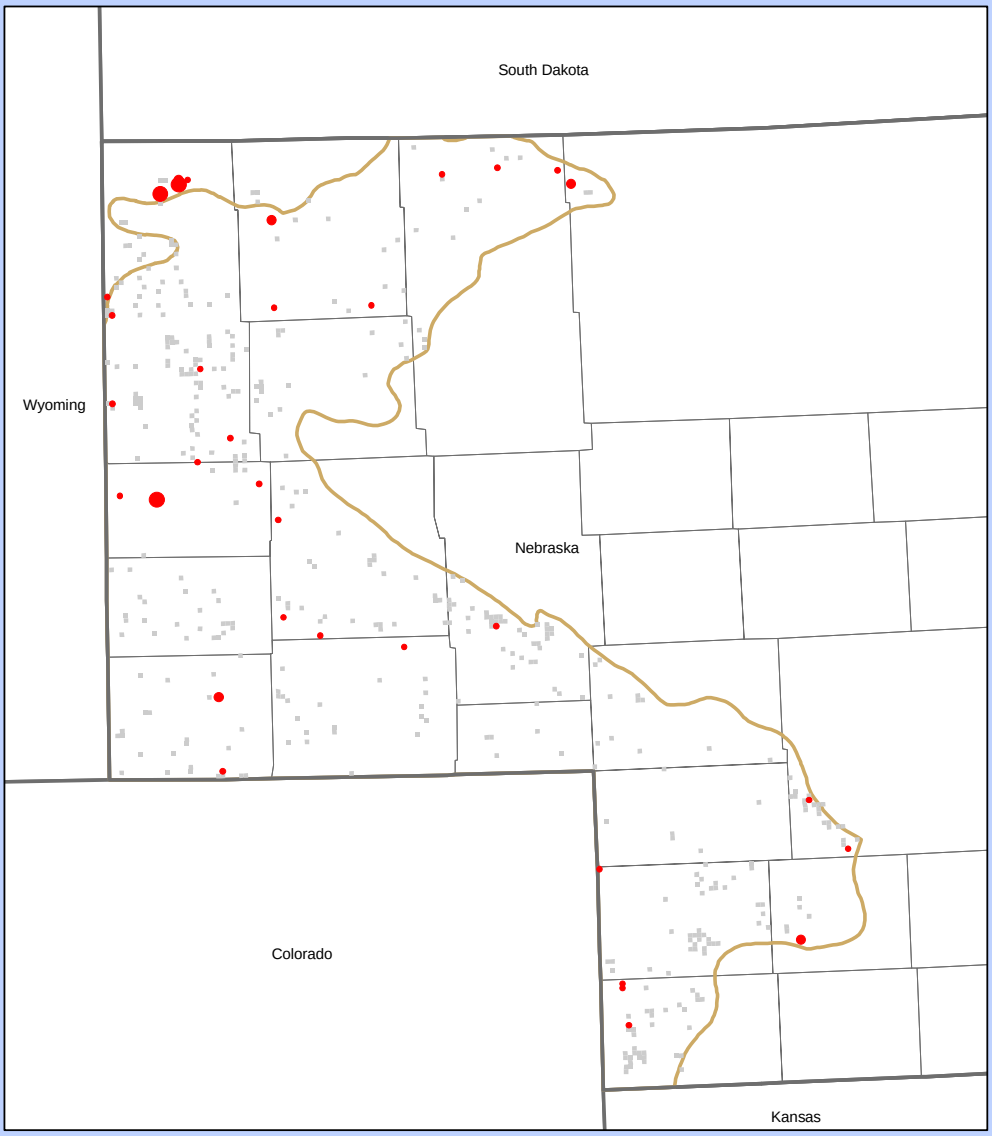
Dickcissel


South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.666667
> 0.666667 AND DICK <= 1.333333
> 1.333333 AND DICK <= 2.666667
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Eastern Kingbird



European Starling



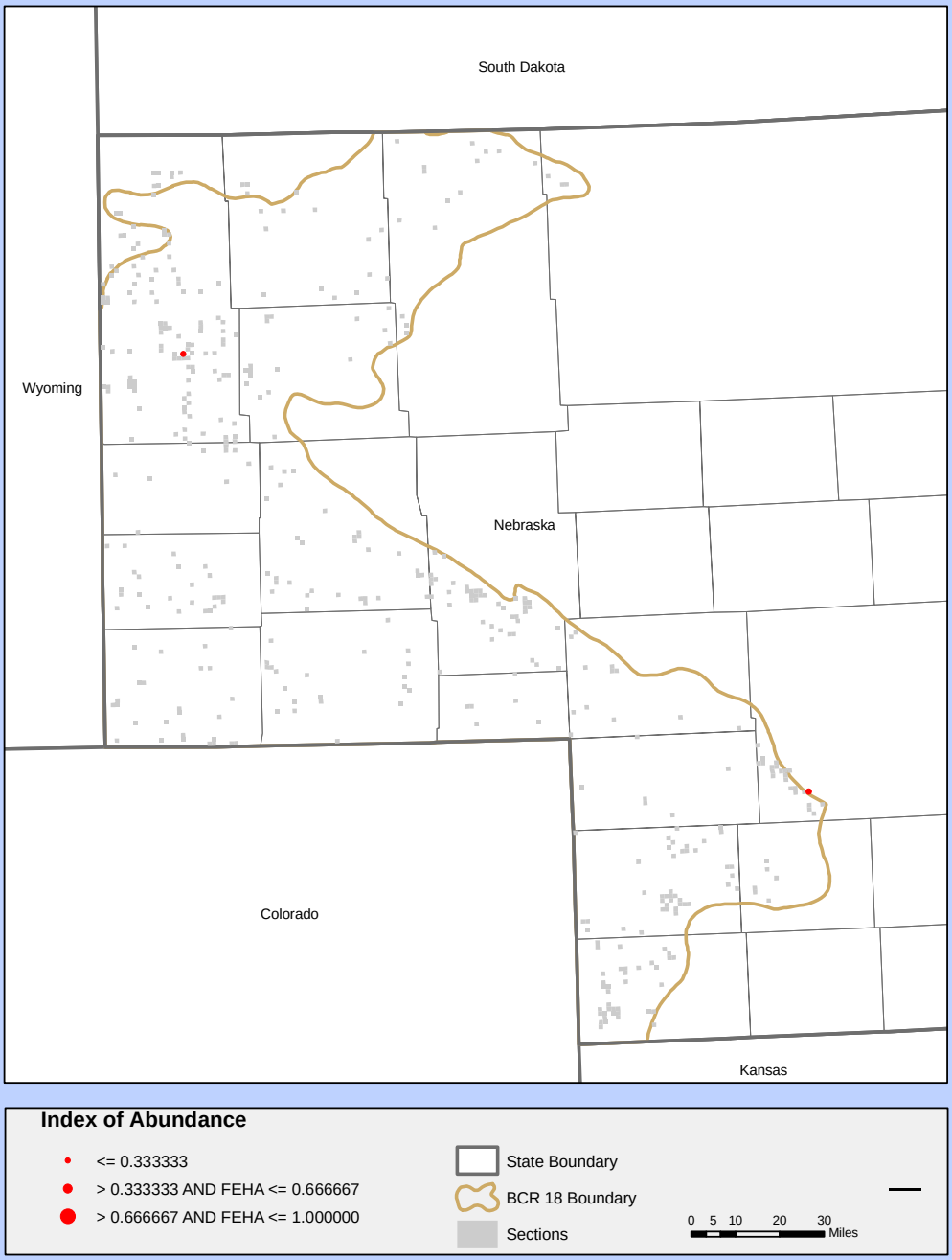
Index of Abundance

- <= 0.666667
- > 0.666667 AND EUST <= 1.333333
- > 1.333333 AND EUST <= 3.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Ferruginous Hawk



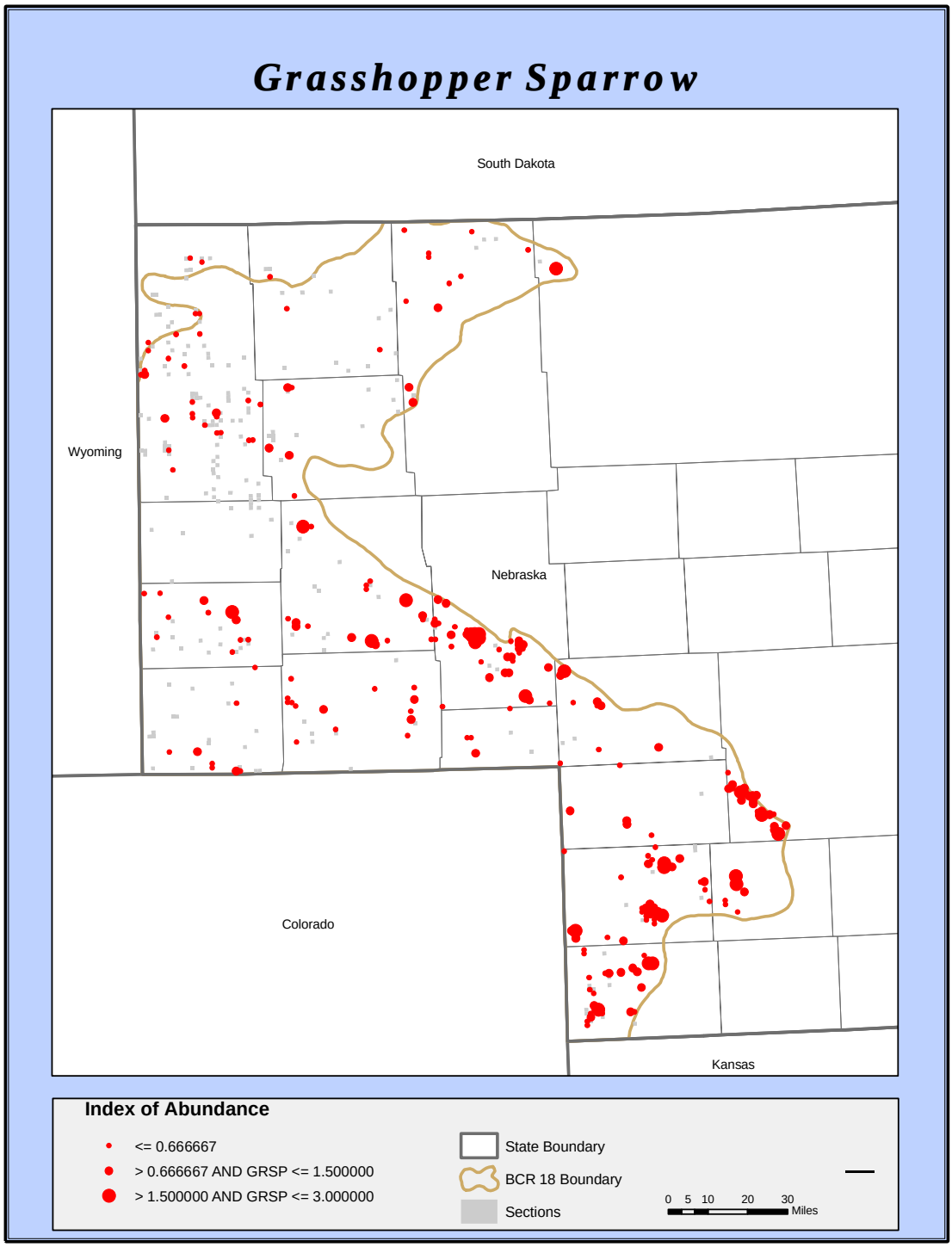
Greater Prairie-Chicken

Index of Abundance

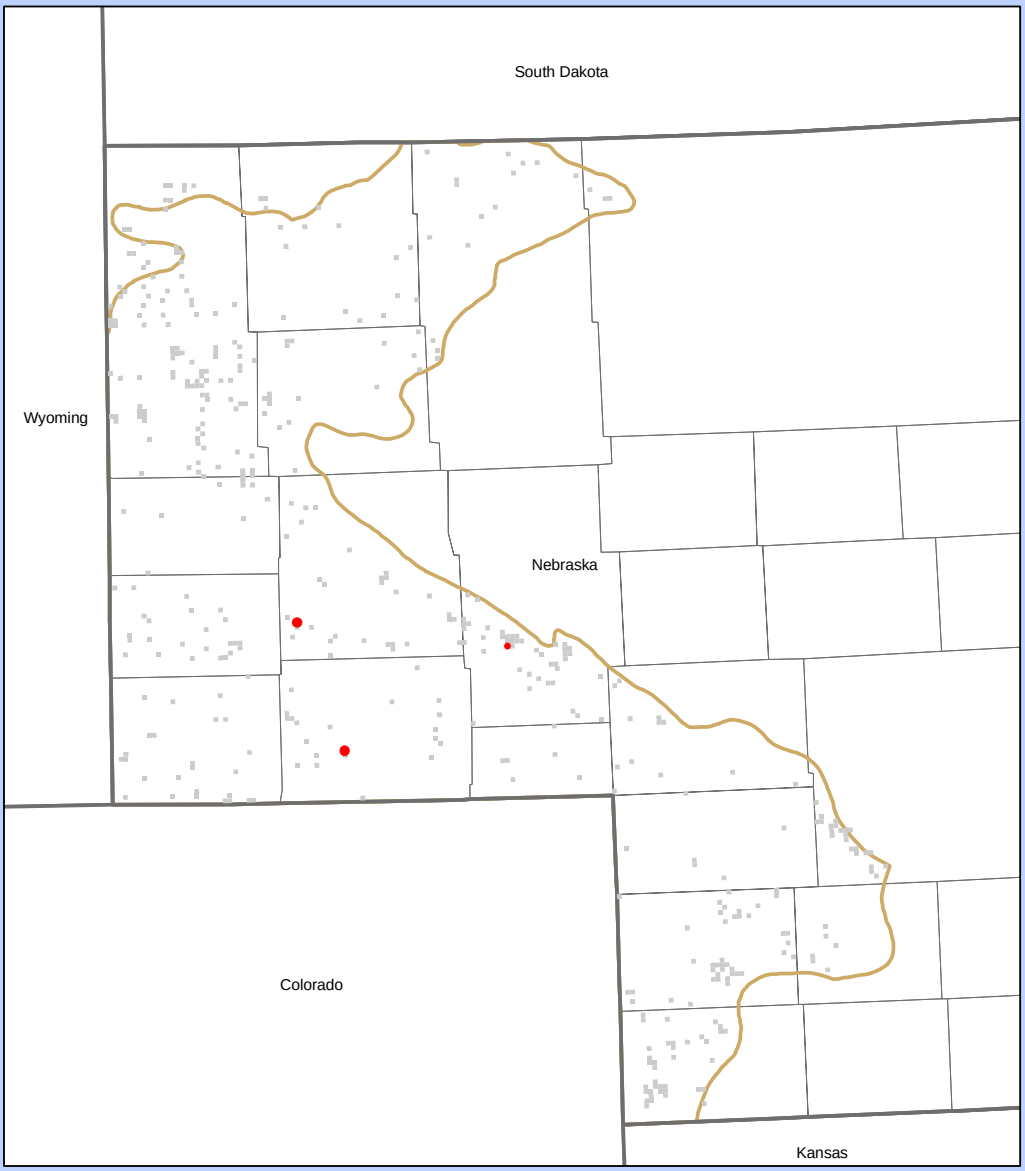
- <= 0.333333
- > 0.333333 AND GRPC <= 0.666667
- > 0.666667 AND GRPC <= 1.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles


Grasshopper Sparrow
South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.666667
> 0.666667 AND GRSP <= 1.500000
> 1.500000 AND GRSP <= 3.000000
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

House Finch



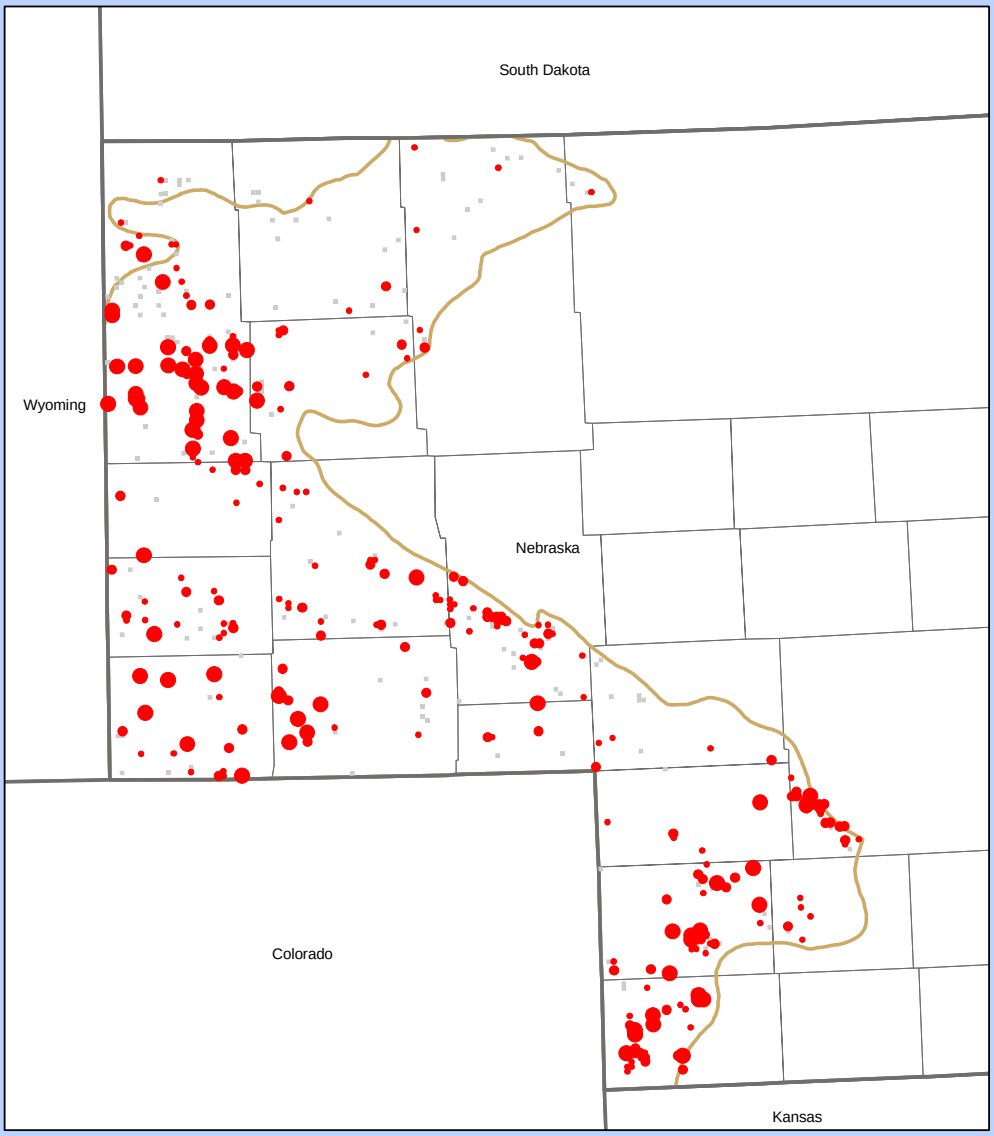
Index of Abundance

- <= 0.333333
- > 0.333333 AND HOFI <= 0.666667
- > 0.666667 AND HOFI <= 1.333333

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Horned Lark

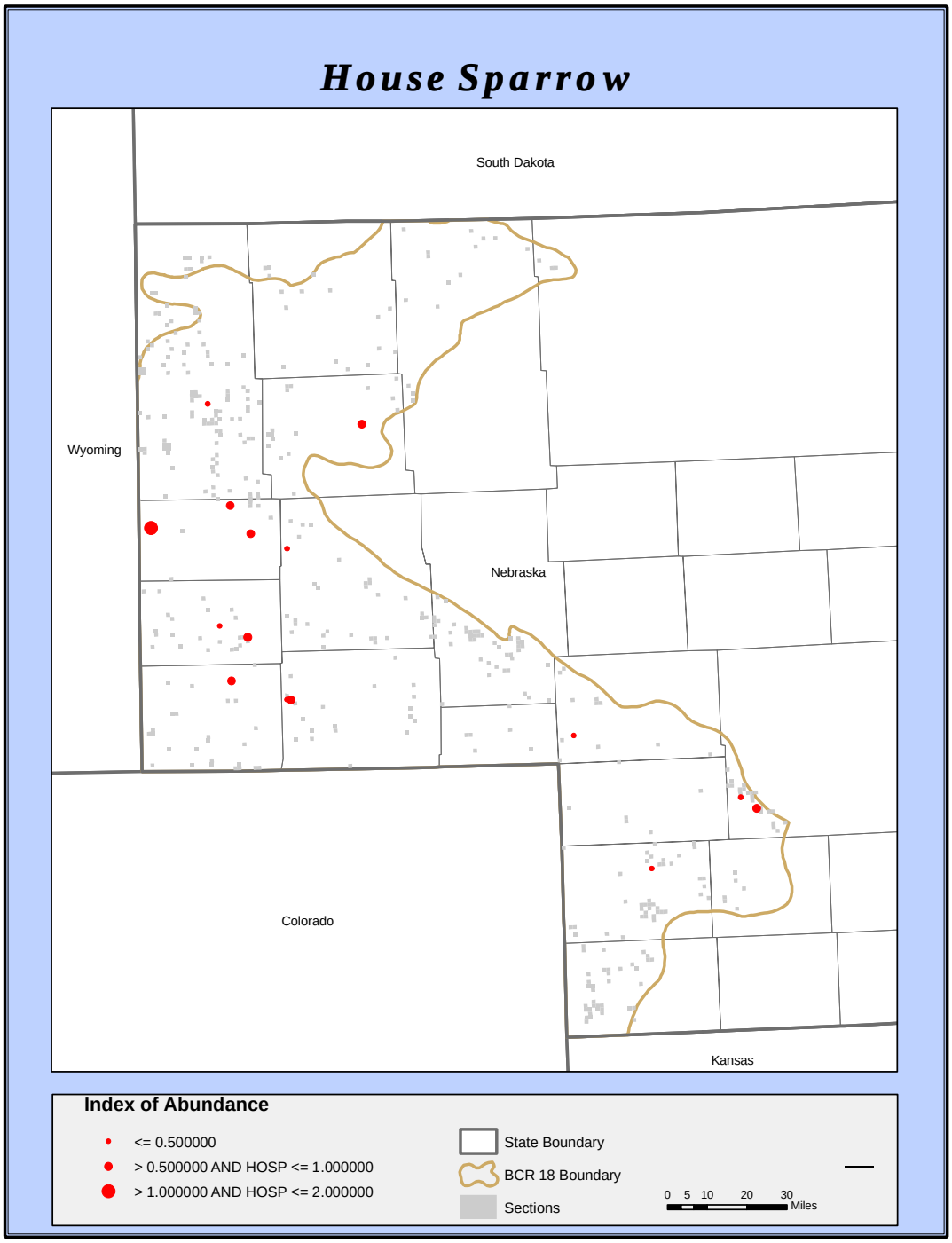


Index of Abundance

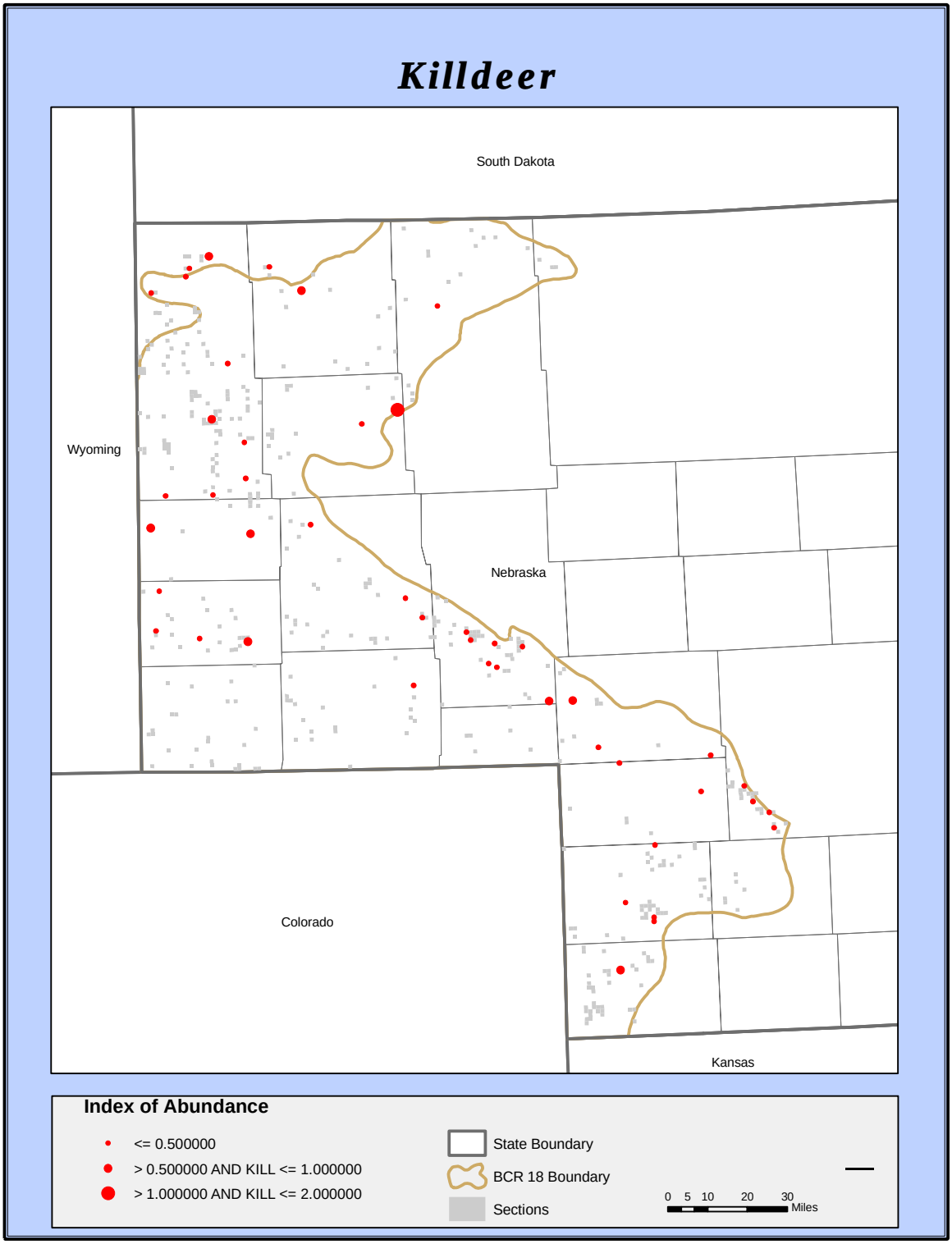
- <= 1.000000
- > 1.000000 AND HOLA <= 2.000000
- > 2.000000 AND HOLA <= 3.000000

State Boundary
BCR 18 Boundary
Sections

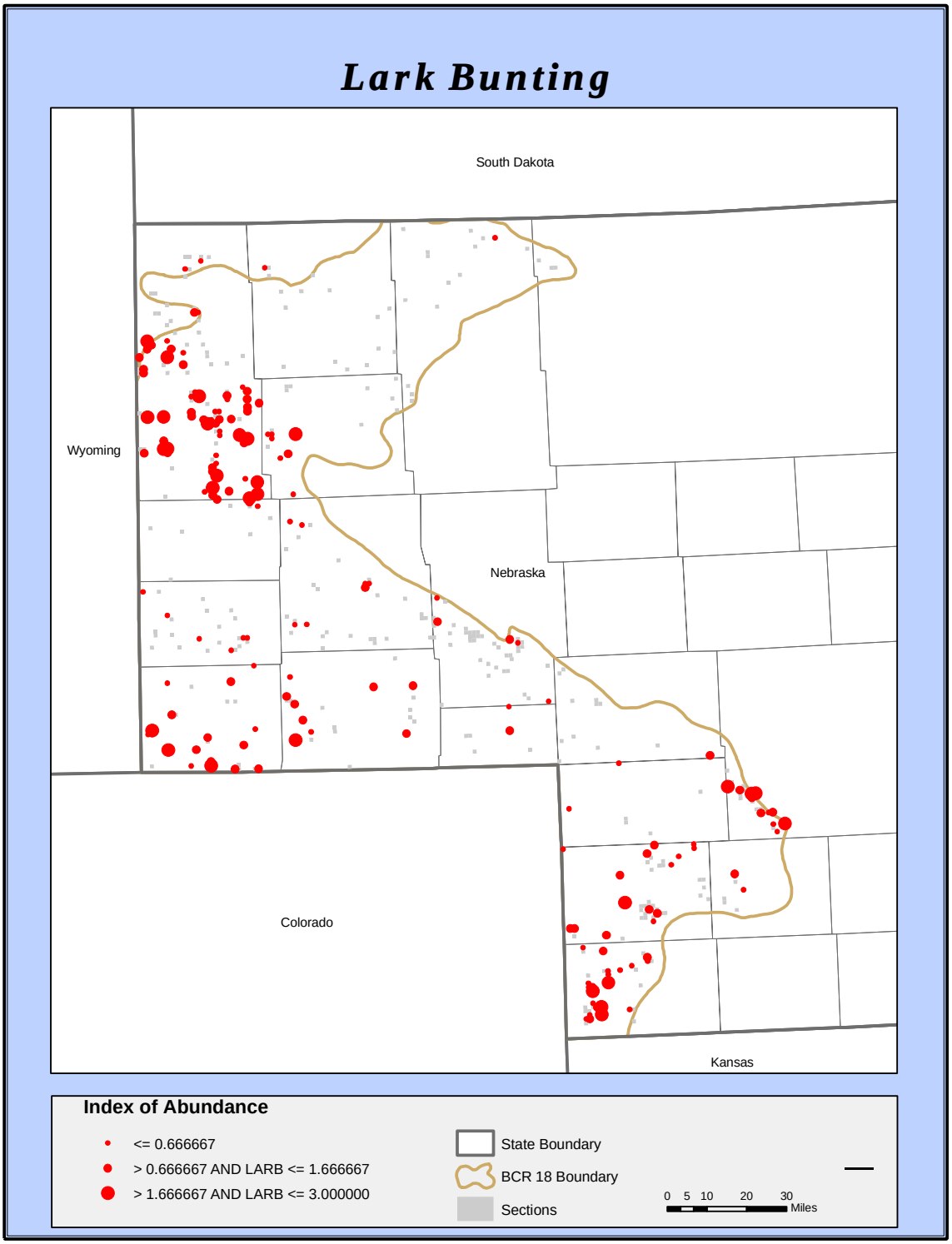
0 5 10 20 30 Miles

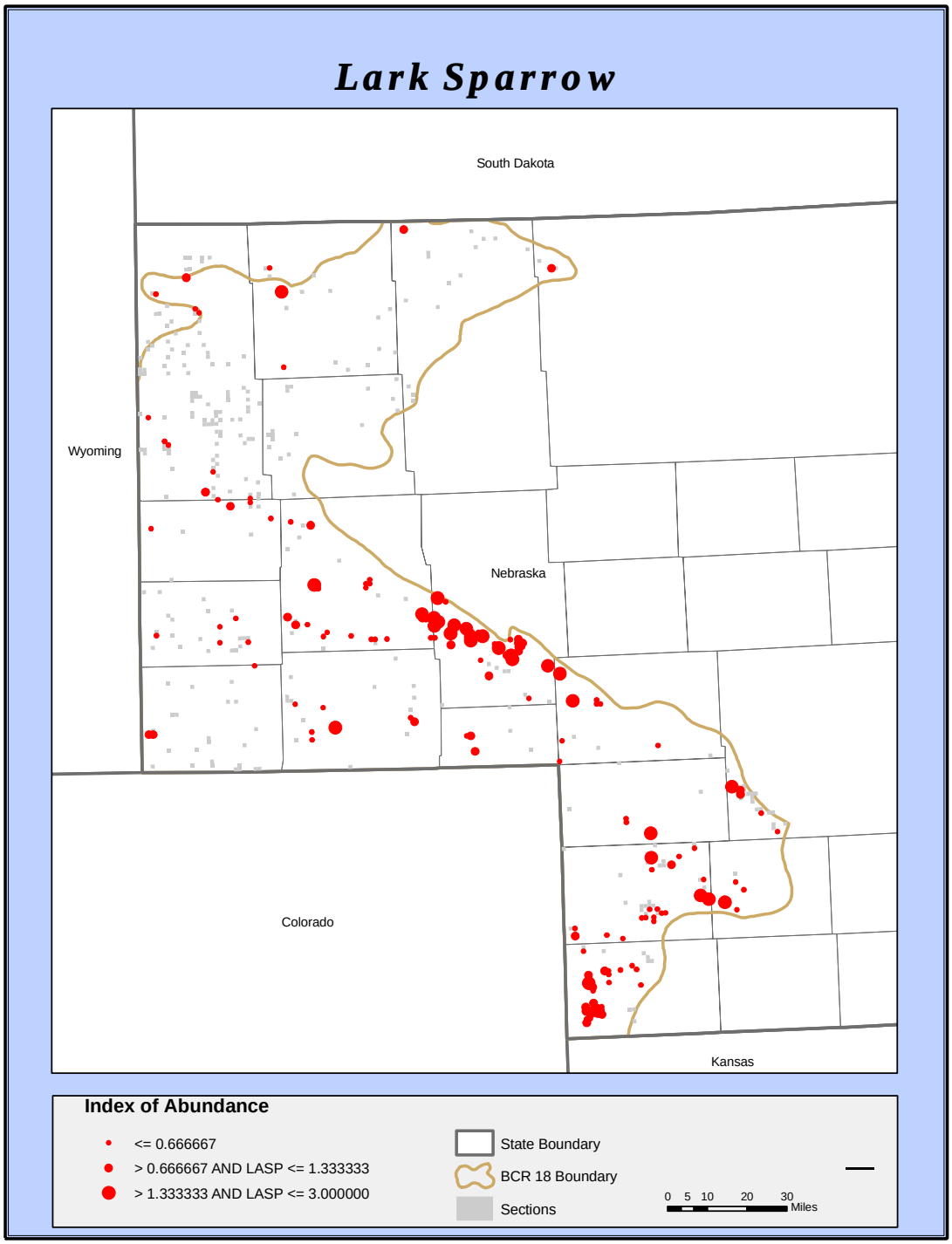

House Sparrow
South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.500000
> 0.500000 AND HOSP <= 1.000000
> 1.000000 AND HOSP <= 2.000000
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Killdeer

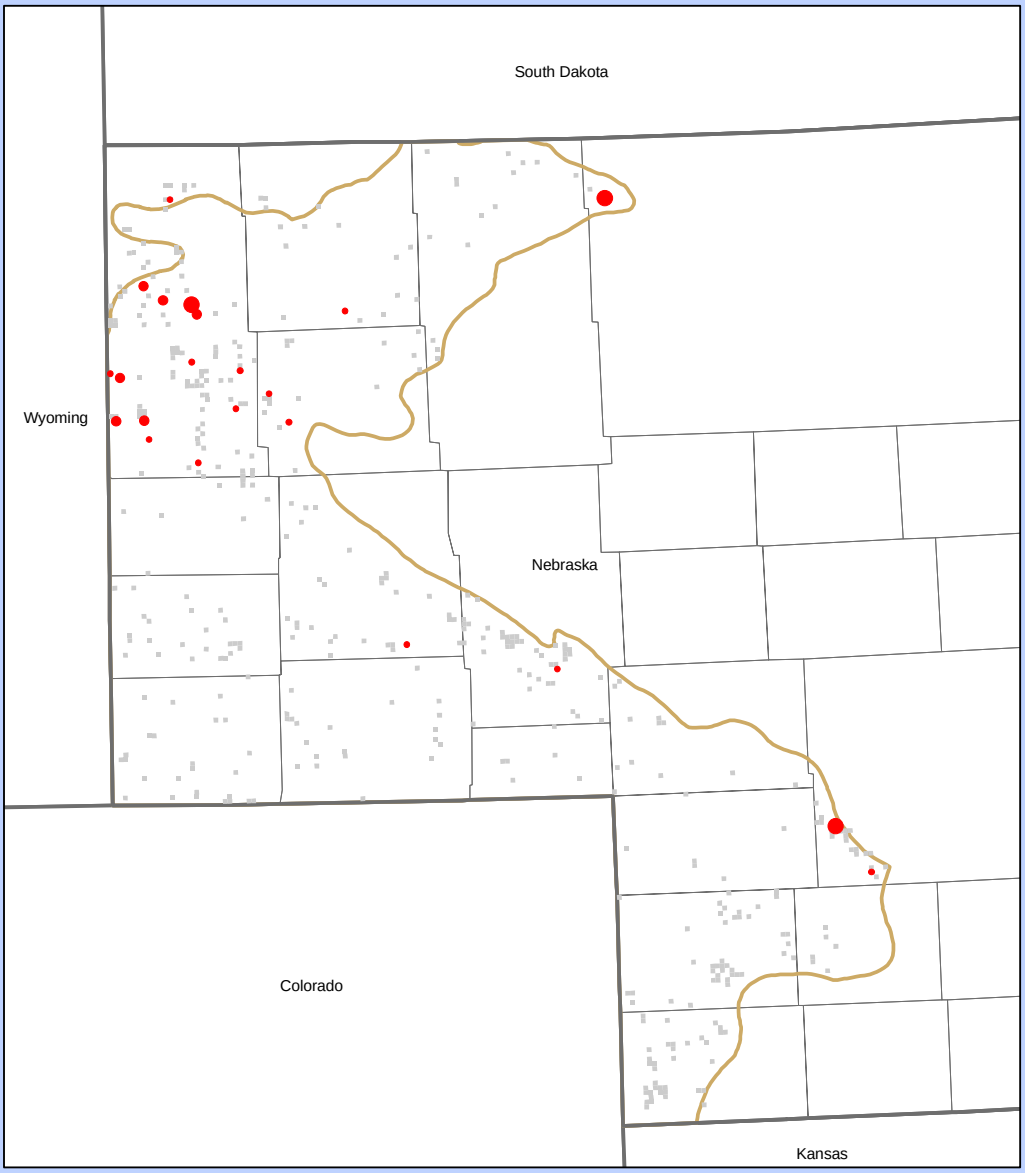

South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.500000
> 0.500000 AND KILL <= 1.000000
> 1.000000 AND KILL <= 2.000000
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Lark Bunting




Lark Sparrow
South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.666667
> 0.666667 AND LASP <= 1.333333
> 1.333333 AND LASP <= 3.000000
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Long-billed Curlew



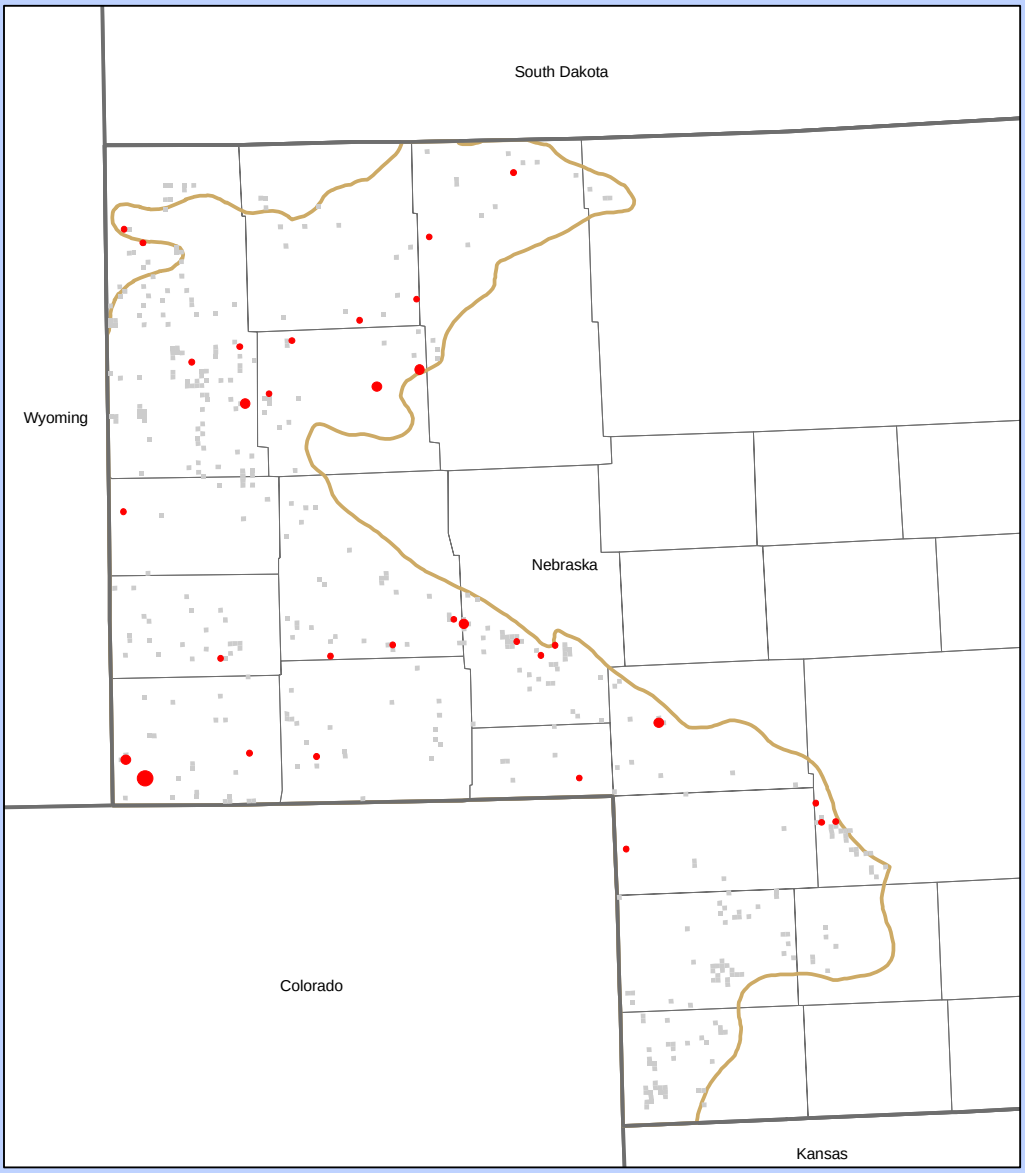
Index of Abundance

- <= 0.333333
- > 0.333333 AND LBCU <= 0.666667
- > 0.666667 AND LBCU <= 1.666667

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Loggerhead Shrike



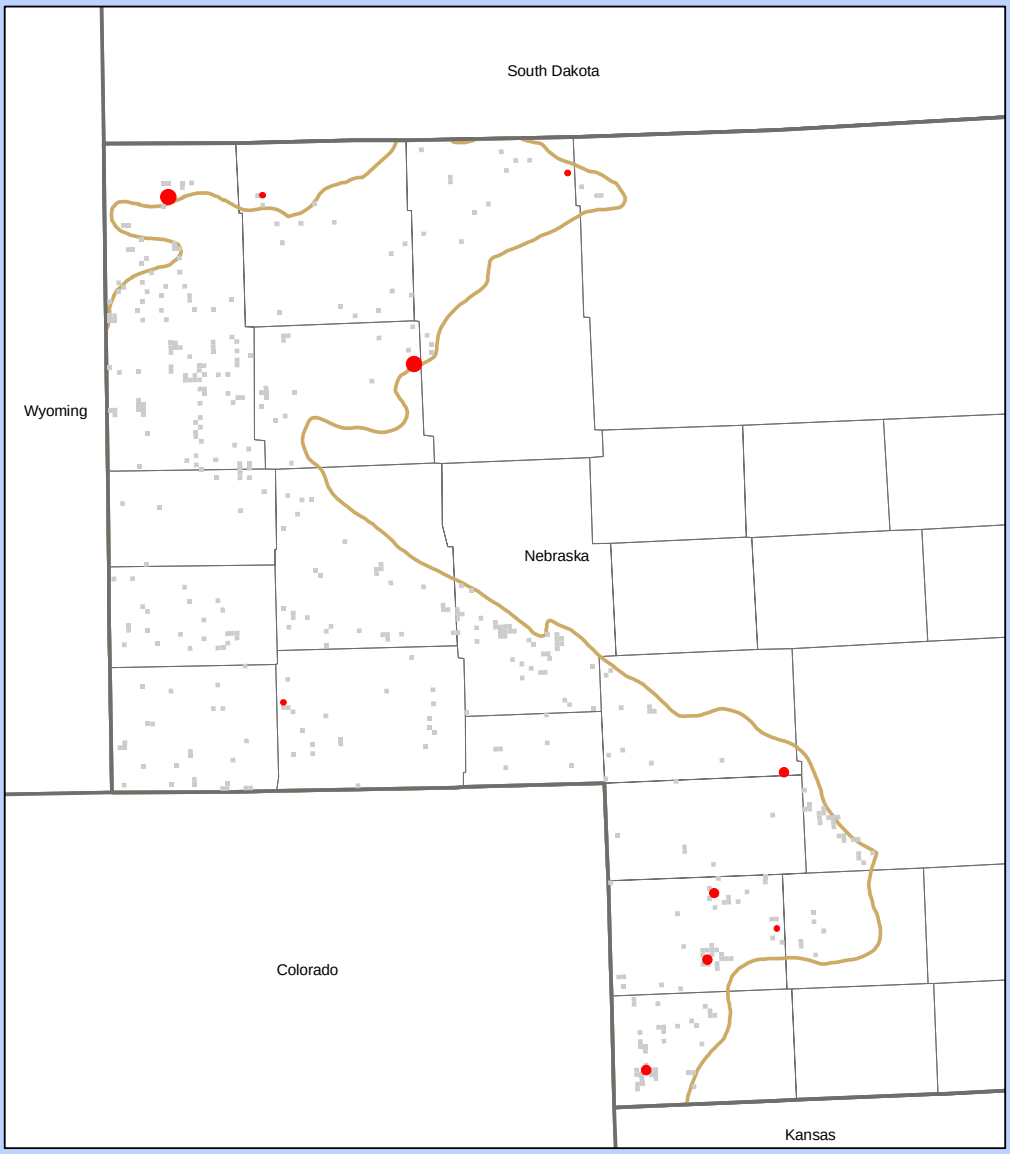
Index of Abundance

- <= 0.333333
- > 0.333333 AND LOSH <= 0.666667
- > 0.666667 AND LOSH <= 1.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Mallard

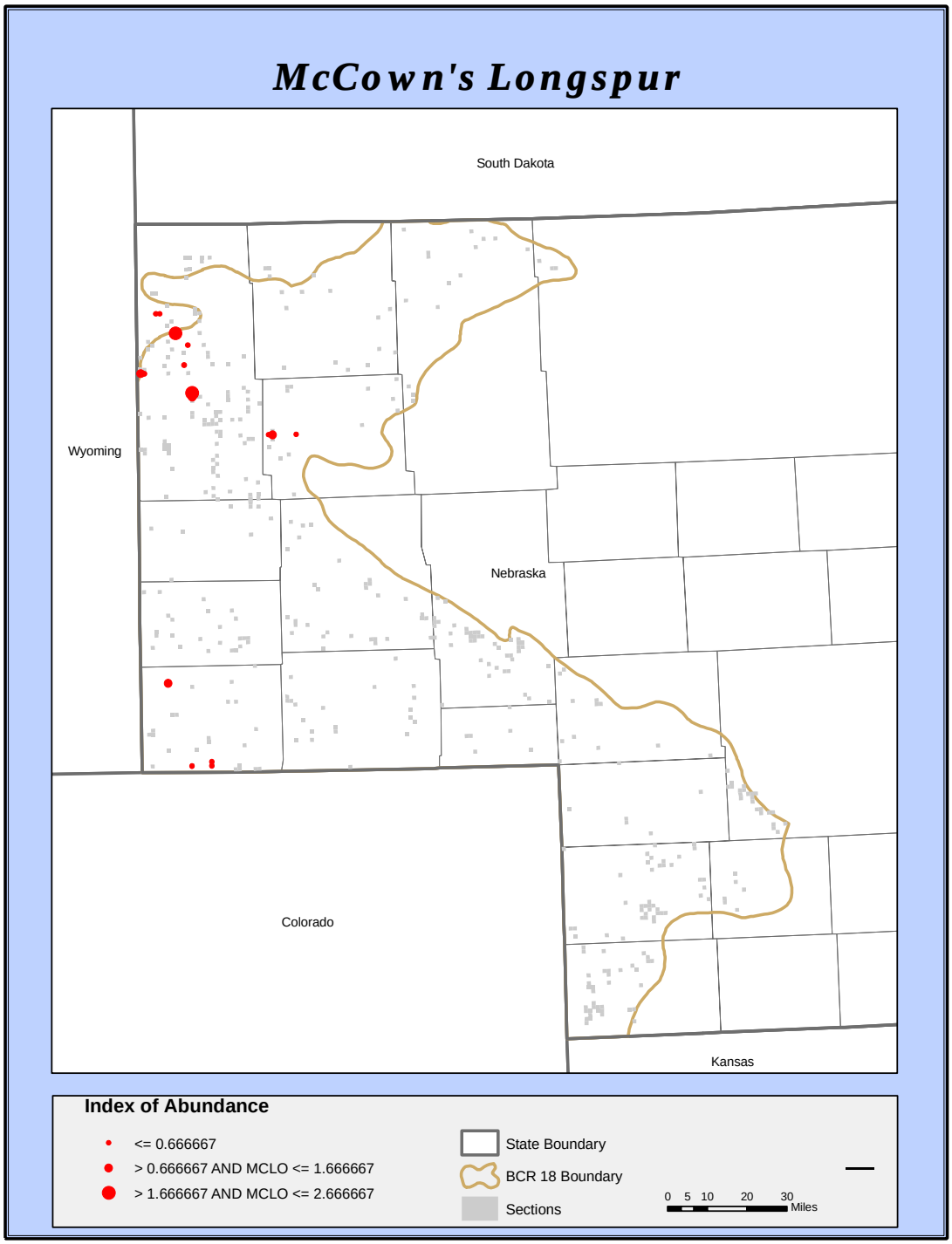


Index of Abundance

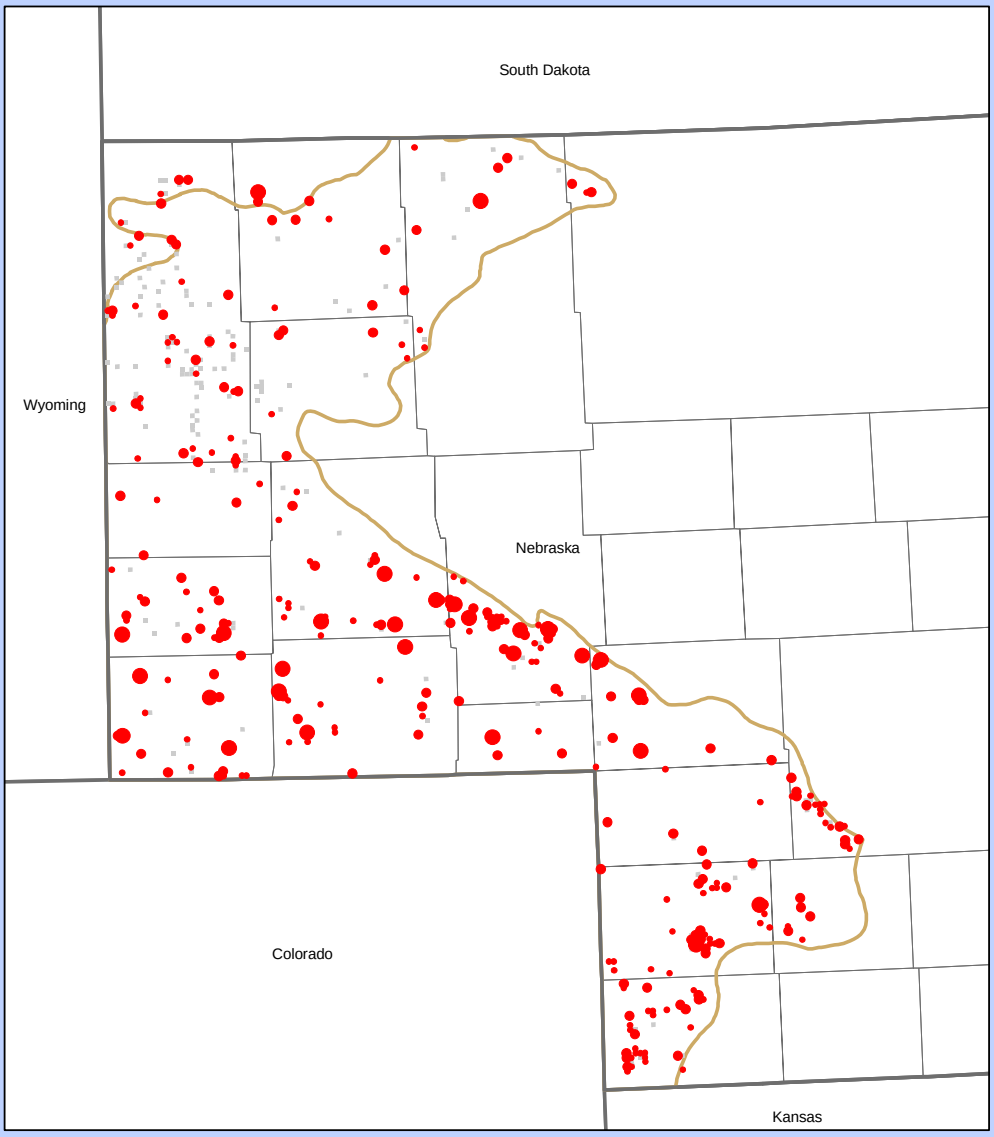
- <= 0.333333
- > 0.333333 AND MALL <= 0.666667
- > 0.666667 AND MALL <= 1.333333

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles


McCown's Longspur
South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.666667
> 0.666667 AND MCLO <= 1.666667
> 1.666667 AND MCLO <= 2.666667
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Mourning Dove



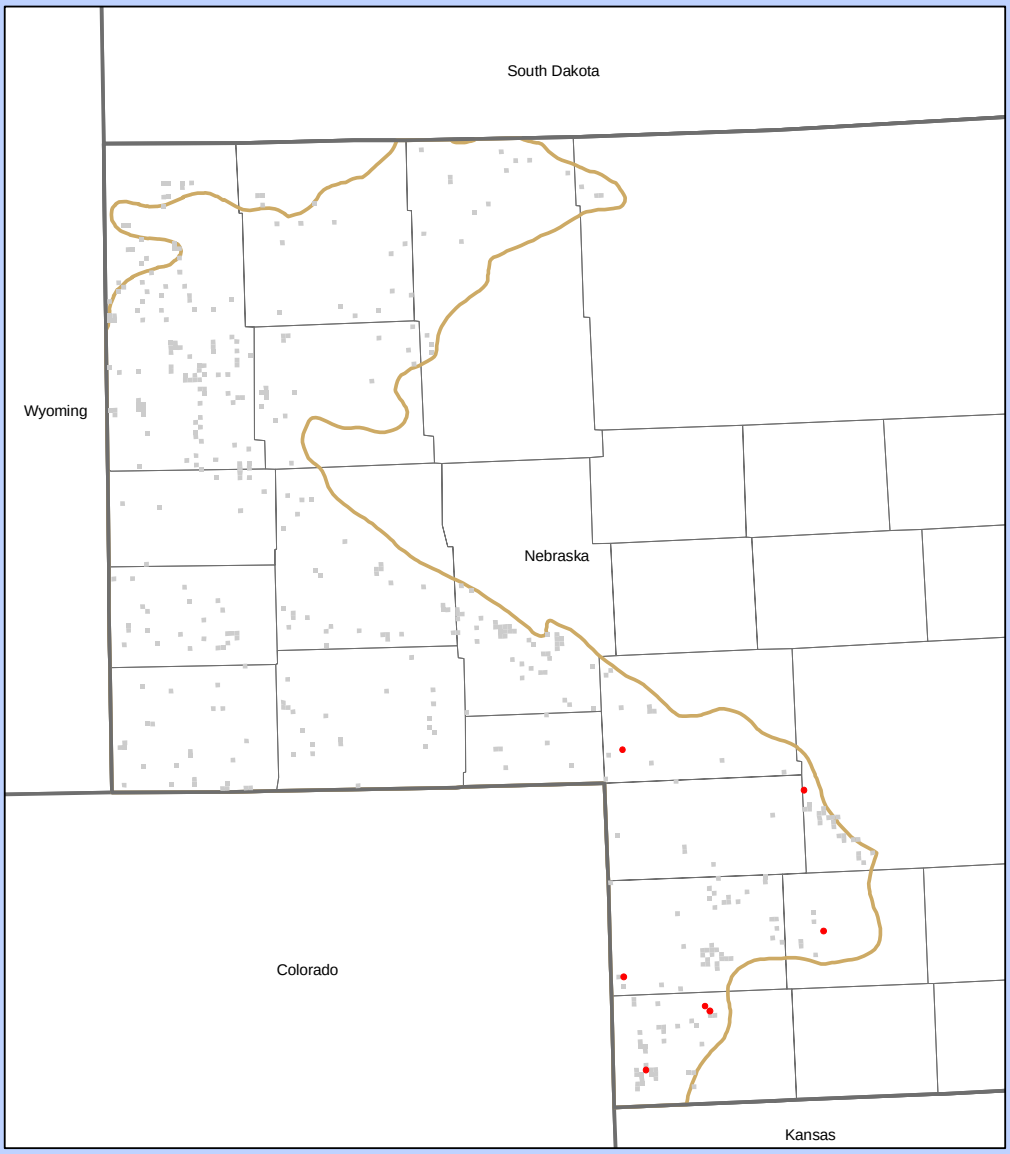
Index of Abundance

- <= 0.666667
- > 0.666667 AND MODO <= 1.666667
- > 1.666667 AND MODO <= 3.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Northern Bobwhite



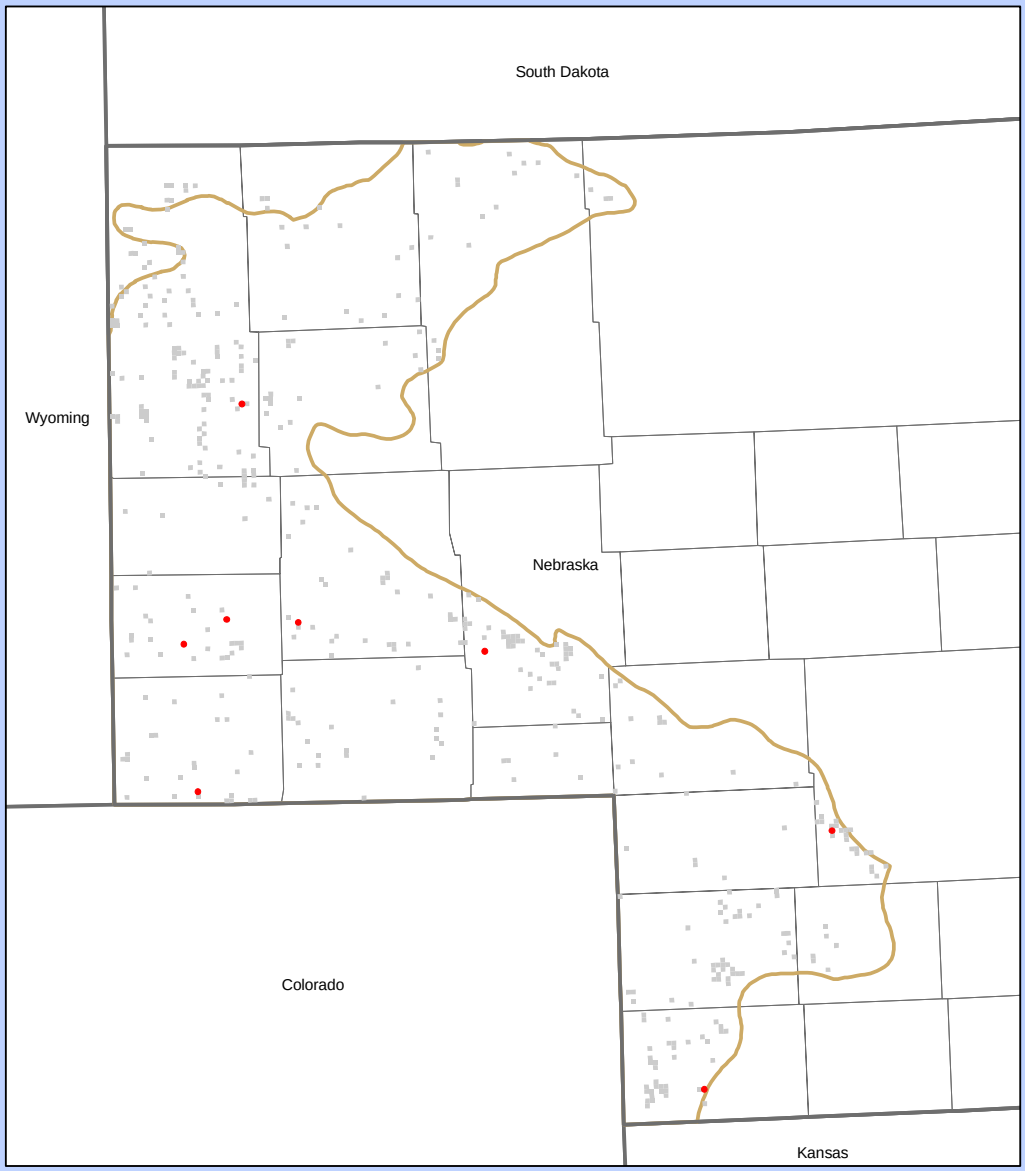
Index of Abundance

- <= 0.333333
- > 0.333333 AND NOBO <= 0.666667
- > 0.666667 AND NOBO <= 1.333333

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Northern Harrier



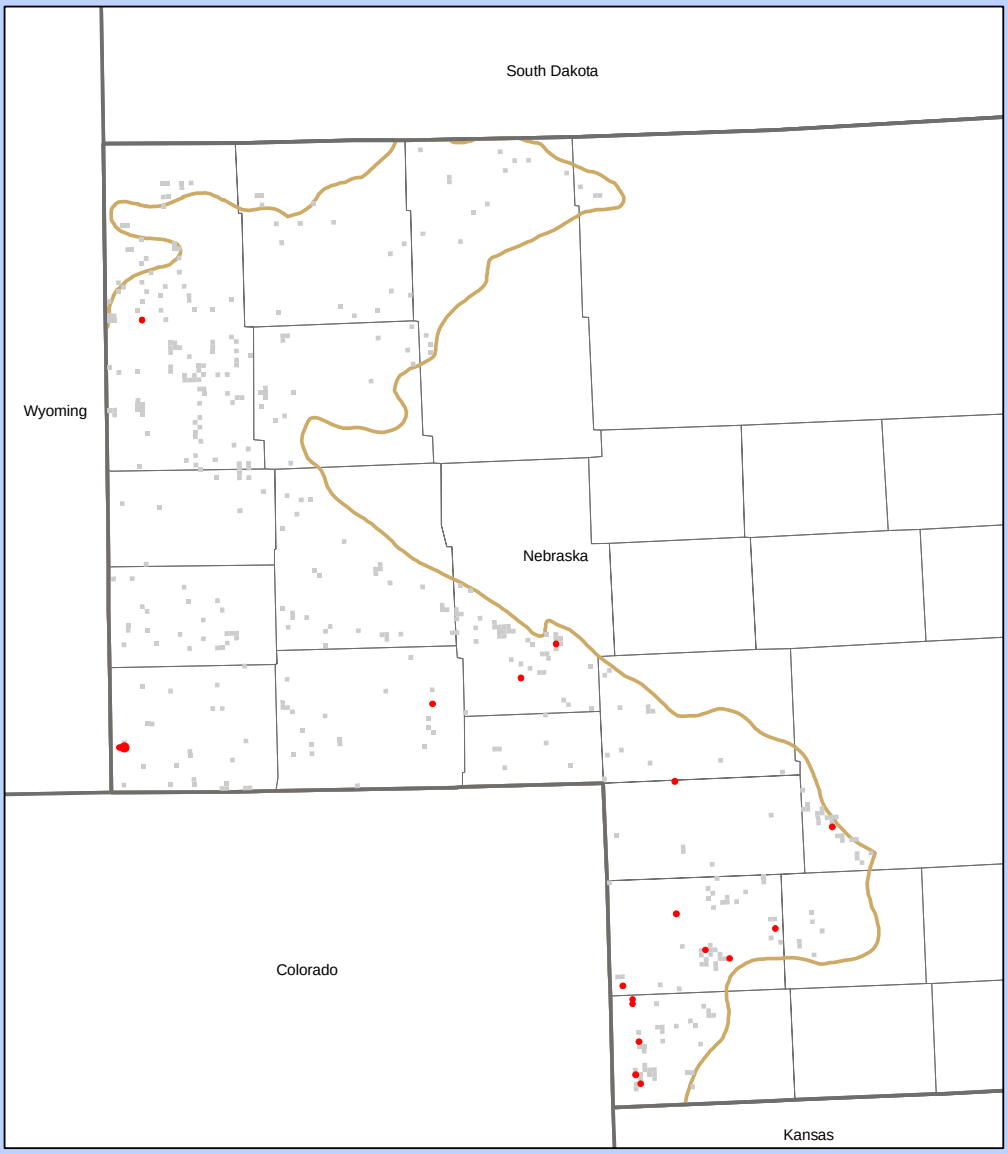
Index of Abundance

- <= 0.333333
- > 0.333333 AND NOHA <= 0.666667
- > 0.666667 AND NOHA <= 1.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Northern Mockingbird



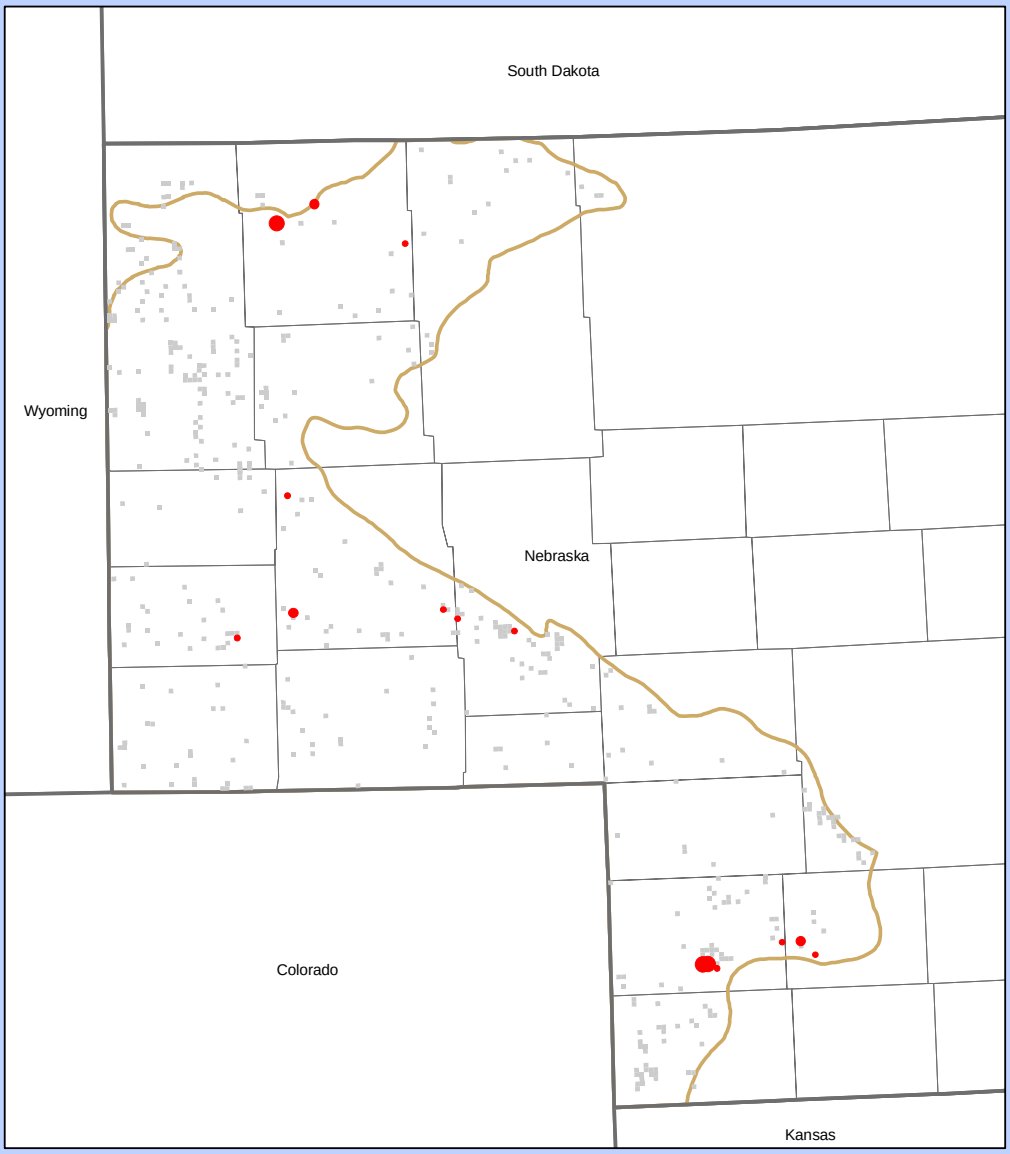
Index of Abundance

- <= 0.333333
- > 0.333333 AND NOMO <= 1.000000
- > 1.000000 AND NOMO <= 1.666667

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Northern Rough-winged Swallow



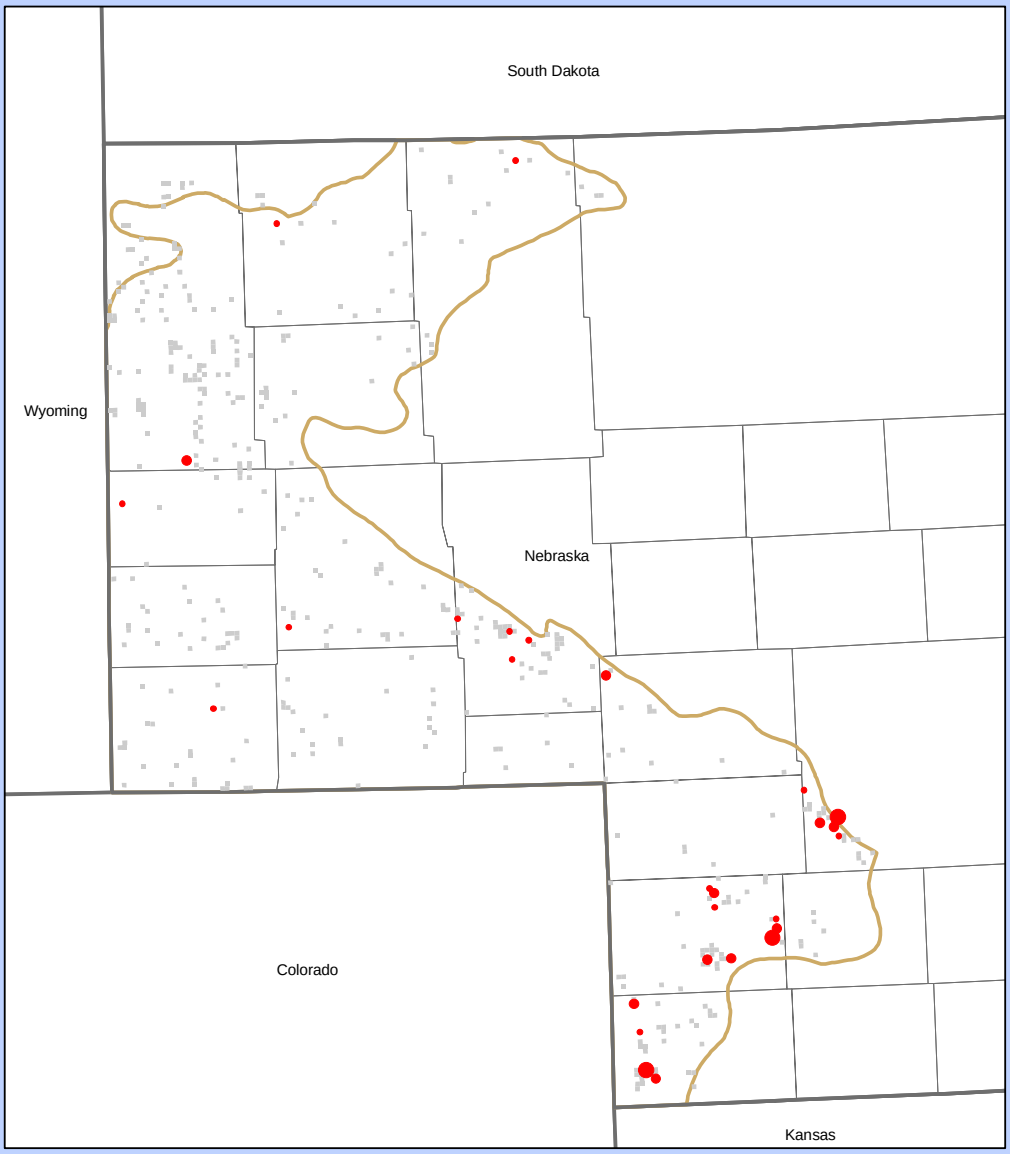
Index of Abundance

- <= 0.333333
- > 0.333333 AND NRWS <= 0.666667
- > 0.666667 AND NRWS <= 1.333333

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Orchard Oriole



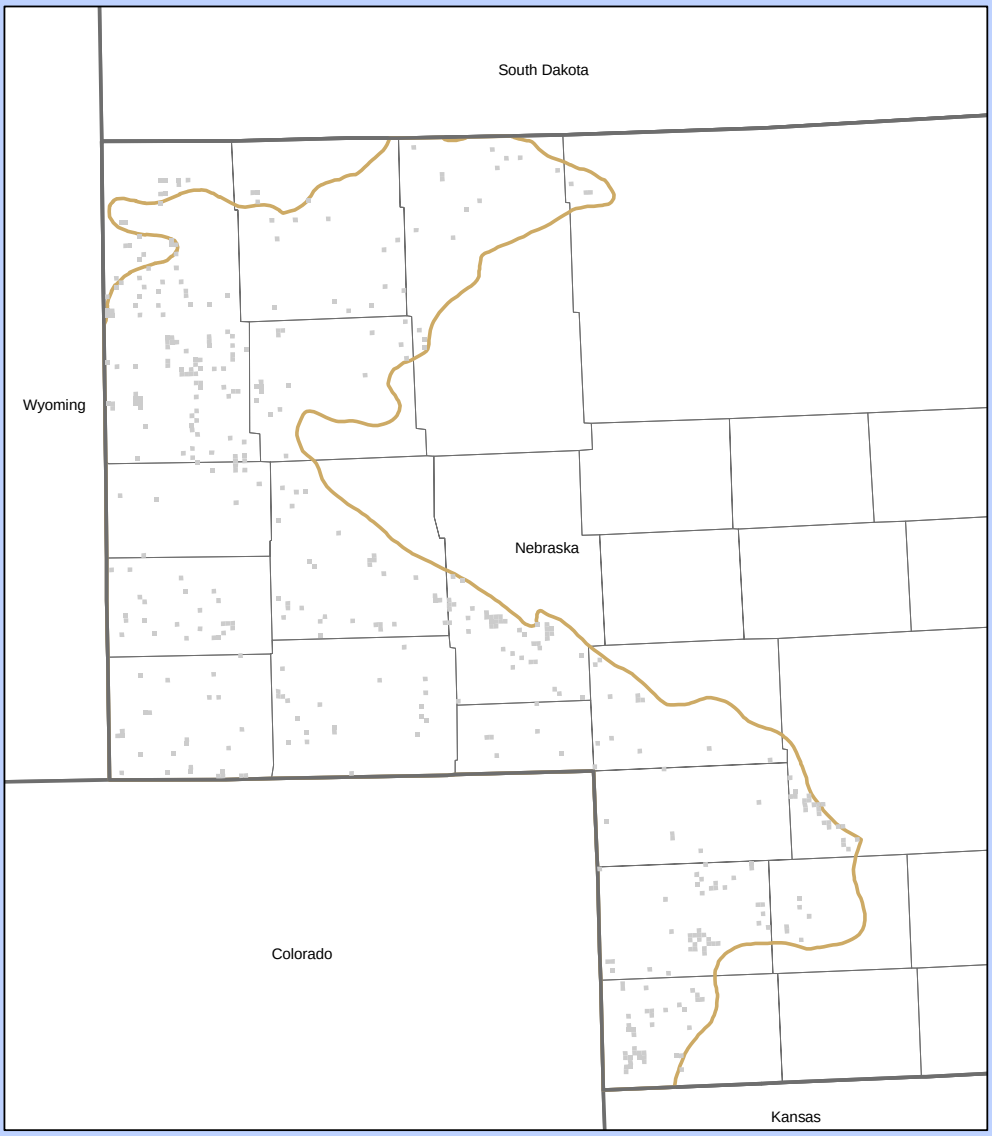
Index of Abundance

- <= 0.333333
- > 0.333333 AND OROR <= 0.666667
- > 0.666667 AND OROR <= 1.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Red-headed Woodpecker



Index of Abundance

<= 0.333333

> 0.333333 AND RHWO <= 0.666667

> 0.000000 AND RHWO <= 0.000000

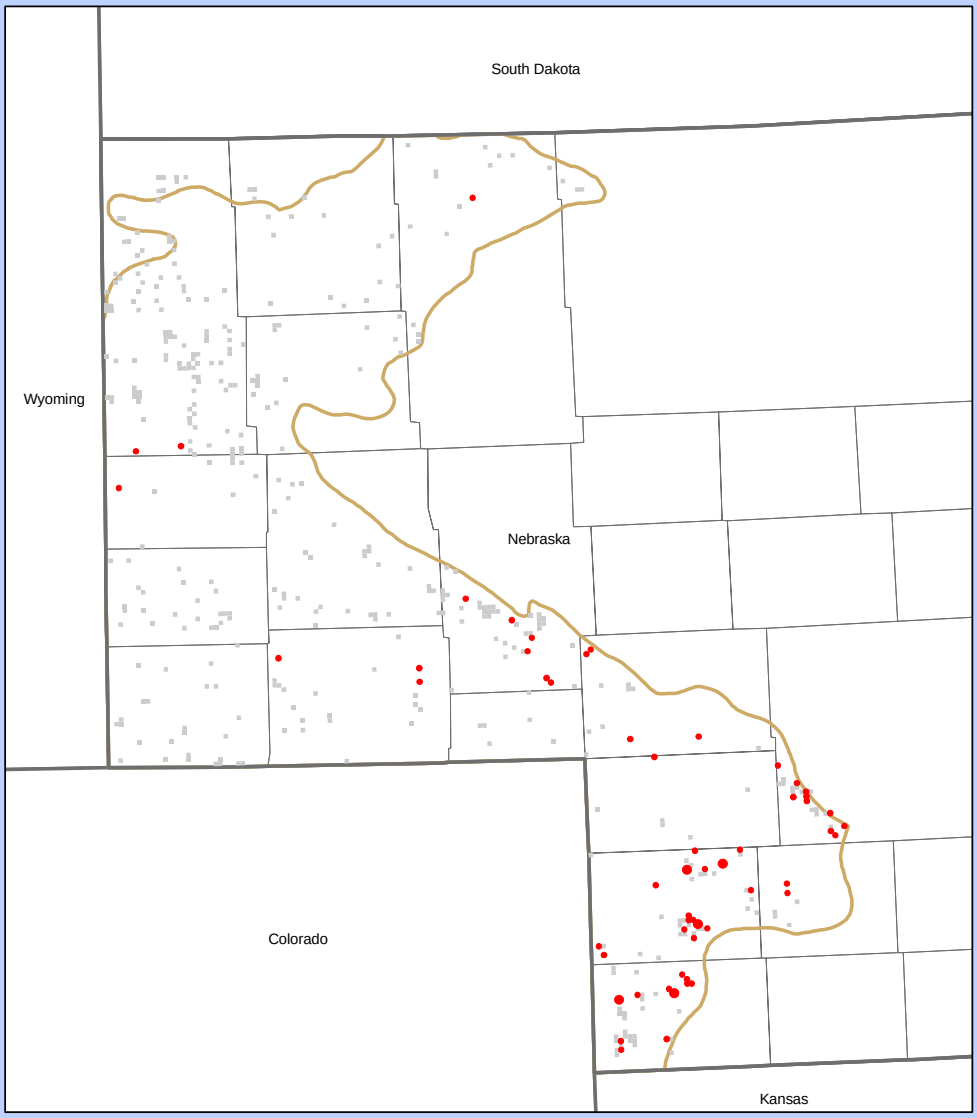
State Boundary

BCR 18 Boundary

Sections

0 5 10 20 30 Miles

Ring-necked Pheasant



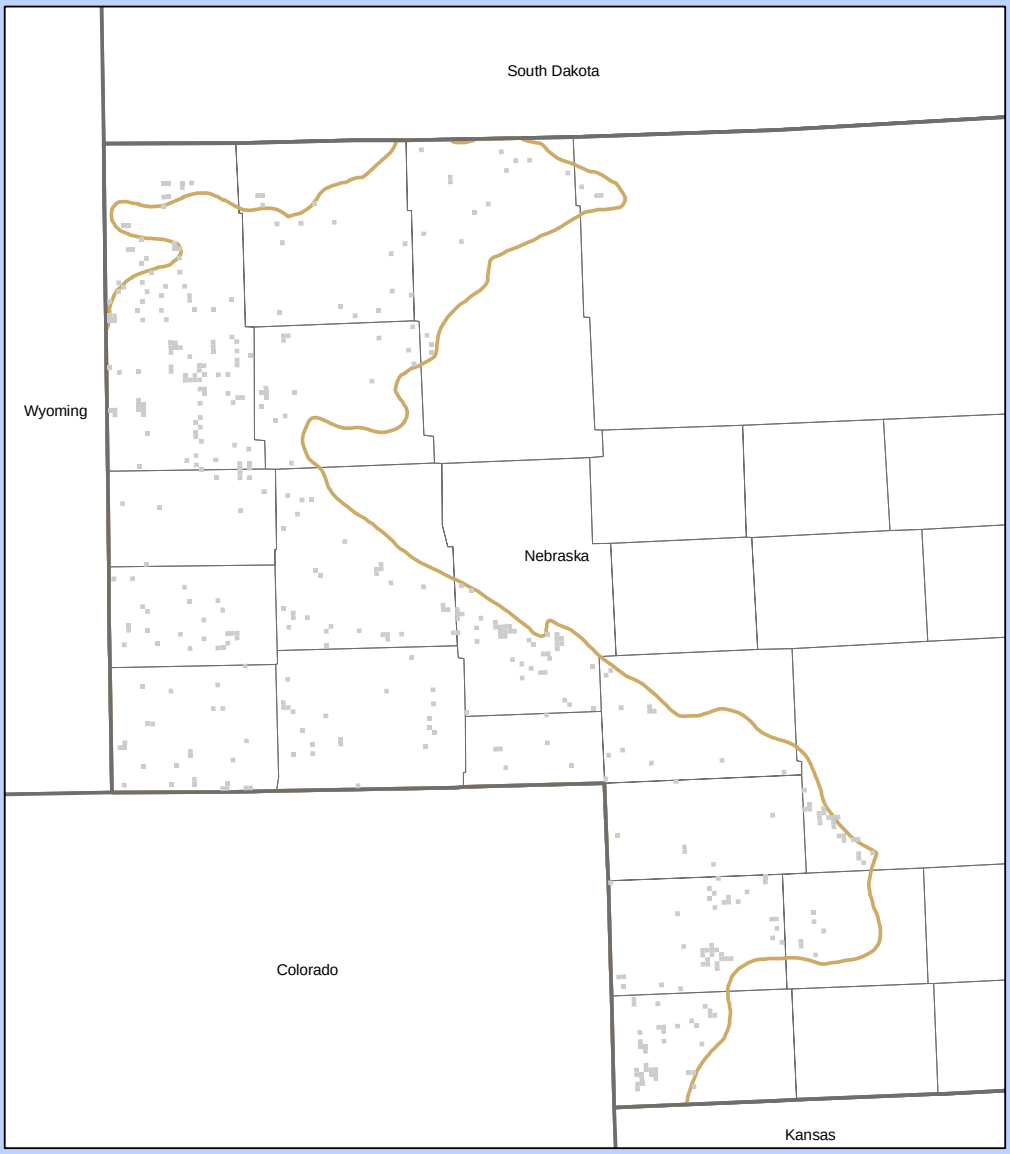
Index of Abundance

- <= 0.666667
- > 0.666667 AND RINP <= 1.333333
- > 1.333333 AND RINP <= 2.333333

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Red-necked Phalarope



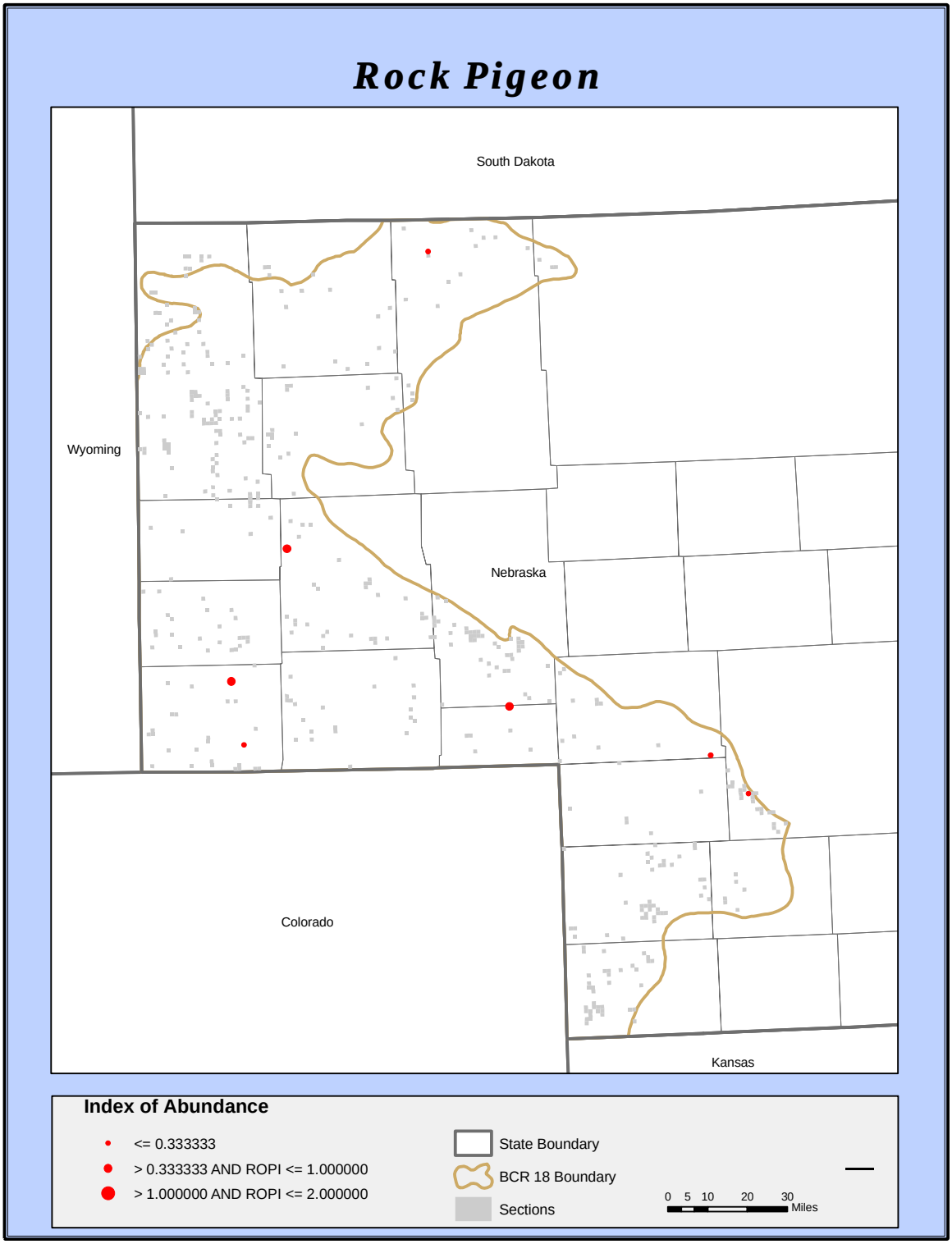
Index of Abundance

- <= 0.333333
- > 0.333333 AND RNPH <= 0.666667
- > 0.666667 AND RNPH <= 1.333333

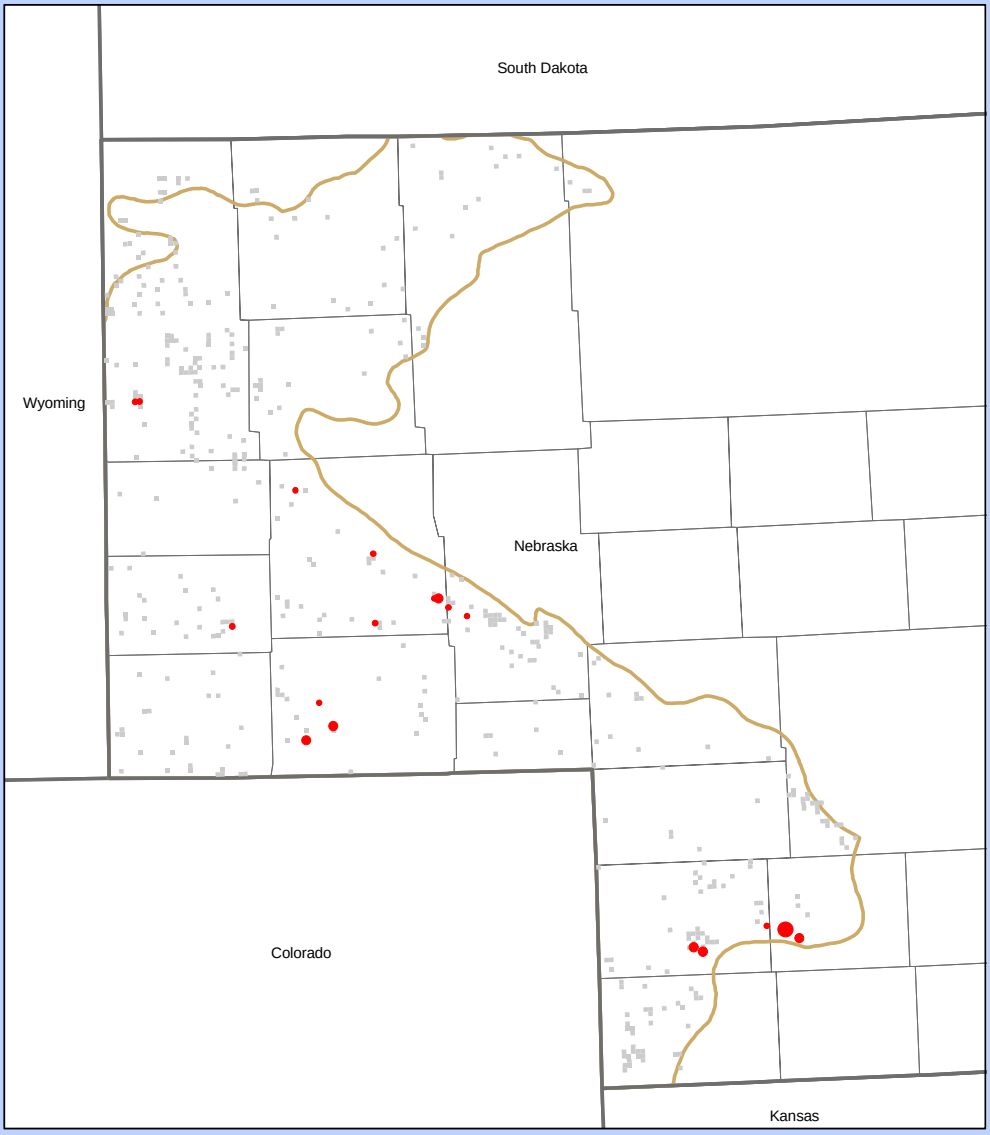
State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Rock Pigeon


South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.333333
> 0.333333 AND ROPI <= 1.000000
> 1.000000 AND ROPI <= 2.000000
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Rock Wren



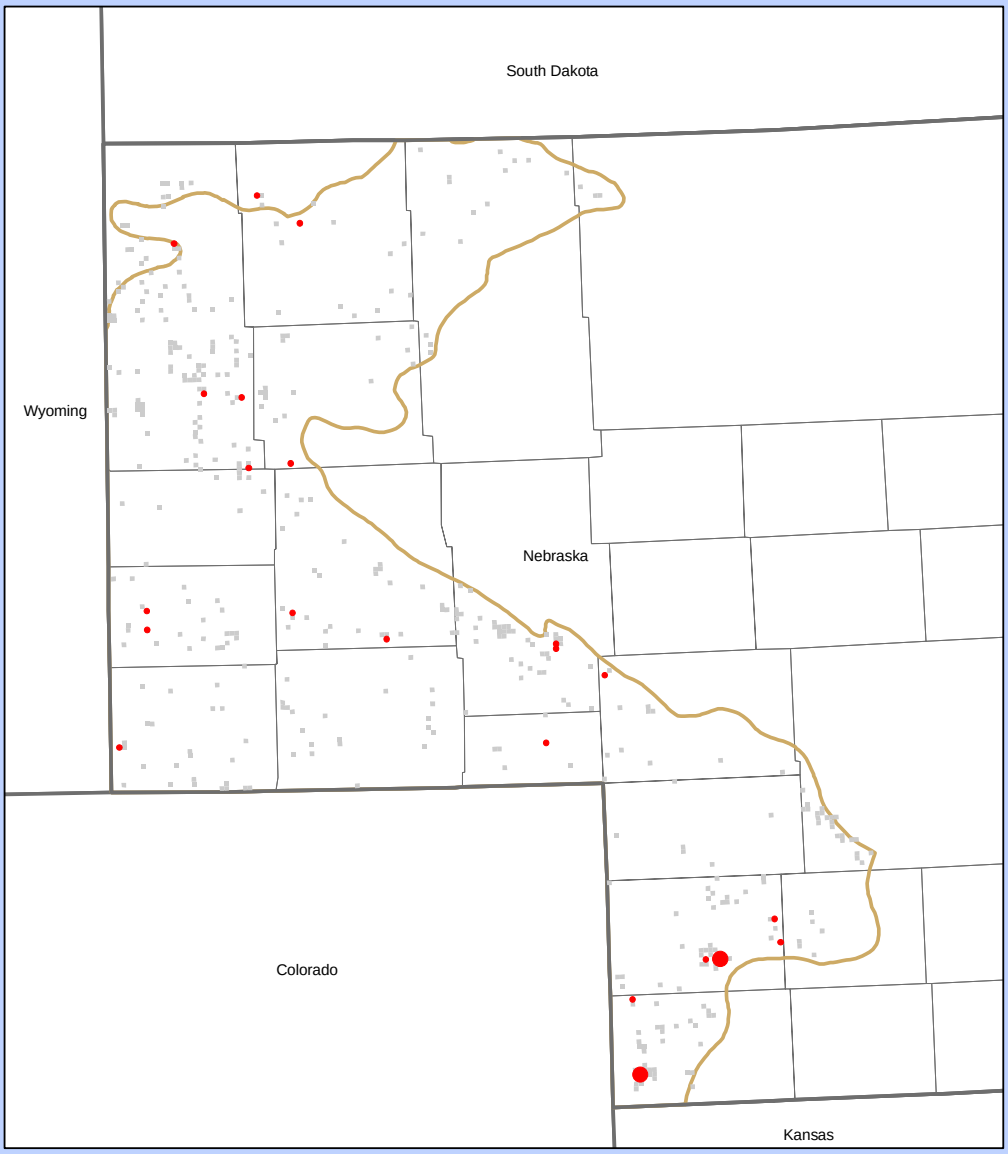
Index of Abundance

- <= 0.333333
- > 0.333333 AND ROWR <= 1.000000
- > 1.000000 AND ROWR <= 1.666667

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Red-tailed Hawk

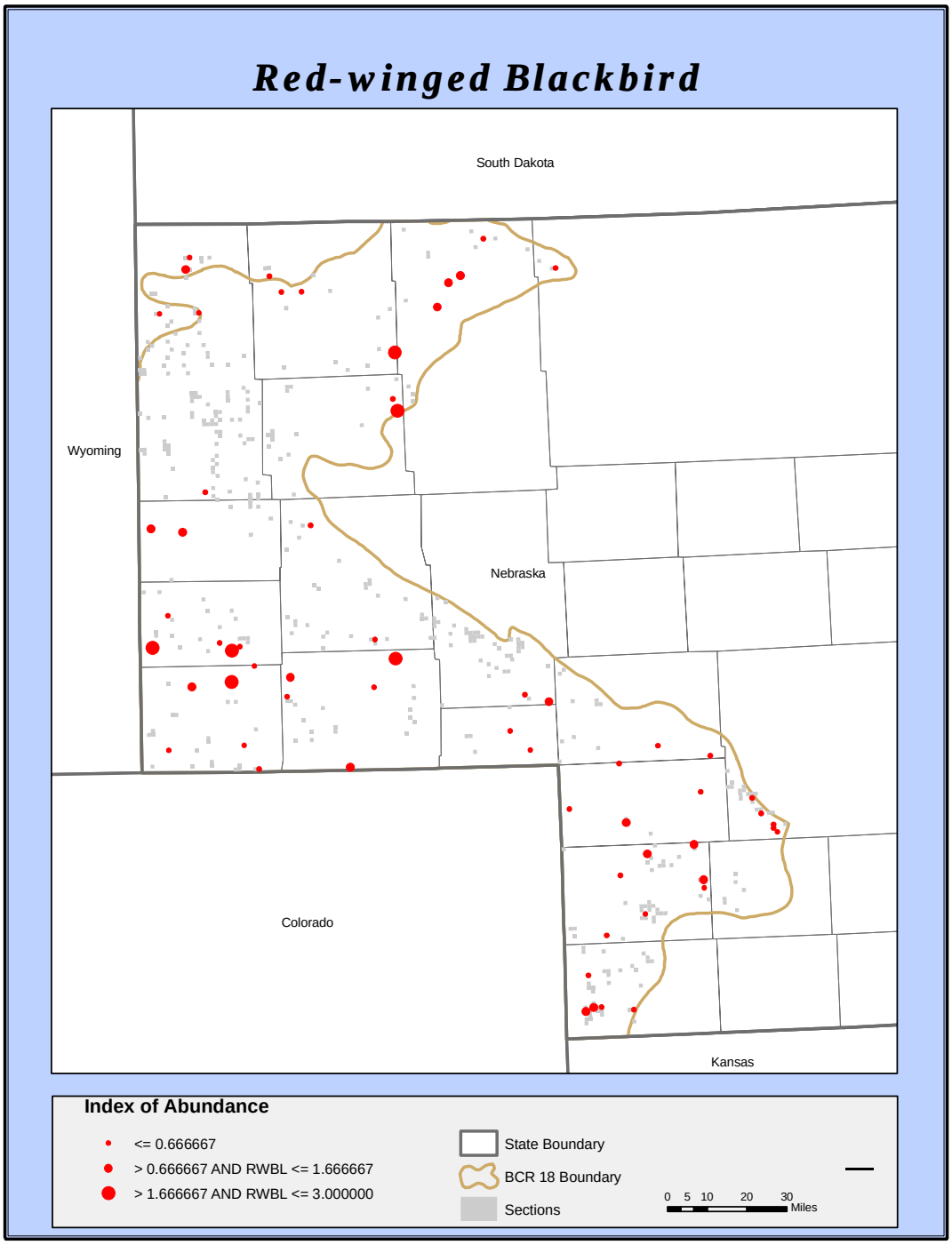


Index of Abundance

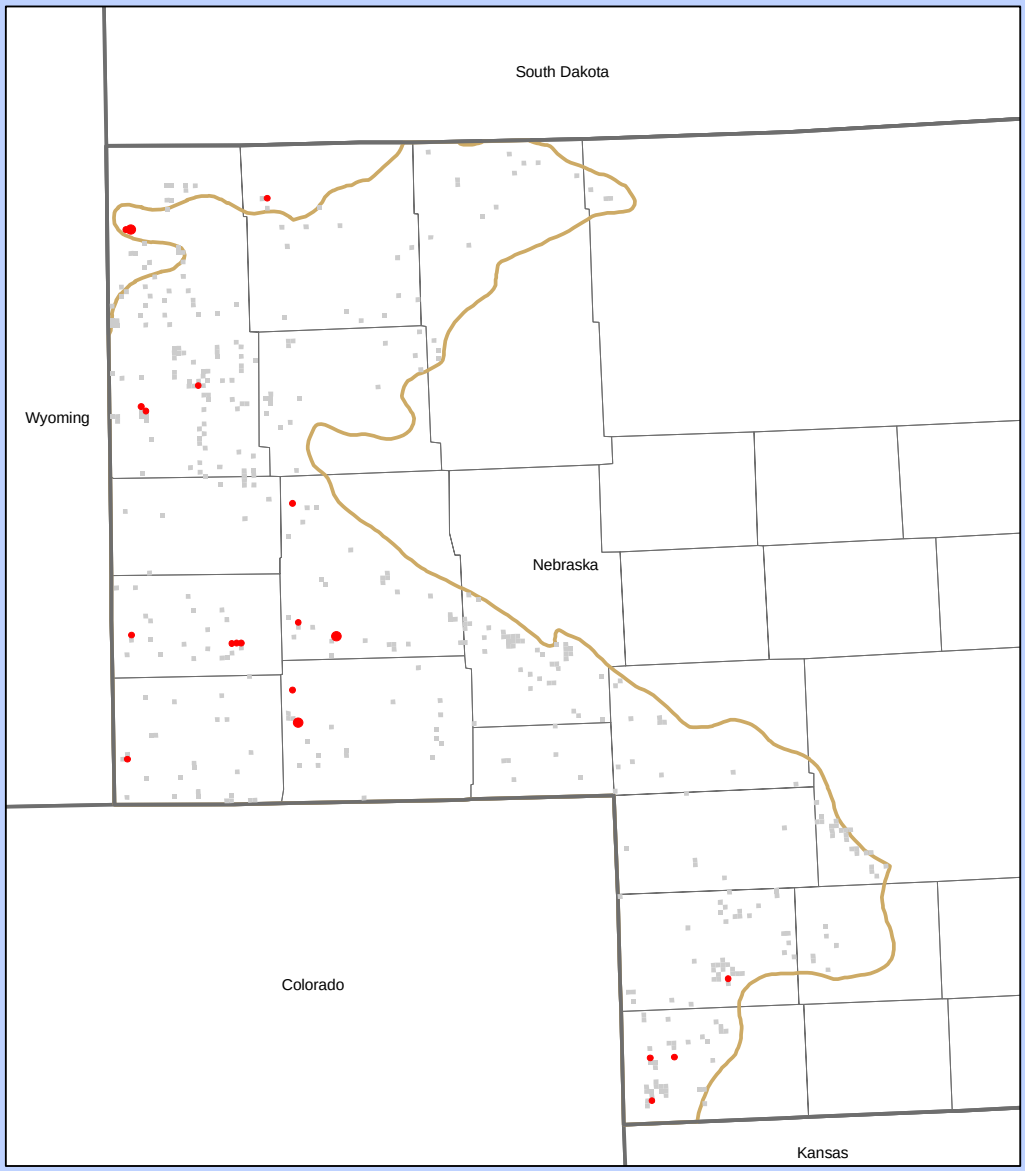
- <= 0.333333
- > 0.333333 AND RTHA <= 0.500000
- > 0.500000 AND RTHA <= 0.666667

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles


Red-winged Blackbird
South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.666667
> 0.666667 AND RWBL <= 1.666667
> 1.666667 AND RWBL <= 3.000000
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

Say's Phoebe



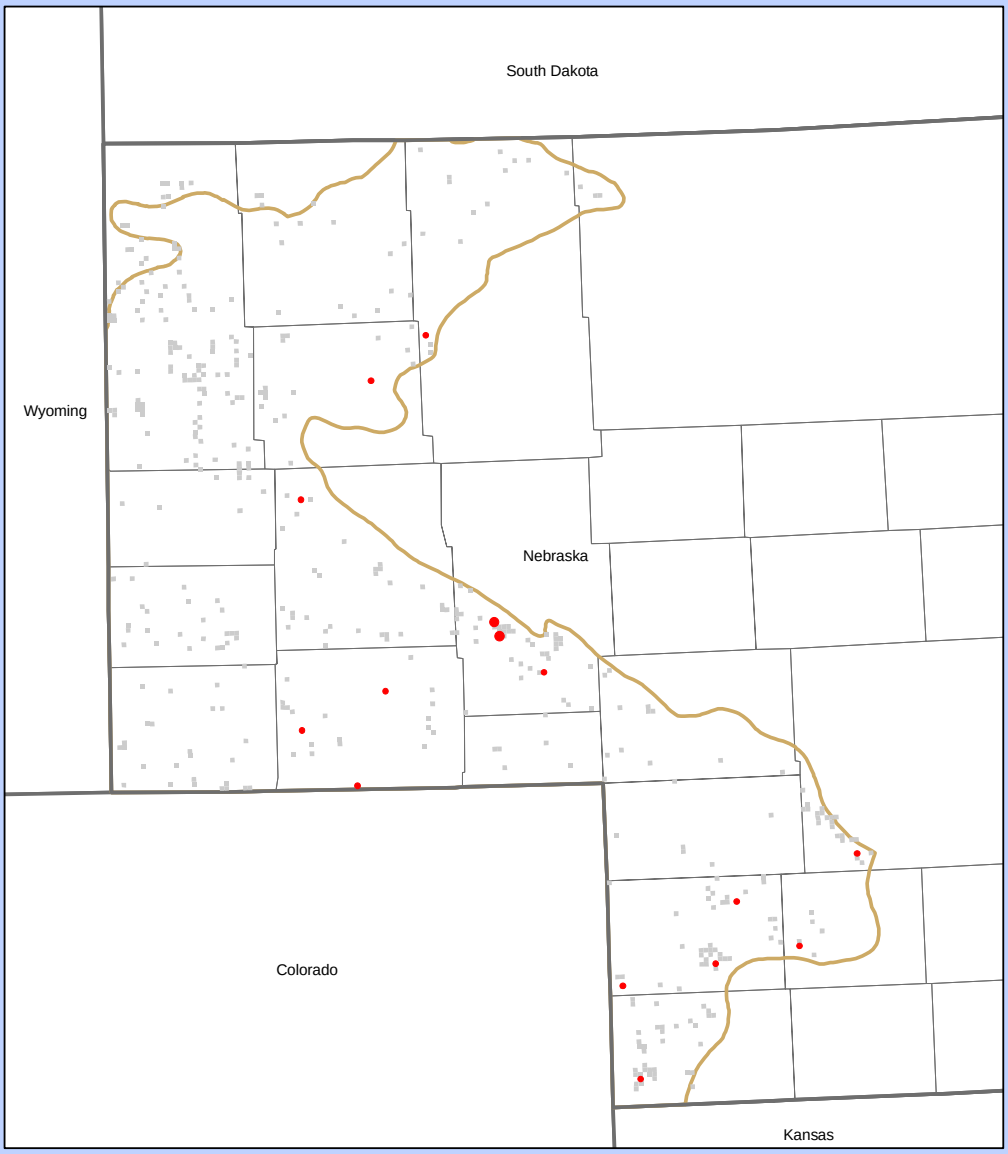
Index of Abundance

- <= 0.333333
- > 0.333333 AND SAPH <= 0.666667
- > 0.666667 AND SAPH <= 1.333333

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Swainson's Hawk



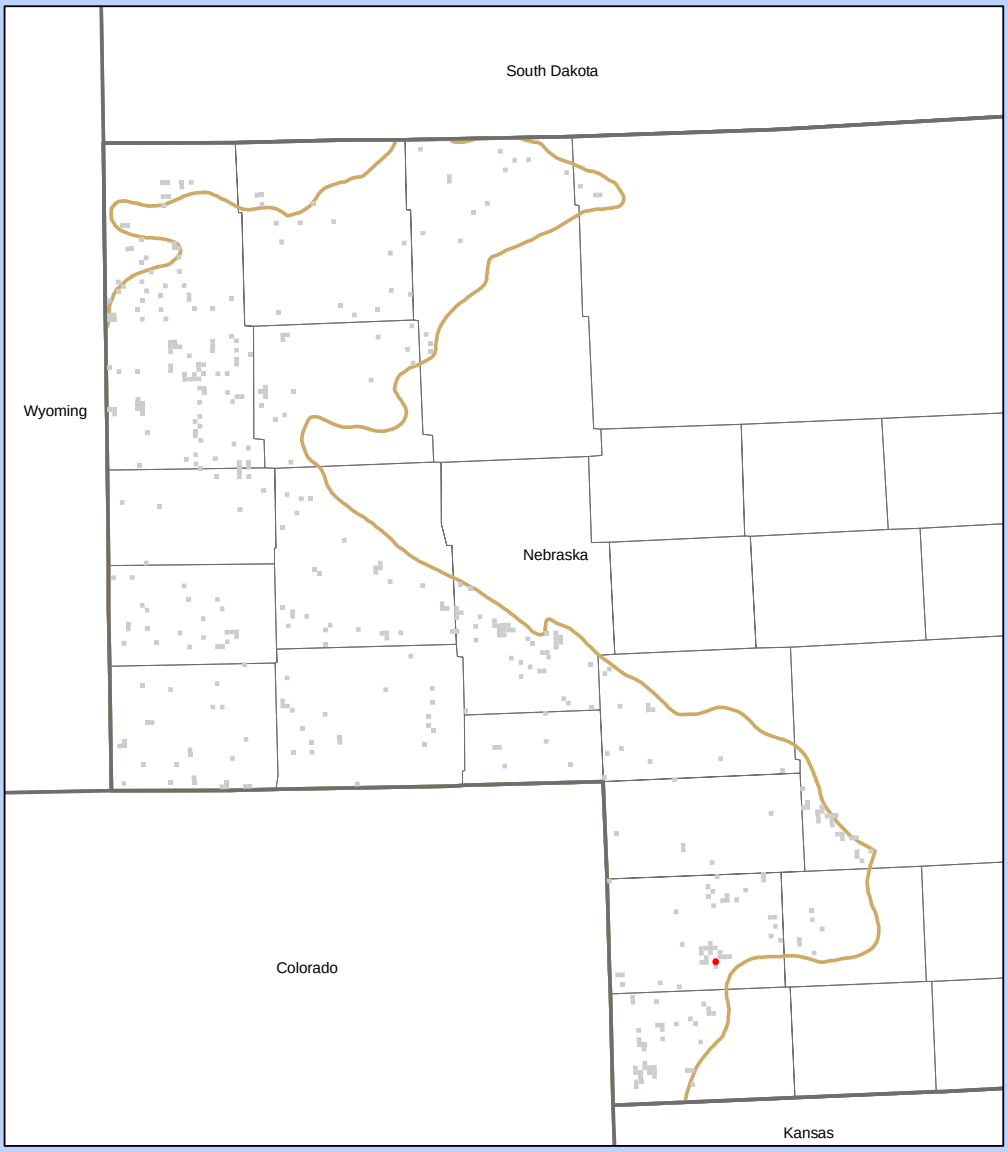
Index of Abundance

- <= 0.333333
- > 0.333333 AND SWHA <= 0.666667
- > 0.666667 AND SWHA <= 1.333333

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Tree Swallow



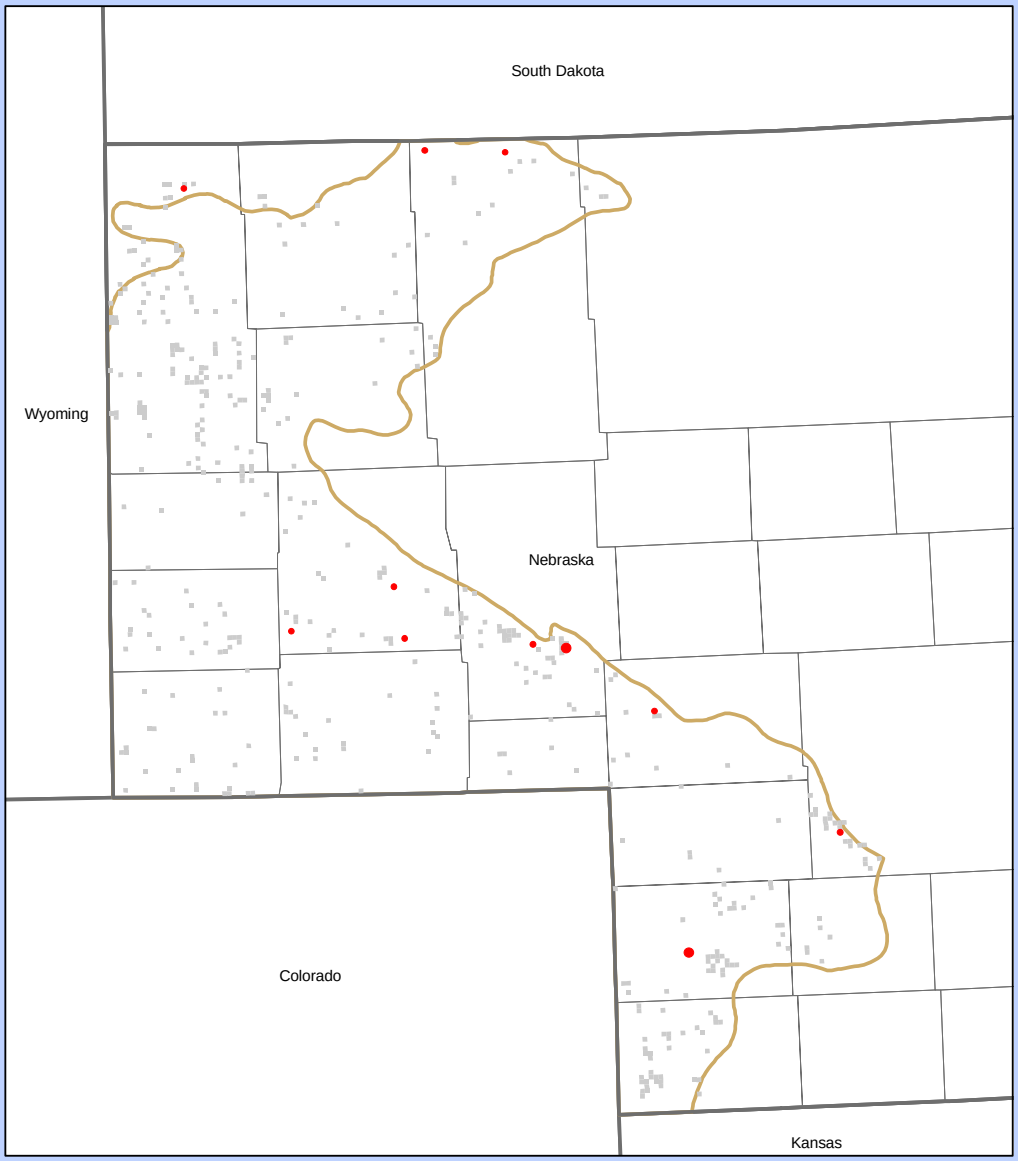
Index of Abundance

- <= 0.333333
- > 0.333333 AND TRES <= 0.666667
- > 0.666667 AND TRES <= 1.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Turkey Vulture



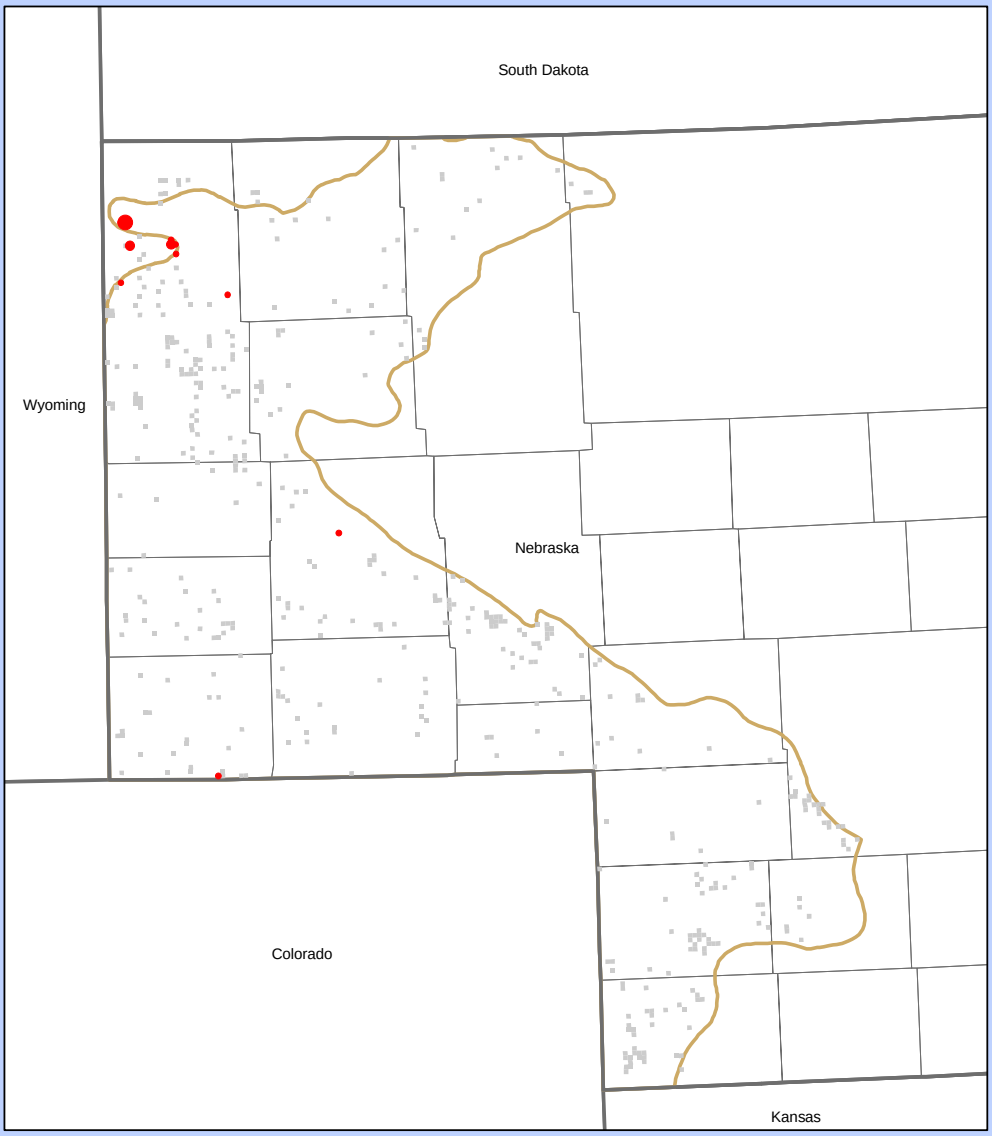
Index of Abundance

- <= 0.500000
- > 0.500000 AND TUVU <= 1.000000
- > 1.000000 AND TUVU <= 3.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles

Vesper Sparrow

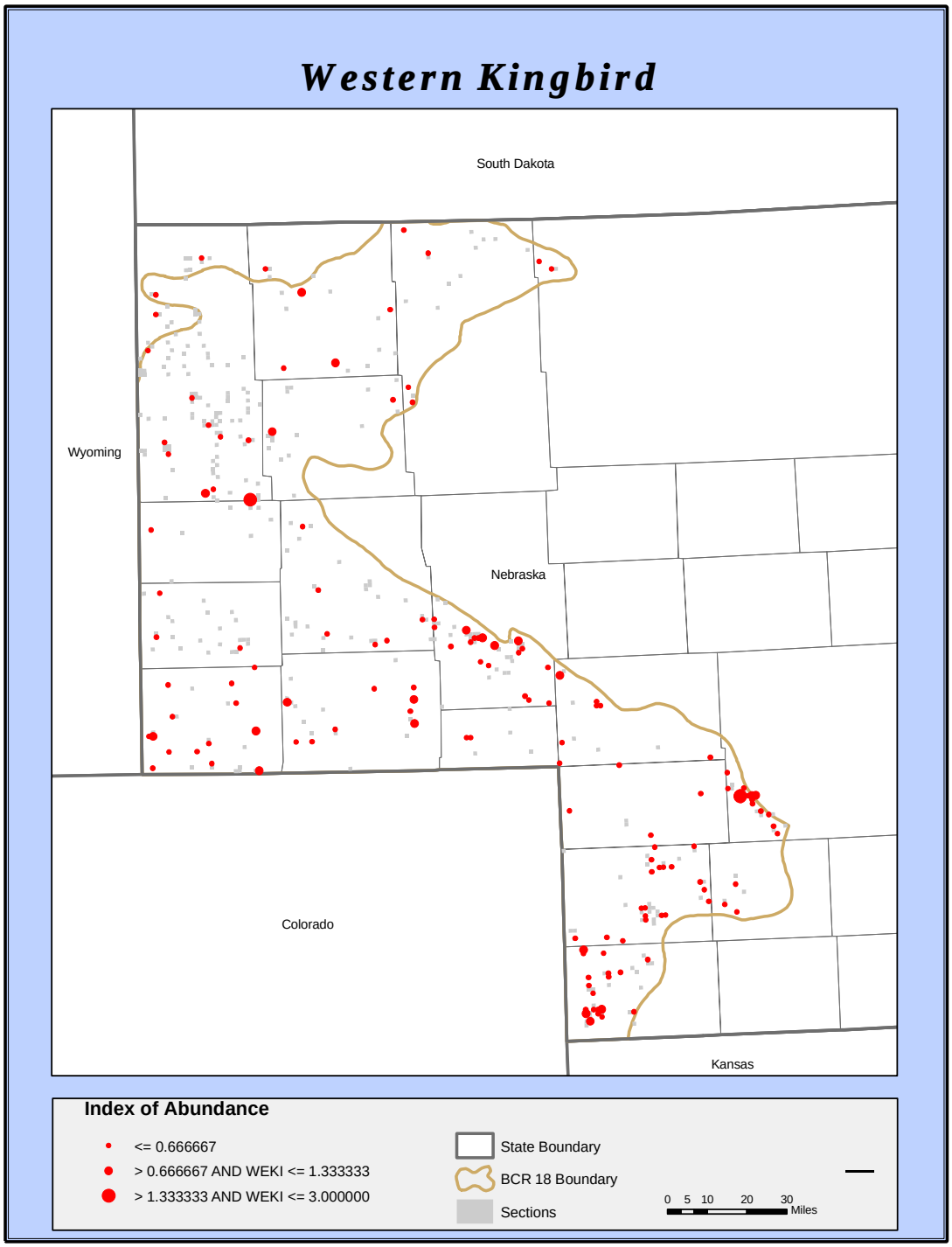


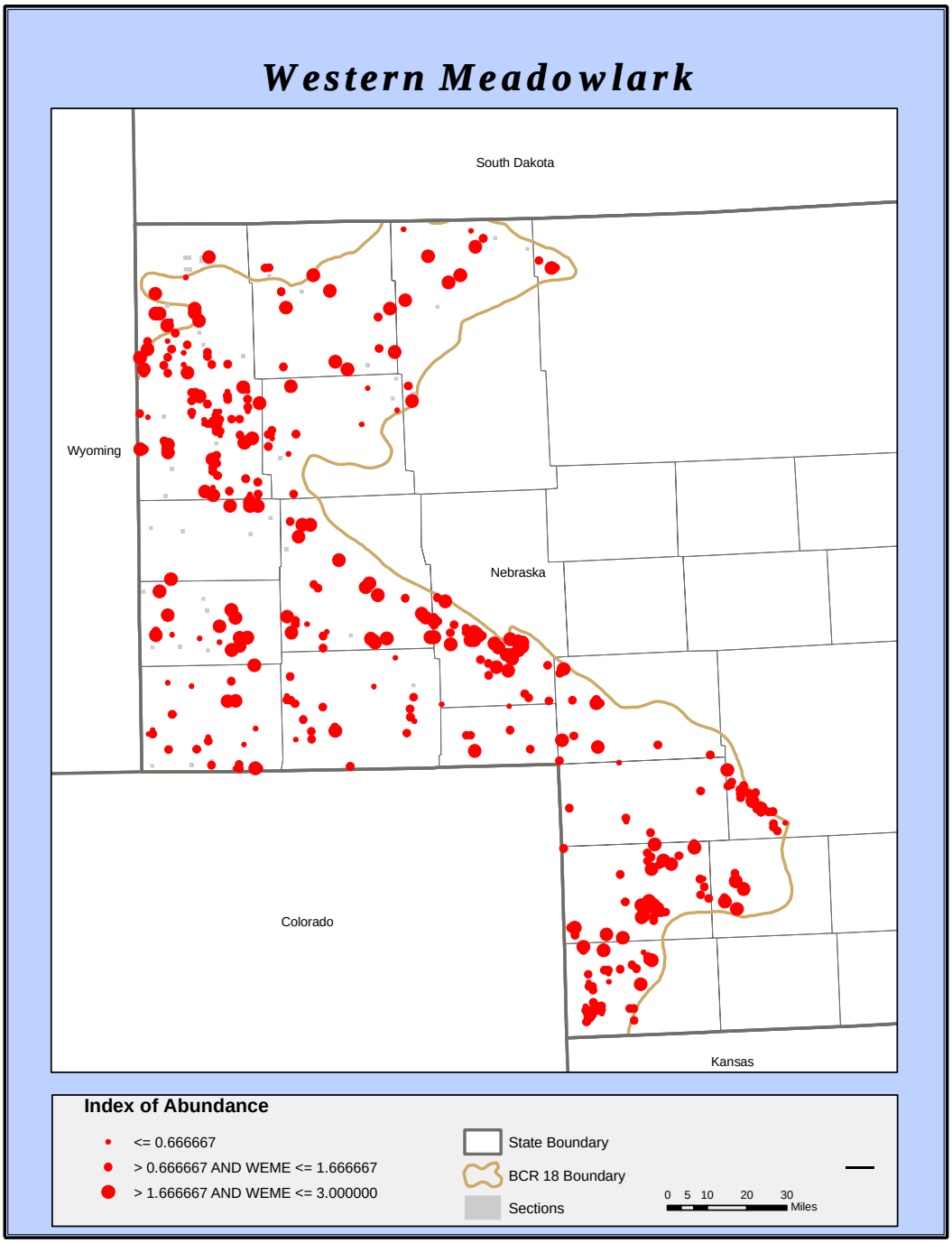
Index of Abundance

- <= 0.333333
- > 0.333333 AND VESP <= 1.000000
- > 1.000000 AND VESP <= 2.000000

State Boundary
BCR 18 Boundary
Sections

0 5 10 20 30 Miles


Western Kingbird
South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.666667
> 0.666667 AND WEKI <= 1.333333
> 1.333333 AND WEKI <= 3.000000
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles


Western Meadowlark
South Dakota
Wyoming
Nebraska
Colorado
Kansas
Index of Abundance
<= 0.666667
> 0.666667 AND WEME <= 1.666667
> 1.666667 AND WEME <= 3.000000
State Boundary
BCR 18 Boundary
Sections
0 5 10 20 30
Miles

OUTREACH AND EDUCATION

Nebraska Prairie Partners complements its survey and research efforts through outreach activities and publications. This allows us to share our findings with those individuals who manage the land and habitats that support grassland birds. In western Nebraska, where over 98% of land is privately owned and zoned for agriculture that means farmers and ranchers, as well as resource professionals.

Landowner Visits

One of our most effective means of outreach continues to be one-on-one visits with private landowners who have a vested interest in the work we do because they live and work within the ranges of species of conservation concern. As in previous years, our mountain plover research and conservation activities have yielded the most interaction at this personal level. In preparation for patch occupancy surveys, we visited with 40 landowners over the phone, explaining our project and the goals of the surveys. All but one of these landowners granted access to their land for this important inventory work; 12 of these also participated in field clearing for nests. The Mountain Plover Nest Conservation Program is designed to assist private landowners in avoiding destruction of nests due to tillage from late April through July, increase the number of plover nests reported by landowners, encourage landowner participation in conservation efforts for this species of conservation concern and encourage landowners to clear their own fields before tilling.

We used several means of contacting landowners/operators about the program. We initiated interest during a mountain plover workshop in Kimball in 2004, followed by an update in the Nebraska Prairie Partners newsletter (see below), and one-on-one visits with 47 farmers in April 2005. Nineteen different landowners/operators participated in this year's program, resulting in over 23,000 acres being surveyed for plover nests. We were particularly excited about the participation of one particular landowner/operator with a high concentration of nests on his property this year. In 2004, we assisted him in locating and conserving 6 nests. This spring, he assisted us in locating 10 nests in the same area, which we monitored through completion. During other field activities, we met an additional 29 landowners, and conducted ranch inventories or interior surveys on 14 of these properties.

We continue to correspond with the Running Water Ranching Coalition, a private landowner based initiative in northern Sioux County dedicated to preserving the ranching heritage and the wildlife it supports. The members are interested in wildlife escape ladders for their stock tanks, and we provided them with a ladder prototype to use in order to produce a number of them independently. We have also been asked to advise the Coalition on other practical bird conservation activities that they might implement, but they have not yet scheduled a meeting on this subject. An independent out-of-state landowner who has property in the same area has contacted us as well with regards to bird conservation. We were provided with a wildlife conservation plan for their property and we plan to meet with them to discuss it in more detail. These same landowners have a ferruginous hawk nest, which we provided information about, to help them stabilize the nest substrate and reduce disturbance during the nesting season.

In the fall, we visited with 17 landowners with regards to NPP or Nebraska Shortgrass Prairie Partnership (NSPP) activities. Two landowners requested ranch bird inventories, which we conducted. A third landowner signed up to host a workshop in October for urban residents to

visit a ranch and learn about birds, and a fourth was referred to the NSPP for financial and technical assistance with native prairie enhancement.

Workshops

Though an effective tool, one-on-one visits generally need a catalyst before they are accomplished. Our survey and conservation work provides a great way to meet interested landowners, but another productive means is through workshops delivering locally relevant material for conservation-minded managers.

RMBO's very successful "Train-the-Trainer" workshop series was implemented in Nebraska through a cooperative effort of NPP and the NSPP. This comprehensive training workshop was developed by our partner Prairie Partners program and provides simple tools for resource professionals and landowners to become more aware of birds, including how to identify them, their habitat needs, and methods to incorporate them into management and monitoring. This workshop was held on May 25th, in Redington (Morrill County) Nebraska.

The format followed RMBO's training manual entitled "Integrating Bird Conservation into Range Management". The morning session of the workshop covered grassland bird identification and the habitat requirements of various species of conservation concern, including a field trip to practice a bird monitoring protocol suggested in the manual for site level use. Following a noon meal, participants learned more detailed methods of categorizing habitat and how to use indicator bird species to assess habitat quality. This session also included a field component where small groups worked together to design management plans for particular species. RMBO's Prairie Partners staff delivered presentations and training. All 32 participants received copies of the training manual and an interactive bird CD-ROM, as well as our Pocket Guide to Prairie Birds, a Stewardship Resources Guide for Private Landowners in Western Nebraska, and Sharing Your Land with Shortgrass Prairie Birds. An additional 20 manuals, CD-ROMS, and Pocket Guides were given to South Dakota NRCS in order to evaluate the workshop for delivery in that state in 2006. The workshop presentations and meals were given at a youth camp facility (Camp Rock), and a local ranch (Schuler Red Angus) provided unlimited access to their land for field demonstrations. Participants included representatives from USDA NRCS (both Nebraska and South Dakota), private ranchers, RMBO, NGPC, Pheasants Forever, USFWS, Chadron State College, and University of Nebraska.

Our second cooperative workshop was a landowner workshop designed to appeal to a broader audience of ranchers. Held on June 29th, it included a short bird identification session in the morning, followed by a field trip to observe some of the key local species and habitat conditions. After a noon meal, Dr. Pat Reece, a range specialist from the University of Nebraska, gave a presentation on rangeland management techniques, including extensive consideration of both bird habitat and beef production needs. We concluded the workshop with general discussions among smaller groups with regards to both birds and grazing management. Thirty-two people attended this workshop, held at Carnine Ranch in Angora, Morrill County- 26 of attendees were local ranchers. Each participant received copies of the Pocket Guide, "Sharing Your Land", "Stewardship Resources Guide", and four University Extension Service leaflets on grazing and other range management techniques. On average, the workshop ranked 5/5 among participants who submitted an evaluation, and five individuals requested site visits to discuss birds or habitat development.

On October 16th we hosted the Urban Workshop south of Chadron, NE at the King Canyon Ranch. Participants viewed presentations about NPP's role and goals for research and

outreach/education. The NSPP, Upper White Natural Resources District and the Nebraska Forest Service presented habitat and habitat improvement programs, followed by group discussion. Participants and workshop leaders identified bird species present, and discussed habitat requirements of these and other species. The Shortgrass Prairie Wildlife Educator provided a hands-on activity for the children on how seeds travel. Fifty-six people attended this workshop, of which 11 were children. Through evaluation forms, the workshop was ranked 4.5/5 by the attendees. Participants gave very positive comments on the evaluation, such as "Interesting and enjoyable", "Very informational", "Great handouts and materials" and "Had a great time" and "Enjoyed the day". The workshop was well appreciated by all.

Volunteer Recruitment

To begin preparations for large-scale, volunteer-based monitoring, we attended a Nebraska Partnership for All-Bird Conservation Symposium on Volunteer Recruitment. We will continue to expand our knowledge in this area and use our outreach and one-on-one visits to find suitable volunteers for burrowing owl and ideally ferruginous hawk monitoring as well, as mentioned before.

We have taken advantage of our outreach events this year to promote a Nebraska Colony Watch program, where volunteers conduct surveys for burrowing owls on some of the colonies that we have been tracking for the last four years. This program will help to get private citizens and landowners directly involved in conservation, while also collecting information to inform habitat management decisions. So far we have recruited five volunteers, who will begin surveys next summer. These individuals are bird-watching enthusiasts, but we also hope to recruit property owners who support burrowing owl nesting areas as well; recruitment is ongoing.

Other Outreach Activities

Public presentations, poster displays, and field days on prairie birds and their conservation are also used to generate publicity for Nebraska Prairie Partners and to foster interest in shortgrass prairie birds. The following presentations were delivered this quarter:

- In March, we presented a seminar on mountain plovers at Nebraska Audubon's Annual Rivers and Wildlife Conference in Kearney. About 30 people attended the seminar, but over 200 were present at the conference and viewed a new poster display featuring all aspects of Nebraska Prairie Partners. We used the opportunity to recruit volunteers for burrowing owl monitoring (to begin in 2006), and we received offers from four bird enthusiasts to travel to western Nebraska or monitor local colonies near their homes. This was an encouraging attempt to recruit volunteers.

- On April 24th, we presented a poster and children's activity at the Riverside Zoo's Annual Community Conservation Day in Scottsbluff, NE. Our display included our general Nebraska Prairie Partners poster and a bird nest scavenger hunt. All youth participating received a habitat-coloring workbook. Forty-five people visited the display, about half of which were elementary-aged children.

- On June 5th, we displayed our Nebraska Prairie Partners display board at a stopping point for the Bike Ride Across Nebraska (BRAN) in Banner Co. Over 240 people viewed the display while waiting in line for breakfast.

- On June 6th, we delivered a presentation to Pack 100 Weblos Boy Scouts in Kimball, NE. We reviewed different grassland bird species and their habitats in the area and had the boys play a migration game that demonstrated how habitat, food sources, and other conditions could effect the population of species in the wild. The Scout Pack also took a bird checklist home and each boy was challenged to watch birds for two weeks and note what species they found, bringing the list back to their next Scout meeting.

- On July 19th, we presented a Nebraska Prairie Partners poster and a burrowing owl natural history presentation at the Scotts Bluff National Monument's Tuesday Evening Program in Scottsbluff, NE. Fifty-eight adults, including Monument staff, bird enthusiasts, and private landowners, attended the program.

- On September 15th, NPP staff attended the Panhandle Prescribed Burn Task Force meeting in Scottsbluff, NE. The Task Force will provide a forum to promote and educate people about prescribed fire for (among other purposes) ecological restoration and wildfire risk reduction.

- On September 30th, we hosted an activity and education station at Oliver Reservoir for Kimball School's annual Outdoor Classroom for 6th graders. We taught identification of some common and uncommon shortgrass prairie birds and their habitat requirements. We also had students play a nesting/predator game where some of the students were nesting birds and other students were predators. The activity forced critical thinking from the perspective of a bird or predator and generated great discussion. A total of 48 students and 11 adults attended this program.

- On October 19th we gave a presentation entitled, "Using Grassland Birds as Indicators of Rangeland Health" at the Nebraska Range Forum, hosted by Natural Resource Conservation Service in North Platte, NE. Sixty landowners and resource professionals attended and were given a packet containing RMBO's Pocket Guide to Prairie Birds, a bird CD-ROM, and a list of ways to learn more about Nebraska's birds. We received very positive feedback, and many people requested additional materials for friends and co-workers.

- On October 21st and 22nd we attended at the annual Nebraska chapter of The Wildlife Society meeting in Grand Island, NE and presented the NPP display. One hundred thirty people attended the meeting, and we distributed 35 Pocket Guides to Prairie Birds.

By reaching rural, urban, and professional audiences, we help generate support for our conservation practices, as well as those of other entities working in shortgrass prairie. This outreach helps empower landowners with knowledge to better manage their properties for native wildlife.

Publications

We complement our inventory and outreach activities with published documents distributed free of charge to cooperators. We distributed a minimum of 374 "Pocket Guides to Prairie Birds", 240 "Sharing Your Land with Shortgrass Prairie Birds" manuals, 186 "Stewardship Resource Guides for Private Landowners in Western Nebraska," 92 interactive bird CD-ROMs, and 26 "Shortgrass Activity Books" this year.

We prepared a spring issue of our Nebraska Prairie Partners newsletter, which was distributed to about 375 landowners and natural resource agency partners across western Nebraska. This newsletter was released in April and included updates on new staff and our new

office in Alliance, as well as a preview of the summer's survey and conservation activities. In December we delivered our second issue of "Nebraska Prairie Partners News". We worked with a local printer to produce the newsletter and mailed 480. We are very excited that our mailing list has grown.

HABITAT CONSERVATION

Stock Tank Ladders and Ferruginous Hawk Nest Cribs

We were granted $2500 by the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program to build 100 wildlife escape ladders. Escape ladders are devices placed in stock tanks to reduce bird and small mammal drowning. With additional funding from the Nebraska Environmental Trust, at least 400 escape ladders will be installed on private ranches across the panhandle by spring 2006. On each participating ranch, we will install ladders in half of the tanks, and landowners will document wildlife mortality in tanks with and without escape ladders. Data the landowners and we will collect include tank characteristics, distance to alternative water source, and the date, number and type (or species, if known) of drowned animals. We are also documenting the presence or absence of water on the ground, which is thought to be a major attractant. A simple analysis of these variables should help us determine the characteristics of tanks that pose the greatest drowning threat for raptors, songbirds, mammals, and other animals. Ladder construction and installation, along with further promotion, will be continuing through our outreach program.

We currently have volunteer groups participating in construction of the tank ladders. The Kimball and Scottsbluff Vocational Agricultural Departments and Future Farmers of America students have volunteered their time to build tank ladders. The Kimball group has built 148 ladders, and the Scottsbluff group will be building 100 in February.

During our outreach activities, we promoted the upcoming ladder distribution and signed up additional landowners. We currently total 24 landowners requesting an estimated 200 tank ladders. These landowners will install ladders in half their tanks and monitor drowning mortality in all tanks. In addition to escape ladders, we will also be constructing up to four cribs around recently active ferruginous hawk nesting trees where cattle can cause damage to the roots and trunk.

NSPP Program Assistance

We assisted with habitat projects for the NSPP in several ways. We visited with several landowners about opportunities to utilize prescribed fire for mountain plover nesting habitat enhancement in Kimball County and reducing pine tree encroachment on grassland parks in Dawes County. We also helped lay out pipelines and fencing on a grazing management project. Finally, we assisted with processing mountain plover nest protection incentive payments, which landowners received in December.

We also assisted with habitat project evaluations for the NSPP by conducting bird inventories on four new and two previously established project sites, where various habitat improvement practices have been or will be implemented. These inventories provide pre-

implementation data on bird communities, whereas subsequent inventories will help NSPP staff to evaluate the impacts of project practices on the bird community.

Collaboration

The Nebraska Game and Parks Commission invited Nebraska Prairie Partners to a bird experts' workshop in March. Leading bird researchers from across the state were present and were asked to review current state status of a number of bird species, and identify areas of high concentrations of species. The information gleaned from this workshop will assist the agency with revising the species' state ranking and help target conservation more directly to species and areas most likely to have broad, long-term impact. We were also invited to participate on the Shortgrass Ecoregion writing team for Nebraska's Natural Legacy Project, a statewide comprehensive wildlife conservation plan. We met with 6-8 other conservation experts in the panhandle to draft a chapter for the plan.

CONCLUSIONS

Nebraska Prairie Partners conducts monitoring and outreach activities in 6 Biologically Unique Landscapes identified in the Nebraska Natural Legacy Project (NNLP) (Schneider *et al.* 2005) - Kimball Grasslands, Wildcat Hills, North Platte River Wetlands, Panhandle Prairies, Pine Ridge, and Ogallala Grasslands. We intensively monitor 3 Tier I species, and track populations of 4 additional Tier I and 7 Tier II species through our Section Surveys. Our mountain plover nest conservation activities are implementing a conservation strategy suggested for Kimball grasslands in the NNLP while raising landowners' awareness of and interest in nongame species conservation. Finally, according to the NNLP, a key stress in the shortgrass prairie ecoregion is a lack of ecological understanding among the region's residents. We are actively working to increase such knowledge through our outreach and education activities, and have made tremendous strides in a short time.

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