Section-based Monitoring of Breeding Birds on Four National Grasslands

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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.*

Bill Schmoker

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Executive Summary

In 2006, Rocky Mountain Bird Observatory (RMBO), under contract with the United States Forest Service, implemented a grassland bird monitoring program on four National Grasslands in the Great Plains, Comanche, Cimarron, Kiowa and Rita Blanca. The objective is to monitor population trends and distribution of shortgrass prairie birds at the scale of a National Grassland. Monitoring at this scale provides Grassland-specific data, resulting in more effective land management decisions regarding conservation of shortgrass prairie birds and their habitat. There are no long term bird monitoring programs currently in place for National Grasslands which will help guide management and provide insight into bird population dynamics. Another advantage bird monitoring programs have are that they provide baseline information on bird habitat associations. These national grasslands provide valuable habitat for endemic grassland species within a deteriorating and fragmented landscape.

In 2006 fifty nine species were detected and twelve species had sufficient detections to estimate density within these four national grasslands. This document reports our findings.

Introduction

Grassland birds have experienced steeper, more consistent, and geographically more widespread declines than any other guild of North American avian species (Sampson and Knopf 1996). Partners in Flight found that 11% of shortgrass prairie birds are declining and 66% lack enough data to assess population trends and stability (Partners in Flight Species Assessment Database 2002). Conversion of native prairie to cropland is one of the factors contributing to these declines.

The Forest Service administers 3.5 million acres of National Grasslands in the Great Plains. Within the grassland bird community, some species have been designated as sensitive by the Forest Service because there is a viability concern. This concern is evidenced by either significant current or predicted downward population trends or density, or significant current or predicted downward trends in habitat capability that would reduce the species' existing distribution. Sensitive species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing. There must be no impacts to a sensitive species without an analysis of the significance of adverse effects on its population, its habitat, and on the viability of the species as a whole. Adequate monitoring information is central to environmental impact analyses and effective avian conservation and management. The Forest Service recognizes the importance of establishing a coordinated avian monitoring program (Manley 1992). However, comprehensive avian monitoring data does not exist for National Grasslands.

Some managers have relied on data derived from the Breeding Bird Survey (BBS), currently the most extensive bird-monitoring program, to monitor bird populations (Robbins et al. 1989, Sauer 1993). The BBS, operational in the Great Plains since 1967, enlists volunteers to conduct roadside surveys of birds across North America and produces indices of population abundance at the continental scale for many common bird species (Robbins et al. 1989). BBS data and analyses are relatively inexpensive and have proven to be a valuable source of information on bird population trends. BBS data can be used to produce continental-scale relative abundance maps. These maps provide a reasonably good indication of the relative abundances of species that are well sampled by the BBS. However, many species and habitats are inadequately sampled by the BBS (Robbins et al. 1993, Sauer 1993), and BBS data do not reliably predict population trends at small geographic scales such as a National Grassland (Sauer 2000). For these and other reasons, BBS data are generally insufficient to guide local and regional management decisions (Leukering et al. 2000), such as those of National Grassland managers. We conducted surveys on four national grasslands (figure 1.) within the Shortgrass Prairie Bird Conservation Region.

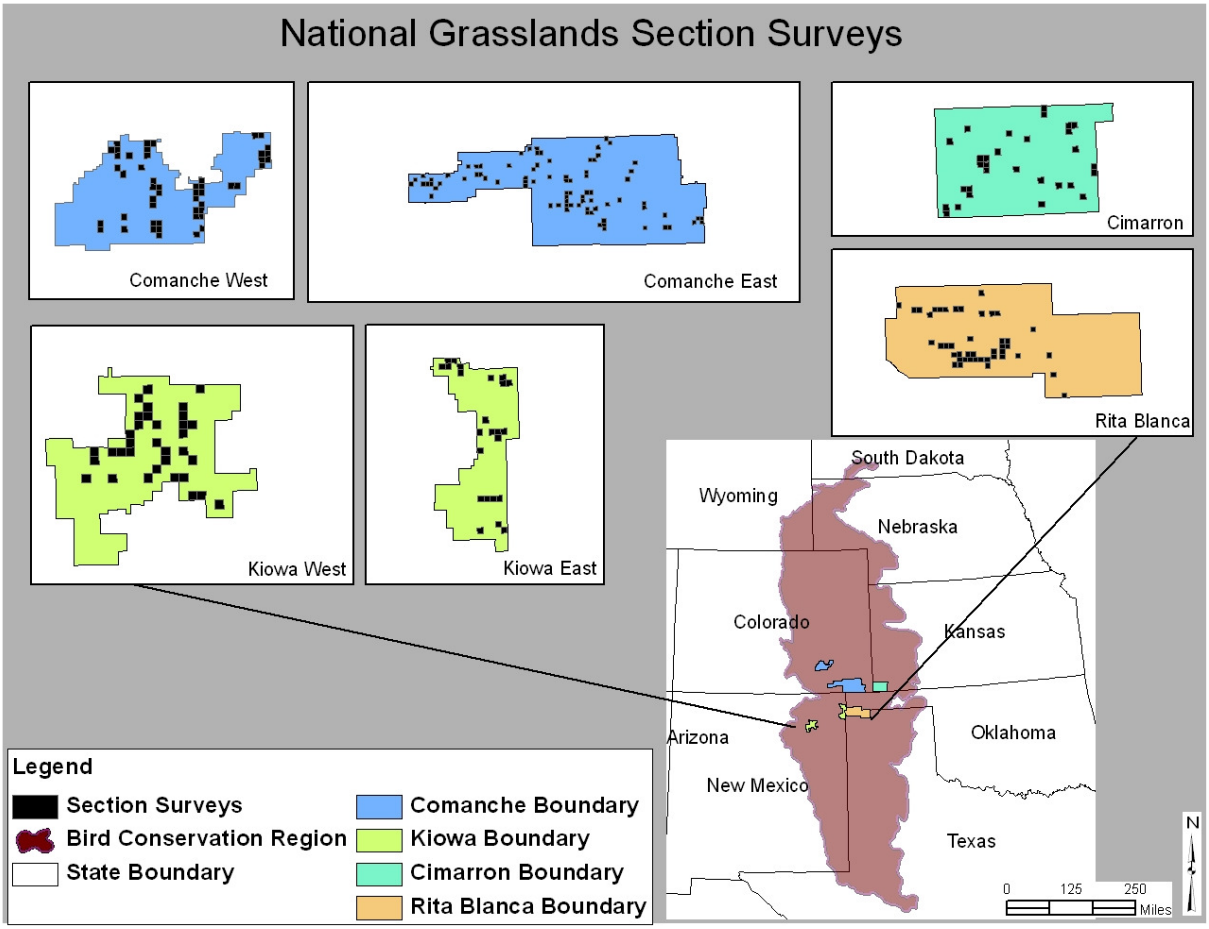

Figure 1. Locations of National Grasslands surveyed in 2006.

Methodology

Study Area:

Section-based monitoring using road-based point counts was conducted on four National Grasslands; Comanche, Cimarron, Kiowa, and Rita Blanca in 2006 (Figure 1). All Grasslands occur within the Shortgrass Prairie Bird Conservation Region (BCR18). This arid region receives 300-500 mm of precipitation per year and is characterized by 2 dominant grasses, buffalo grass (*Buchloe dactyloides*) and blue grama (*Bouteloua gracilis*) (Lauenroth 1992).

Section Selection:

Sections are defined by the Public Land Survey System (PLSS) as 1-mi^2 parcels of land and are the sampling units of section-based monitoring. Prior to field season, we used GIS to randomly select homogenous sections (600 - 700 acres) of Forest Service land that lie adjacent to at least 1 road. If, during the field season, a section was determined not to meet these criteria, it was replaced with the closest qualifying section in a randomly selected direction. In 2006, a total of 257 sections were selected for surveying on National Grasslands: 126 on Comanche, 30 on Cimarron, 58 on Kiowa, and 43 of Rita Blanca (Figure 1).

Road-based Point Count Technique:

A point count data collection process modified from Buckland et al. (1993) was used to establish road-based point counts. Three road-based point counts, located at least 0.2 mi (322m) apart along the road, were conducted on each section. Four point counts per section does not yield a statistically significant difference in the number of species detected (Hanni 2002). Point count locations were determined using a random number table and were recorded using a Garmin *etrex* global positioning system (GPS) unit. Point count locations were distributed around a section based on the number of roads surrounding that section. For example, on sections adjacent to only 1 road, 3 counts were conducted from that road. On sections with 2 roads, 2 counts were conducted along 1 road, and 1 count was conducted along the other; the road on which 2 counts were conducted was randomly selected using a random number table. On sections bordered by 3 roads, 1 count was conducted along each road. Where 4 roads surrounded the section, 1 road was randomly selected and eliminated using a random number table, and the section was then treated as a three-road section.

Data Collection:

Data were collected on Comanche, Cimarron, Kiowa, and Rita Blanca National Grasslands from 15 May – 4 July 2006. We considered arrival and productivity periods of early and late-breeding species in the assumption that the majority of the species were on their breeding territories. Observers conducted point counts from sunrise until no later than 1100 hours when detectable activity typically lessened or ceased. We recorded survey "start" and "end" times. Surveys were not conducted during periods of rain or winds in excess of 18 mph. Observers recorded weather

conditions, including cloud cover, wind speed, and temperature. Township, range, and section (TRS) of the surveyed sections were also documented.

Point counts were conducted for 5 minutes looking from the road 180° into the section. All birds seen and/or heard within this section were recorded. 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. This practice ensures that we adhere more strictly to the assumption inherent in random sampling that all observations are independent of each other.
Distance from the observer to the point of first detection was recorded for each bird observed. Distances were determined using a Bushnell Yardage Pro 500 Rangefinder. Method of detection (i.e. visually, aurally), sex (if known), and habitat association (i.e. shrub, ground, fence, etc.) were recorded. Birds flying over the section were tallied separately. From each point, we recorded vegetation characteristics, including grass height, percent shrub cover, and dominant shrub cover species, within a 150 m semicircle of the surveyed section. Grass height categories included <15 cm and >15 cm (~ankle height). When there was a combination of the 2 heights, the proportions in each category were recorded. Shrub cover data were recorded only when a shrub community was present. Technicians were provided with a reference guide to shrub percent cover that illustrated examples of shrub percent for each of the different shrub species to be encountered in the field. The categories were <1%, >1%-3%, >3%-10%, and >10%. These percentages were recorded for sagebrush, rabbit brush, four-winged salt bush, greasewood, cholla, yucca, and other species that occurred less frequently.

All black-tailed prairie dog colonies and playas visible within the section were sketched by the observer onto the data sheet. All black-tailed prairie dog colonies were documented on maps and in notes. Black-tailed prairie dog colonies, whether occupied or abandoned by prairie dogs, and playas were searched with binoculars for both Burrowing Owls and Mountain Plovers. Nests of any raptors were documented by recording UTMs and by marking the location on a map.

Technician training was provided by RMBO at the Central Plains Experimental Range near Pawnee National Grassland. The technicians were trained for 5 consecutive days via lecture and field practice. Technicians were deemed proficient in grassland bird identification (visual and aural), distance estimation with rangefinders, GPS use, mapping skills, methodologies, vegetation identification, and ground cover estimation. Recordings of the songs and calls of grassland birds were provided to each technician for sharpening skills after the five day training period.

Data Analysis:

Program DISTANCE version 5.0 (Thomas 1998-99) was used to analyze the point count data. The notation, concepts, and analysis methods of DISTANCE were developed by Buckland et al. (1993). Density estimates (D) were calculated for species that had a minimum of 20 observations or had a coefficient of variation (CV) of less than 50%. No flyover detections were used in the DISTANCE analysis. We evaluated the fit of detection models using half-normal and hazard-rate key functions with cosine and simple polynomial parameter adjustments. Analysis using DISTANCE assumes that 1) all birds at distance 0 are detected; 2) distances of the birds close to the points or line are measured accurately; and, 3) birds do not move in response to the observer's presence. In this analysis, we adjusted the sampling effort to 0.5 because birds were recorded in only 180˚of the point count circle, instead of 360˚.

The index of relative abundance used in the distribution maps (Appendix A) was calculated from data collected using the road-based point count technique. The index of abundance, represented by graded map symbols, was defined as the total number of individuals for each species detected on the section divided by the number of point counts conducted on that section (Appendix A).

Bird taxonomy and nomenclature in this report follow that of the American Ornithological Union (1998, 2002).

Results

Results of the 2006 section surveys are presented collectively over the four National Grasslands surveyed including Comanche, Cimarron, Kiowa, and Rita Blanca National Grasslands. In addition to results from the National Grasslands for 2006, we present section survey results from data collected in years 2001 – 2005.

Section Surveys detected a total of 59 bird species in 2006(Appendix B). Number of detections of these species on each National Grassland is reported in Appendix B. Twelve of these species had sufficient detections to estimate density (Table 1).

We first present individual species density estimates by National Grassland by year (Table 1) followed by graphs of these density estimates per species. Some National Grasslands had insufficient detections for a given species and year to obtain density estimates.

Four National Grasslands:

We surveyed 257 sections collectively on Comanche, Cimarron, Kiowa, and Rita Blanca National Grasslands. We surveyed 126 sections on Comanche, 30 sections on Cimarron, 58 sections on Kiowa and 43 sections on Rita Blanca.

Table 1. Density estimates for species detected on four National Grasslands within BCR 18.

Species	Grassland	Year	Estimate	%CV	LCI	UCI	n
Northern Bobwhite	**Cimarron**	2003	1.64	67	0.58	4.67	5
		2004	3.44	36	1.91	6.20	15
		2005	2.70	45	1.31	5.57	11
		2006	1.38	42	0.70	2.73	6
Long-billed Curlew	**Comanche**	2001	4.02	69	1.42	11.39	29
		2002	0.84	44	0.42	1.68	14
		2003	0.31	44	0.15	0.61	9
		2004	0.59	47	0.28	1.25	17
		2005	0.07	74	0.02	0.21	2
		2006	0.78	63	0.30	2.06	14
	Rita Blanca	2002	1.25	38	0.68	2.30	12
		2003	1.39	40	0.73	2.63	11
		2004	2.51	35	1.42	4.41	22
		2005	2.21	85	0.60	8.16	6
		2006	0.67	58	0.27	1.66	6
Mourning Dove	**Cimarron**	2003	71.44	36	40.13	127.18	49
		2004	75.52	38	40.87	139.56	58
		2005	32.80	39	17.40	61.85	30
		2006	14.29	42	7.24	28.21	14

Species	Grassland	Year	Estimate	%CV	LCI	UCI	n
	Comanche	2001	8.49	44	4.20	17.15	8
		2002	26.08	26	16.97	40.07	57
		2003	21.32	22	14.91	30.47	82
		2004	17.38	25	11.60	26.05	60
		2005	9.46	26	6.18	14.47	35
		2006	27.23	21	19.28	38.47	100
	Kiowa	2002	17.24	43	8.74	34.00	22
		2003	13.86	41	7.24	26.55	19
		2004	9.65	46	4.64	20.06	13
		2005	16.97	41	8.89	32.40	23
		2006	24.07	36	13.42	43.17	33
	Rita Blanca	2002	12.24	36	6.78	22.08	28
		2003	12.17	48	5.66	26.15	23
		2004	19.14	49	8.83	41.48	29
		2005	153.07	17	114.48	204.67	99
		2006	33.66	15	26.07	43.44	72
Burrowing Owl	**Comanche**	2001	1.67	55	0.71	3.94	6
		2002	0.84	88	0.24	2.98	7
		2003	0.68	51	0.31	1.52	10
		2004	1.47	38	0.81	2.69	21
		2005	0.92	36	0.51	1.65	13
		2006	0.36	55	0.15	0.84	5
Western Kingbird	**Cimarron**	2003	7.34	69	2.52	21.37	5
		2004	14.39	38	7.85	26.38	14
		2005	18.72	69	6.51	53.80	9
		2006	15.42	44	7.59	31.31	15
	Comanche	2001	8.34	51	3.72	18.71	8
		2002	20.22	28	12.91	31.68	45
		2003	7.15	24	4.87	10.50	28
		2004	8.67	29	5.42	13.85	33
		2005	2.65	40	1.41	4.99	10
		2006	9.63	24	6.54	14.17	36
	Kiowa	2002	11.65	32	6.94	19.54	23
		2003	8.49	30	5.16	13.94	18
		2004	6.72	36	3.77	11.97	14
		2005	7.15	34	4.14	12.35	15
		2006	30.17	15	23.42	38.87	64
Northern Mockingbird	**Comanche**	2001	0.78	72	0.26	2.31	2
		2002	1.18	44	0.59	2.37	7
		2003	1.63	32	0.98	2.71	17

Species	Grassland	Year	Estimate	%CV	LCI	UCI	n
		2004	2.56	27	1.64	3.99	26
		2005	0.50	62	0.19	1.28	5
		2006	7.72	24	5.18	11.49	77
Horned Lark	**Cimarron**	2003	50.14	36	27.40	91.75	24
		2004	80.44	29	49.54	130.60	55
		2005	83.05	33	47.78	144.34	53
		2006	65.81	24	44.43	97.47	45
	Comanche	2001	153.65	22	107.29	220.04	184
		2002	132.26	12	108.41	161.35	337
		2003	163.42	12	133.54	199.98	261
		2004	69.80	15	54.45	89.48	208
		2005	40.17	12	33.00	48.89	224
		2006	148.91	11	123.85	179.04	324
	Kiowa	2002	72.72	28	46.08	114.74	115
		2003	115.37	25	77.22	172.35	54
		2004	65.38	22	45.44	94.08	93
		2005	129.57	21	92.05	182.39	120
		2006	175.47	13	142.86	215.52	270
	Rita Blanca	2002	98.64	11	81.62	119.23	194
		2003	183.64	21	130.94	257.57	170
		2004	58.85	30	36.19	95.70	65
		2005	19.01	64	6.75	53.53	9
		2006	115.08	14	91.50	144.73	188
Cassin's Sparrow	**Cimarron**	2003	17.89	34	10.12	31.63	14
		2004	60.84	20	43.57	84.96	68
		2005	105.45	18	78.13	142.32	110
		2006	50.10	17	37.44	67.06	56
	Comanche	2001	33.87	28	21.34	53.74	39
		2002	68.51	18	50.80	92.38	183
		2003	33.18	15	26.00	42.34	156
		2004	33.69	16	25.86	43.90	154
		2005	36.70	16	28.08	47.96	166
		2006	92.92	12	76.06	113.51	417
	Kiowa	2002	14.05	23	9.67	20.41	72
		2003	26.87	43	13.41	53.84	21
		2004	20.47	34	11.76	35.63	32
		2005	67.40	25	45.06	100.80	66
		2006	108.50	13	87.34	134.79	239
	Rita Blanca	2002	31.22	19	22.95	42.47	91

Species	Grassland	Year	Estimate	%CV	LCI	UCI	n
		2003	85.97	23	59.29	124.67	207
		2004	15.78	21	11.14	22.36	42
		2005	14.57	32	8.51	24.93	12
		2006	50.28	16	38.69	65.36	137
Lark Sparrow	**Cimarron**	2003	6.09	103	1.41	26.27	3
		2004	22.75	58	9.16	56.50	10
		2005	18.28	51	8.15	41.01	12
		2006	14.22	59	5.71	35.42	10
	Comanche	2001	29.05	26	19.03	44.34	26
		2002	33.24	17	25.30	43.66	69
		2003	17.79	19	13.02	24.31	65
		2004	12.10	22	8.47	17.30	38
		2005	15.93	16	12.22	20.76	56
		2006	21.79	18	16.15	29.40	76
	Kiowa	2002	15.67	35	8.89	27.62	17
		2003	15.44	30	9.49	25.13	18
		2004	27.94	29	17.42	44.80	32
		2005	24.30	31	14.72	40.12	28
		2006	14.59	35	8.26	25.77	17
Lark Bunting	**Comanche**	2001	64.88	21	45.59	92.33	123
		2002	2.27	48	1.06	4.88	10
		2003	6.20	24	4.18	9.20	48
		2004	10.90	20	7.84	15.15	82
		2005	10.07	19	7.35	13.81	75
		2006	3.52	25	2.35	5.27	26
	Kiowa	2002	27.18	38	14.81	49.91	24
		2003	37.96	26	24.73	58.28	36
		2004	16.10	42	8.16	31.74	15
		2005	122.68	22	85.64	175.76	101
		2006	11.60	40	6.13	21.96	11
	Rita Blanca	2002	17.87	39	9.59	33.30	28
		2003	17.77	50	8.08	39.06	23
		2004	27.96	51	12.61	61.97	29
		2005	223.56	21	156.88	318.59	99
		2006	49.16	20	35.33	68.39	72
Grasshopper Sparrow	**Cimarron**	2004	32.11	30	19.52	52.83	23
		2005	73.30	22	50.88	105.58	49
		2006	18.15	44	8.90	37.01	13
	Comanche	2001	36.81	30	22.69	59.70	26

Species	Grassland	Year	Estimate	%CV	LCI	UCI	n
		2002	14.65	38	7.91	27.13	24
		2003	1.73	45	0.85	3.55	5
		2004	4.99	33	2.95	8.44	14
		2005	14.42	27	9.31	22.32	40
		2006	23.61	20	17.08	32.64	65
	Kiowa	2002	3.18	48	1.49	6.80	6
		2004	2.51	47	1.19	5.32	5
		2005	4.50	44	2.24	9.02	9
		2006	18.76	24	12.69	27.73	38
	Rita Blanca	2002	25.41	53	11.16	57.89	17
		2003	25.34	63	9.64	66.60	14
		2004	22.92	53	10.00	52.54	14
		2005	5.29	109	1.14	24.60	1
		2006	41.58	48	19.63	88.07	26
Western Meadowlark	**Cimarron**	2003	132.02	32	77.47	224.99	90
		2004	52.43	15	41.04	66.99	122
		2005	66.37	18	49.14	89.63	150
		2006	17.29	16	13.23	22.61	69
	Comanche	2001	40.40	20	29.28	55.73	139
		2002	40.51	13	32.54	50.44	236
		2003	53.59	10	45.41	63.25	305
		2004	19.48	15	15.25	24.87	224
		2005	21.86	13	17.76	26.92	285
		2006	62.21	24	42.06	92.03	401
	Kiowa	2002	17.11	14	13.62	21.50	120
		2003	51.82	26	33.89	79.23	103
		2004	25.41	23	17.50	36.88	102
		2005	40.37	14	32.23	50.56	135
		2006	77.35	13	62.01	96.47	209
	Rita Blanca	2002	34.38	12	28.42	41.59	120
		2003	77.69	14	61.64	97.92	224
		2004	41.11	13	33.35	50.68	131
		2005	12.17	27	7.65	19.35	12
		2006	37.39	12	30.89	45.26	122

D = Density estimate expressed in birds/km^2, DLCL & DUCL = lower and upper 90% confidence limits of D, DCV = coefficient of variation of D, n = number of detections used to calculate D.

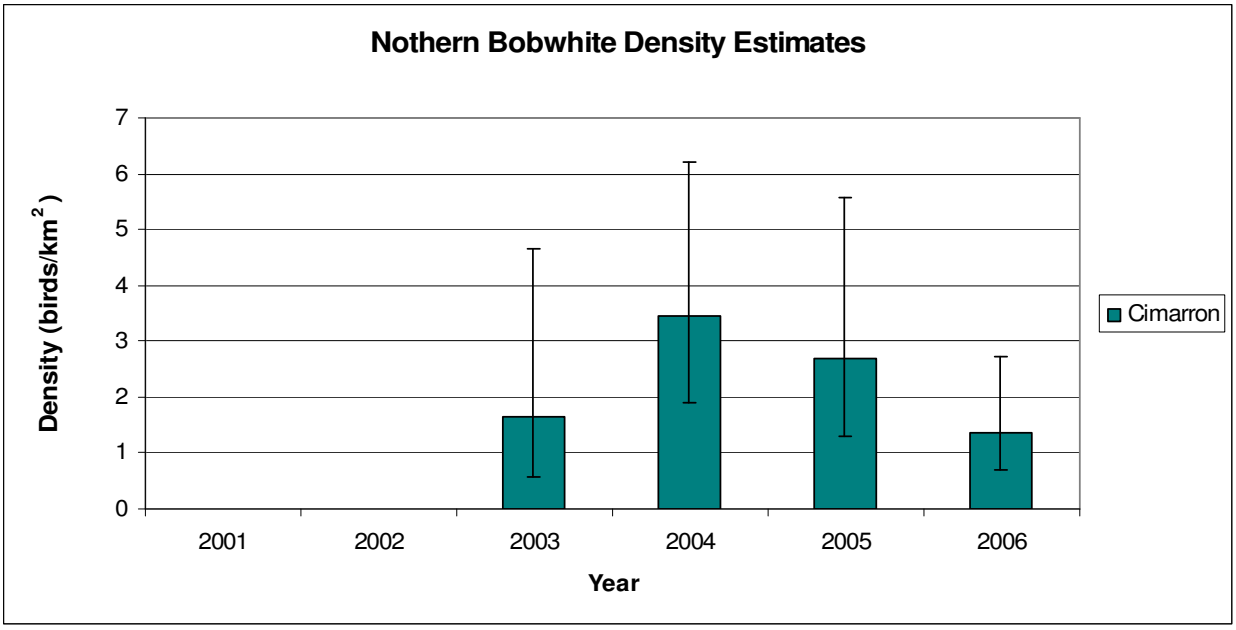

Figure 2. Northern Bobwhite density estimates.

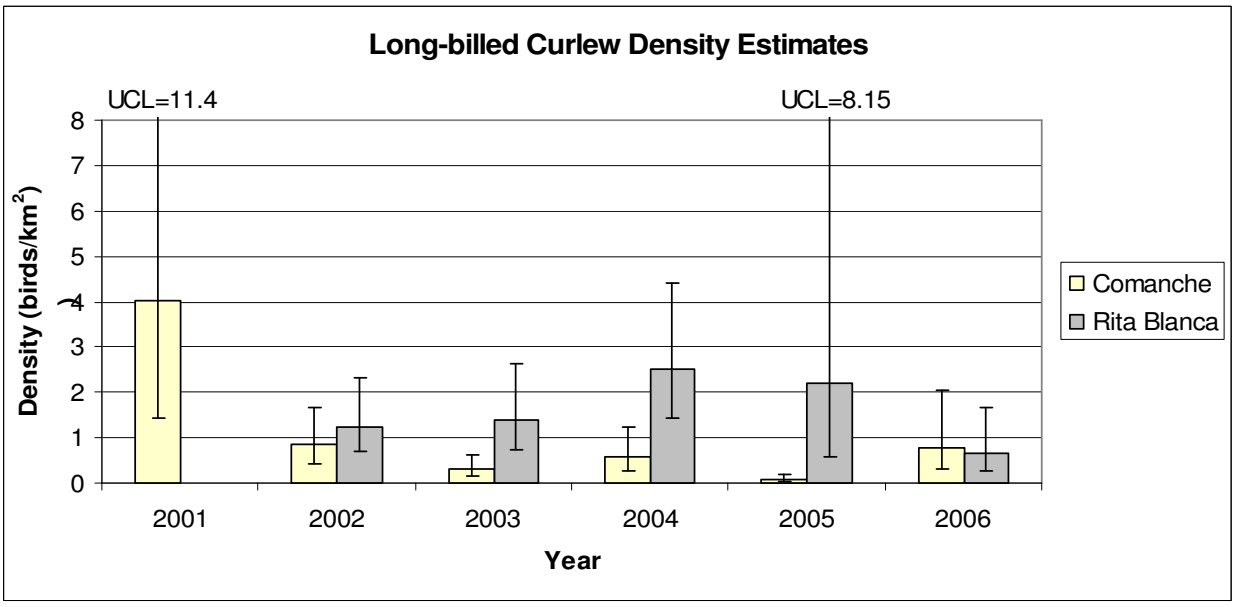

Figure 3. Long-billed Curlew density estimates.

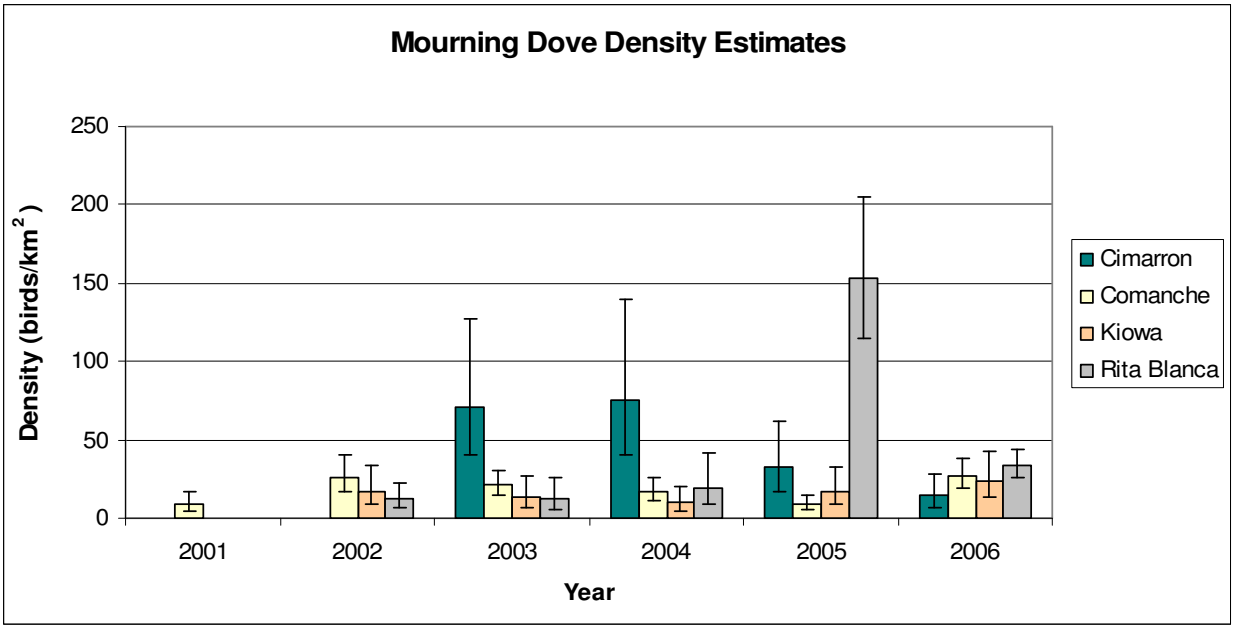

Figure 4. Mourning dove density estimates.

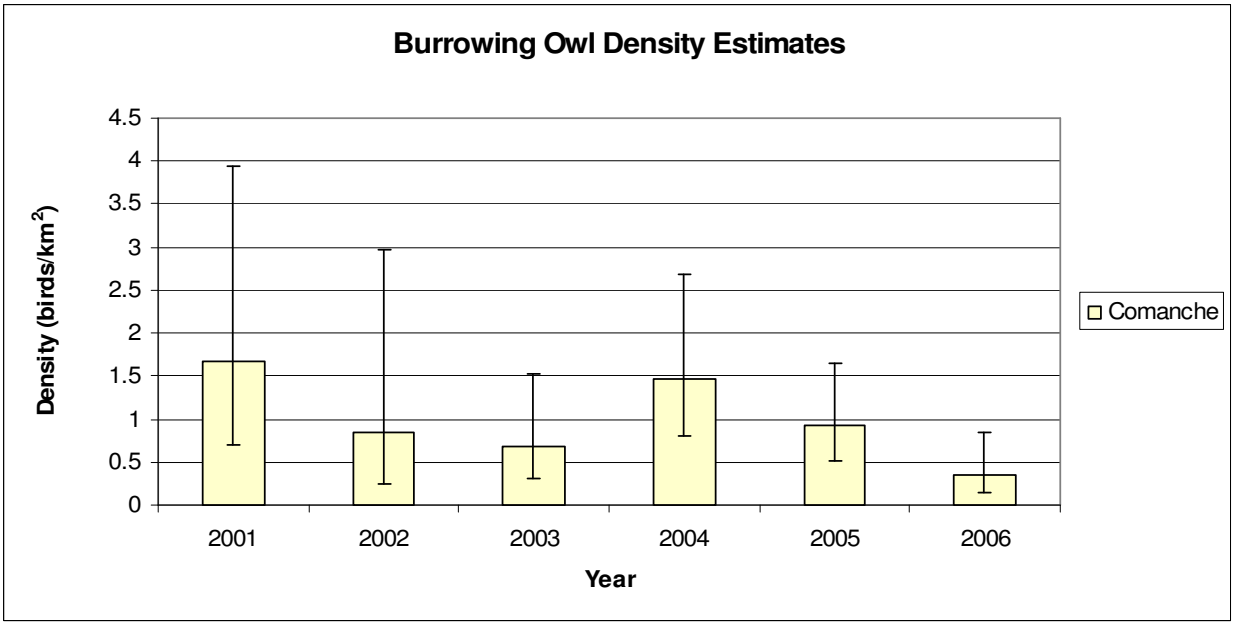

Figure 5. Burrowing Owl density estimates.

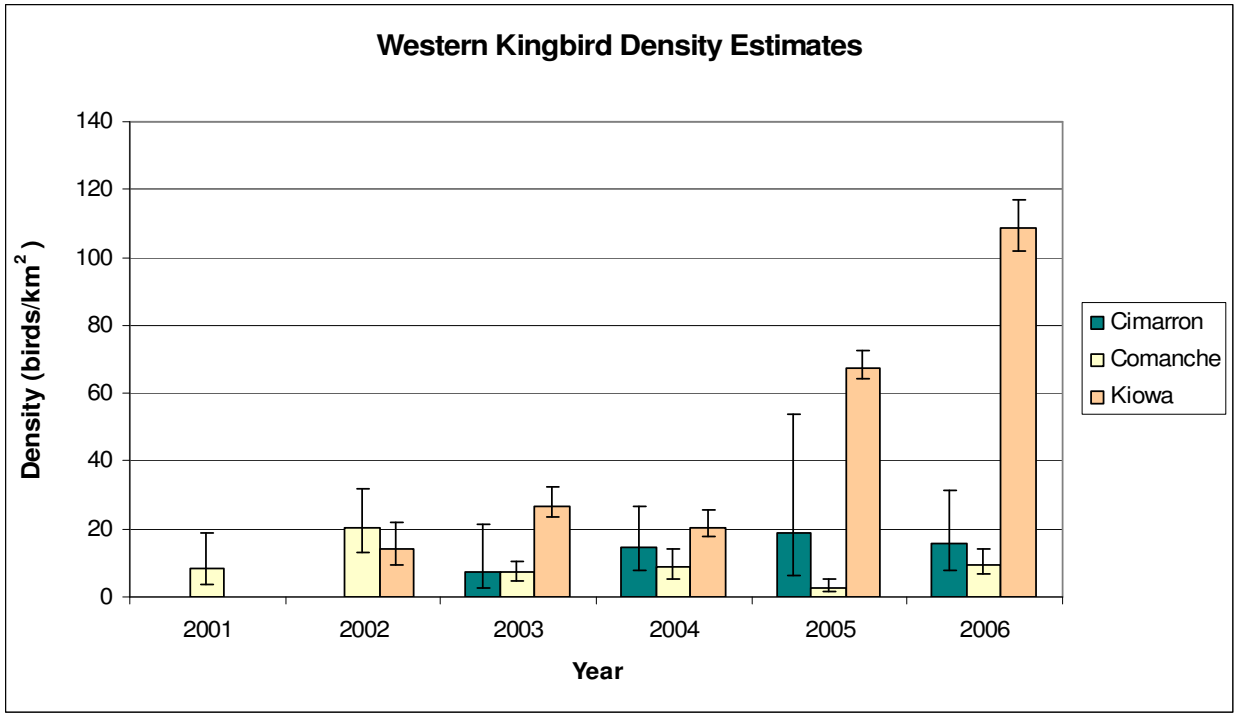

Figure 6. Western Kingbird density estimates.

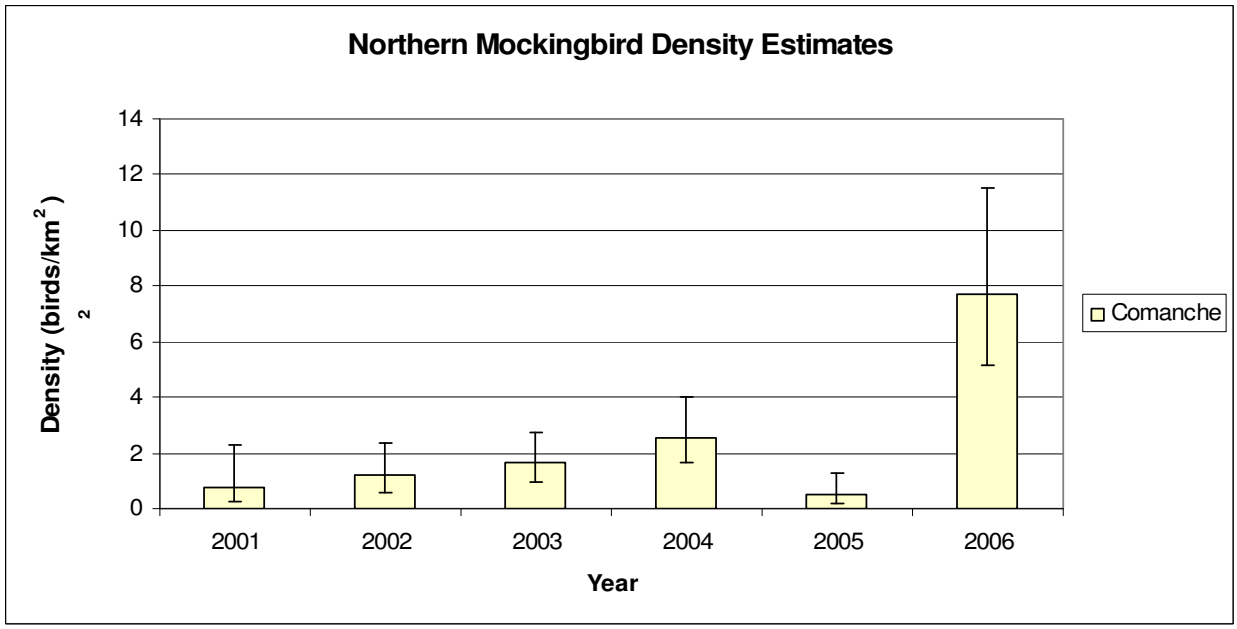

Figure 7. Northern Mockingbird density estimates.

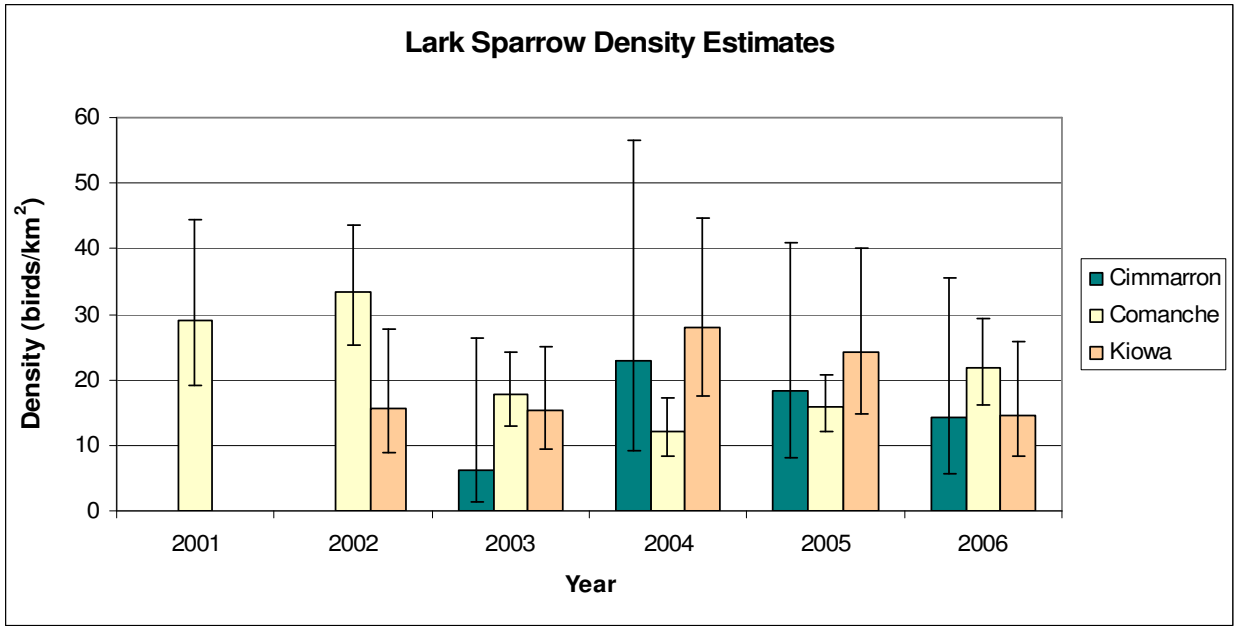

Figure 8. Lark Sparrow density estimates.

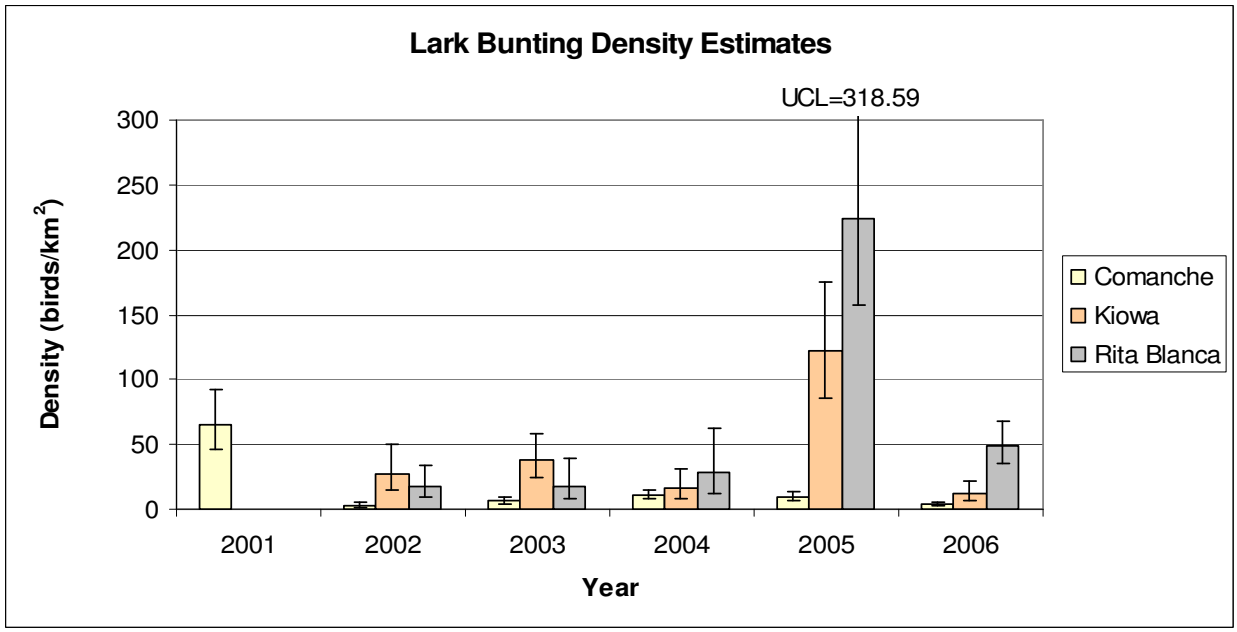

Figure 9. Lark Bunting density estimates.

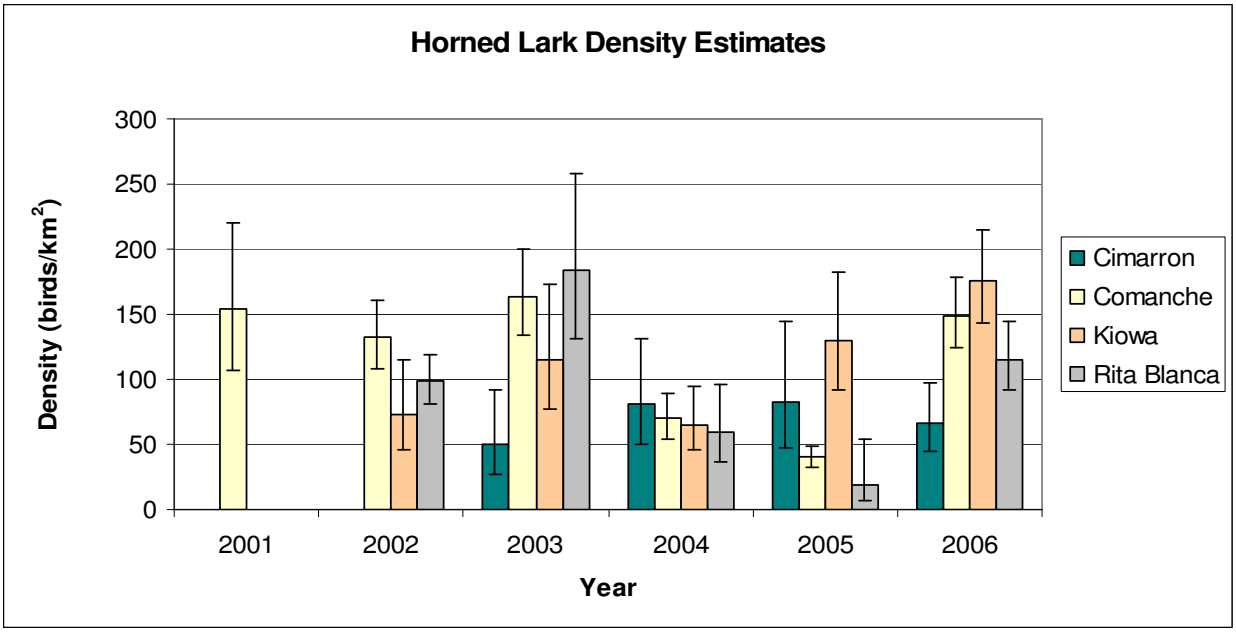

Figure 10. Horned Lark density estimates.

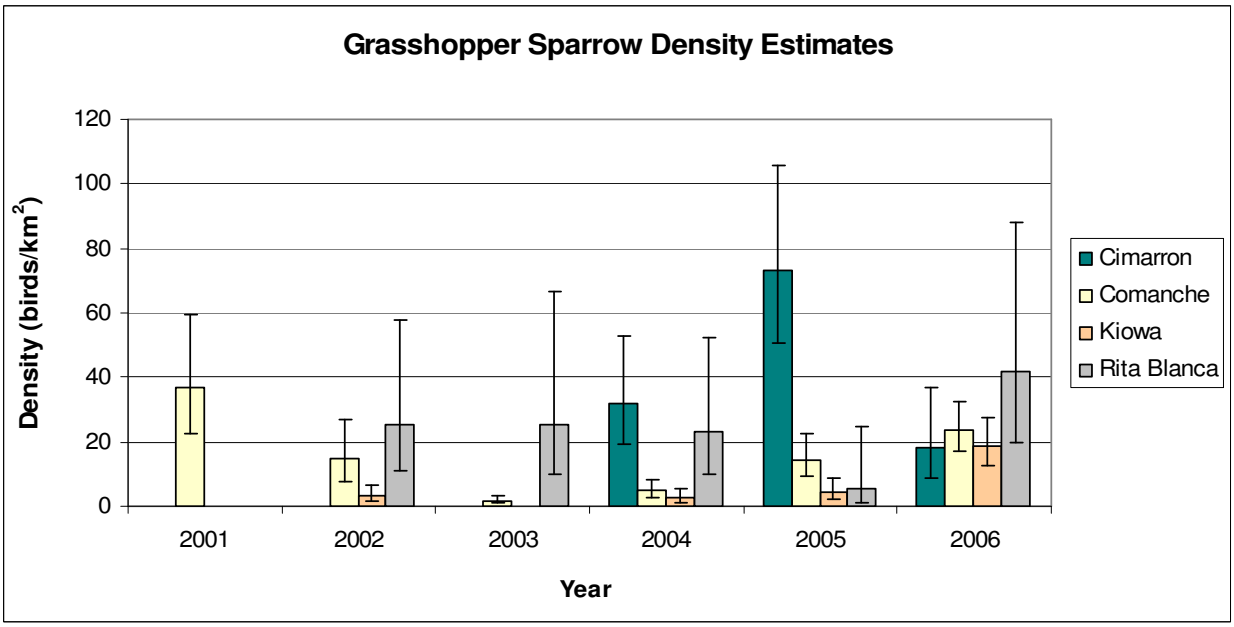

Figure 11. Grasshopper Sparrow density estimates.

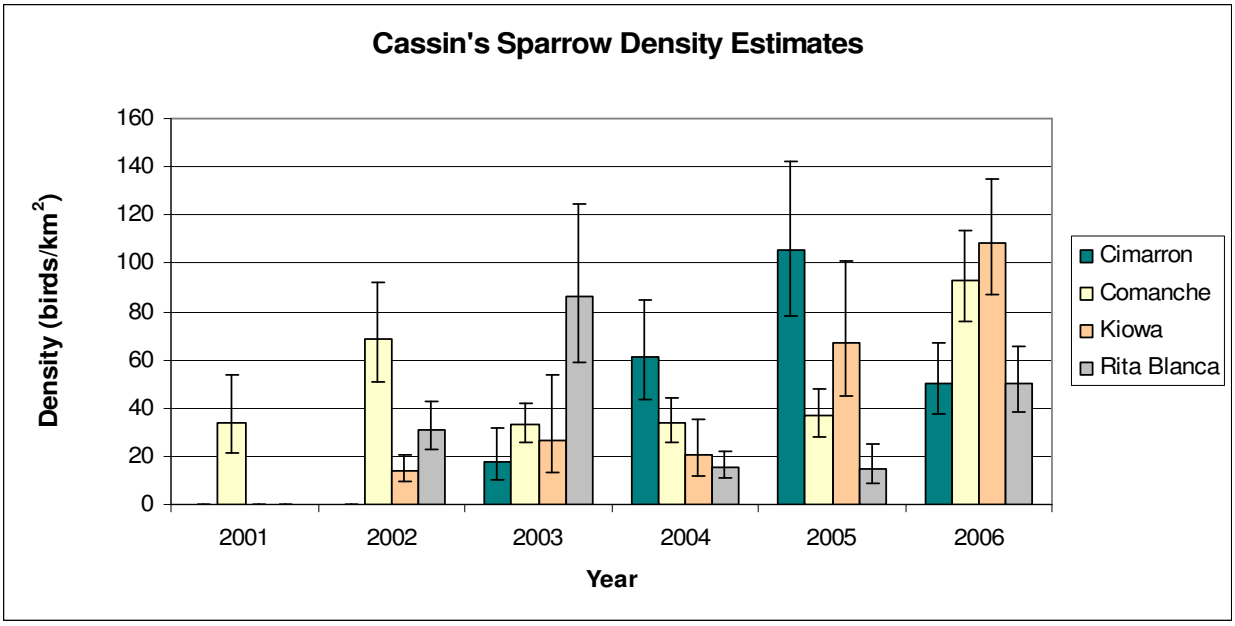

Figure 12. Cassin's Sparrow density estimates.

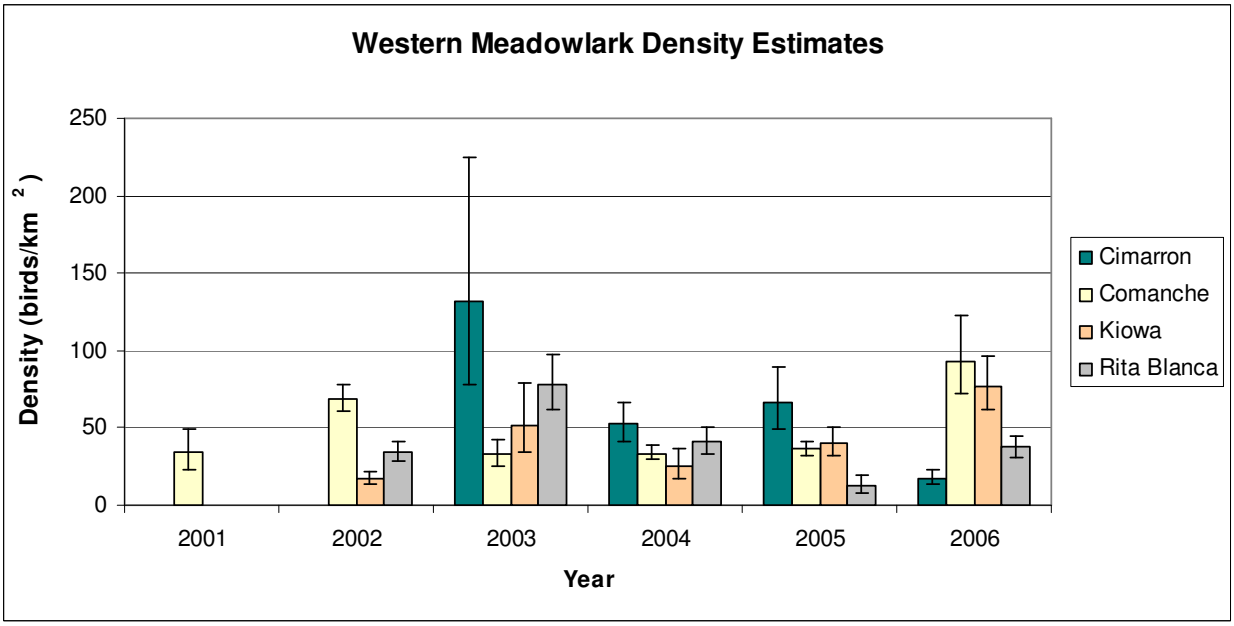

Figure 13. Western Meadowlark density estimates.

Discussion and Recommendations

In 2006, section-based monitoring on Comanche, Cimarron, Kiowa, and Rita Blanca National Grasslands yielded density estimates for 12 of the 59 detected grassland bird species. These section-based surveys provide the data necessary to detect and monitor trends in species population and distribution within the Grasslands. Increasing the sample size on the currently surveyed Grasslands or surveying additional Grasslands will potentially increase the number of species monitored under this protocol and will yield more robust data.

Monitoring at a Grassland scale provides Grassland-specific data, resulting in more effective land management decisions regarding conservation of grassland birds and their habitat. For example, data collected through section-based monitoring can be used to link habitat types or management practices to bird counts. Permanently marked point count locations can be related to base vegetation using GIS layers or to management practices using Forest Service records. Correlations can then be drawn among avian trends, densities, diversity and management practices. Evaluating management practices based on population trends and distributions will enable us to focus conservation efforts and help land managers to make decisions that conserve prairie birds on National Grasslands.

A disadvantage of our section-based monitoring program, which is also shared by BBS, is the potential road bias resulting form the road-based surveying technique. This should not affect our ability to monitor bird populations into the future assuming there is no variation in the roadside bias among years. We are currently working toward generating a correction factor that would allow us to calculate more accurate density estimates. The road-based point counts are being compared to un-biased point transects to determine a variable for each species for which there are density estimates from both techniques. The correction factor will compensate for the density estimate generated, from road-based point counts, and should offer a more accurate population estimate for individual species.

Overall, section-based monitoring at a Grassland scale is inexpensive, defensible, site-specific, and habitat-specific. It fills an important management need at a modest cost. However, there should be no expectation that this technique will detect and develop trends for all grassland bird species. No single technique can accomplish such an assessment of all grassland birds. Section-based monitoring provides an overview of the avian community and can be used to identify areas in need of particular management attention, resulting in more effective conservation of Great Plains birds on National Grasslands.

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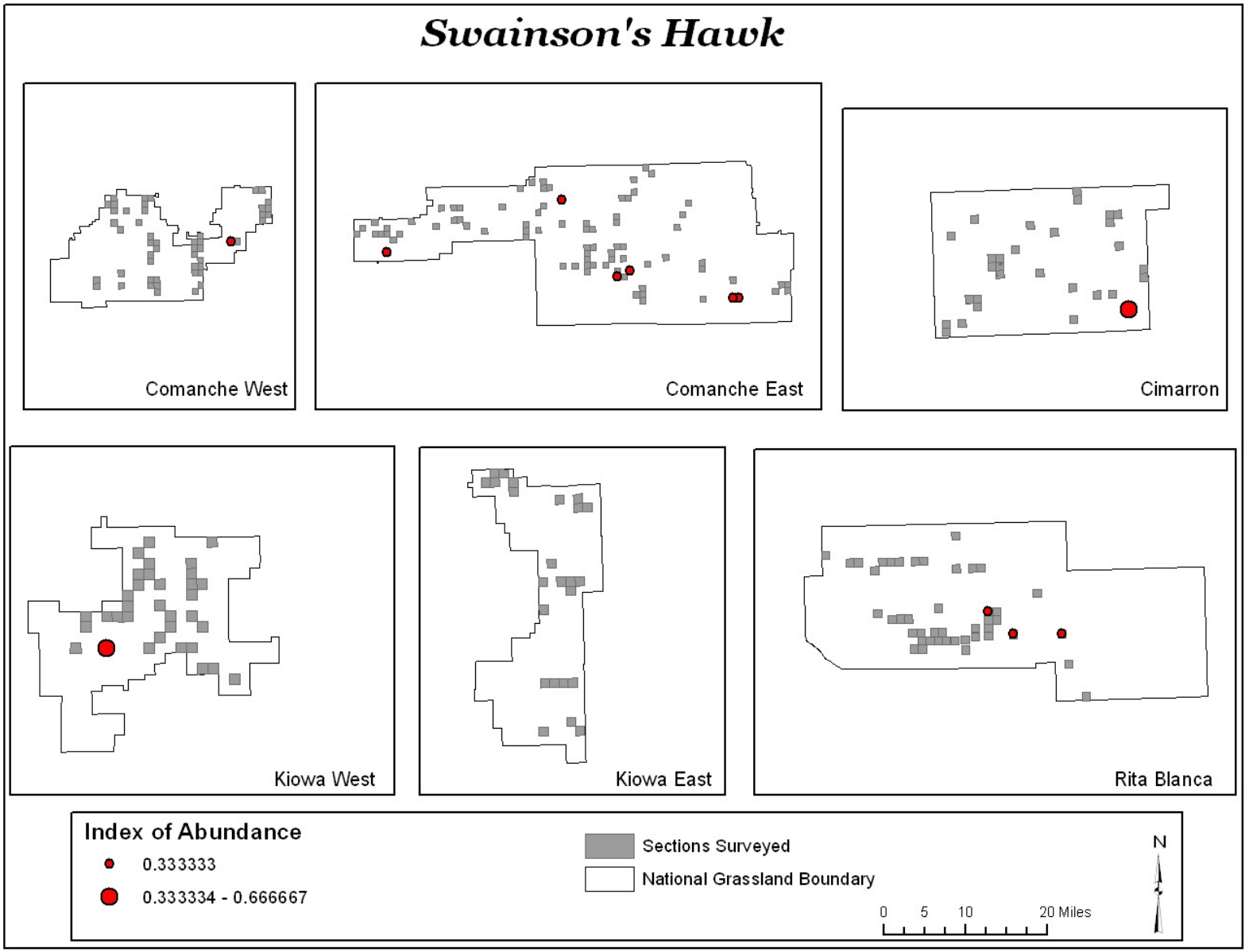
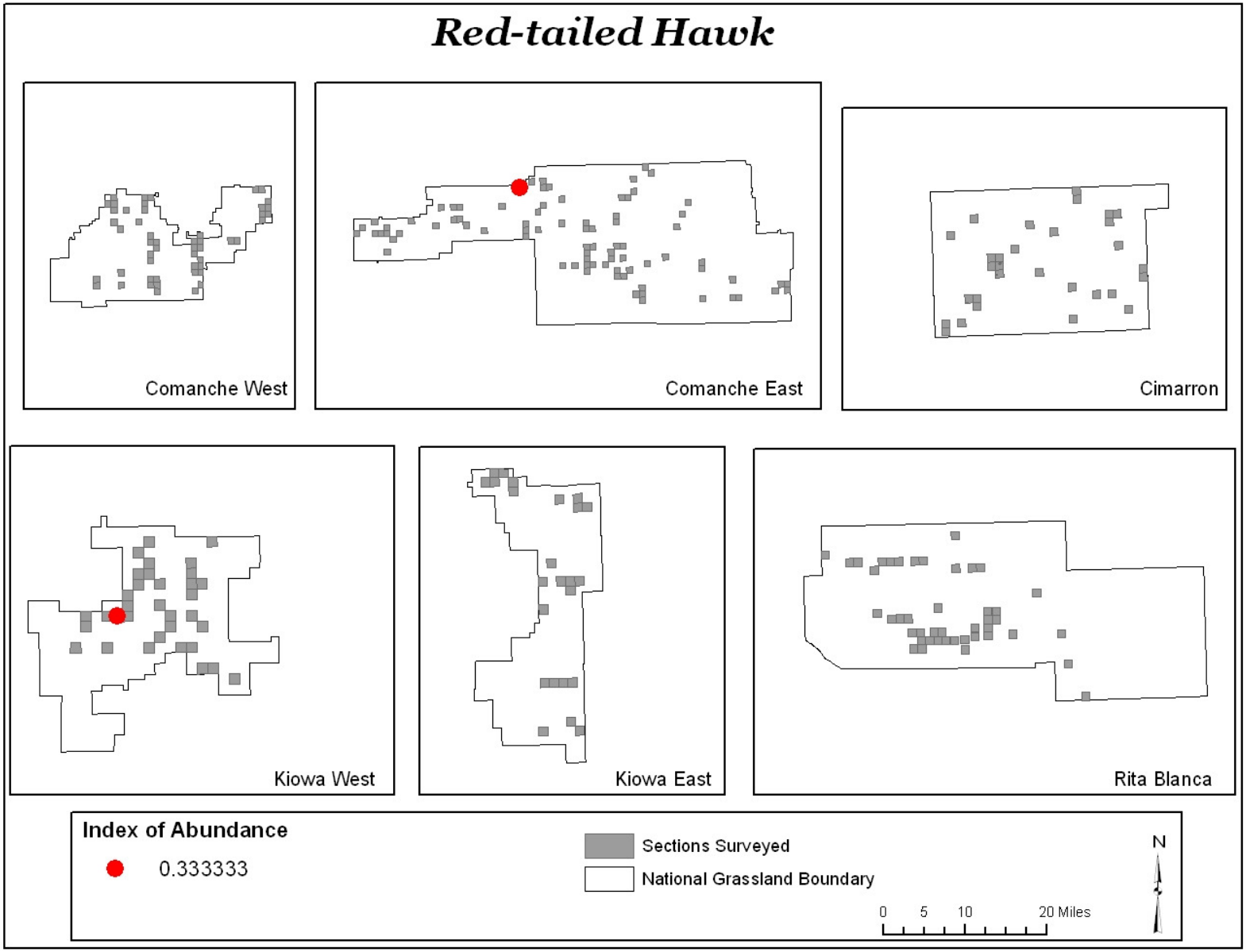
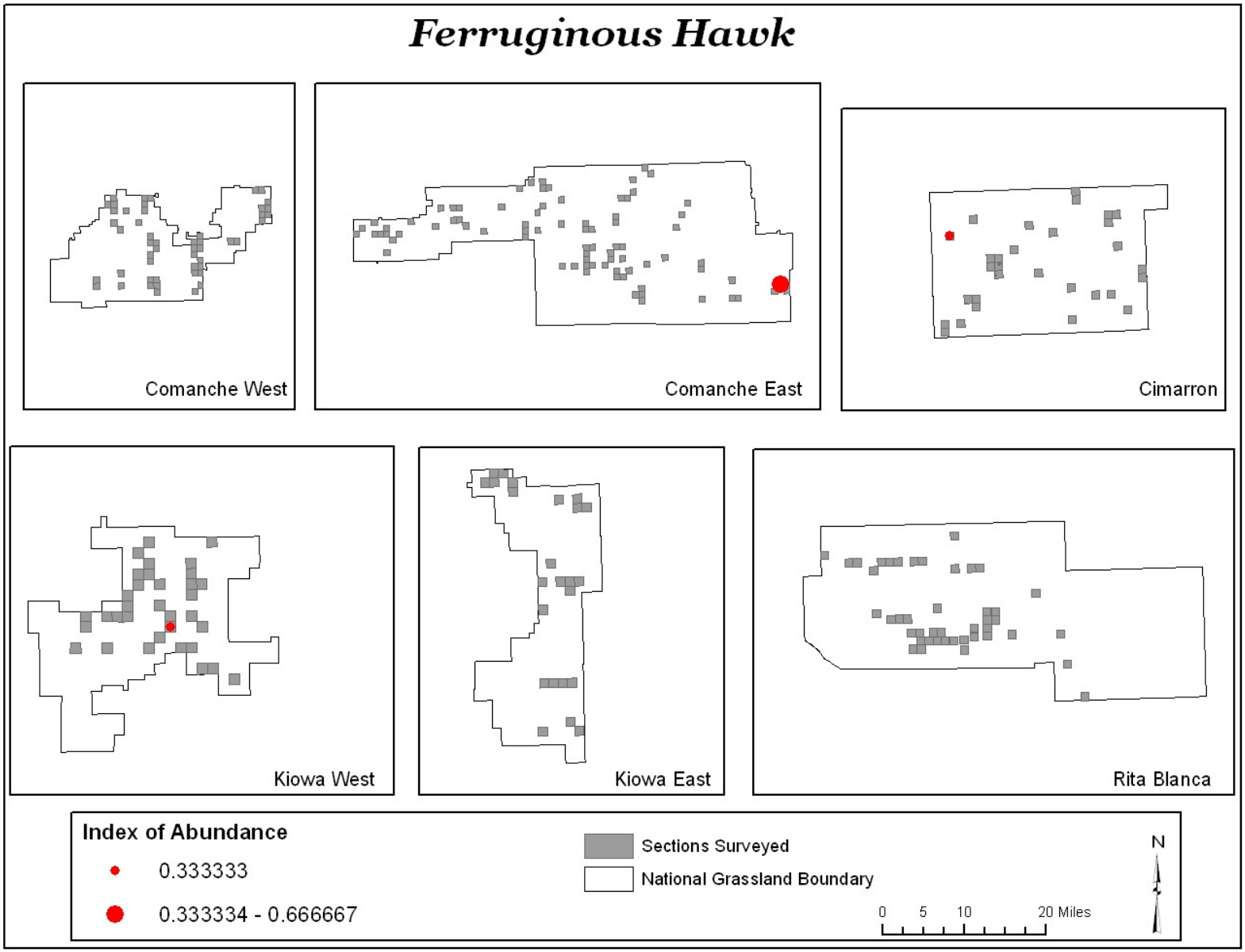
Appendix A

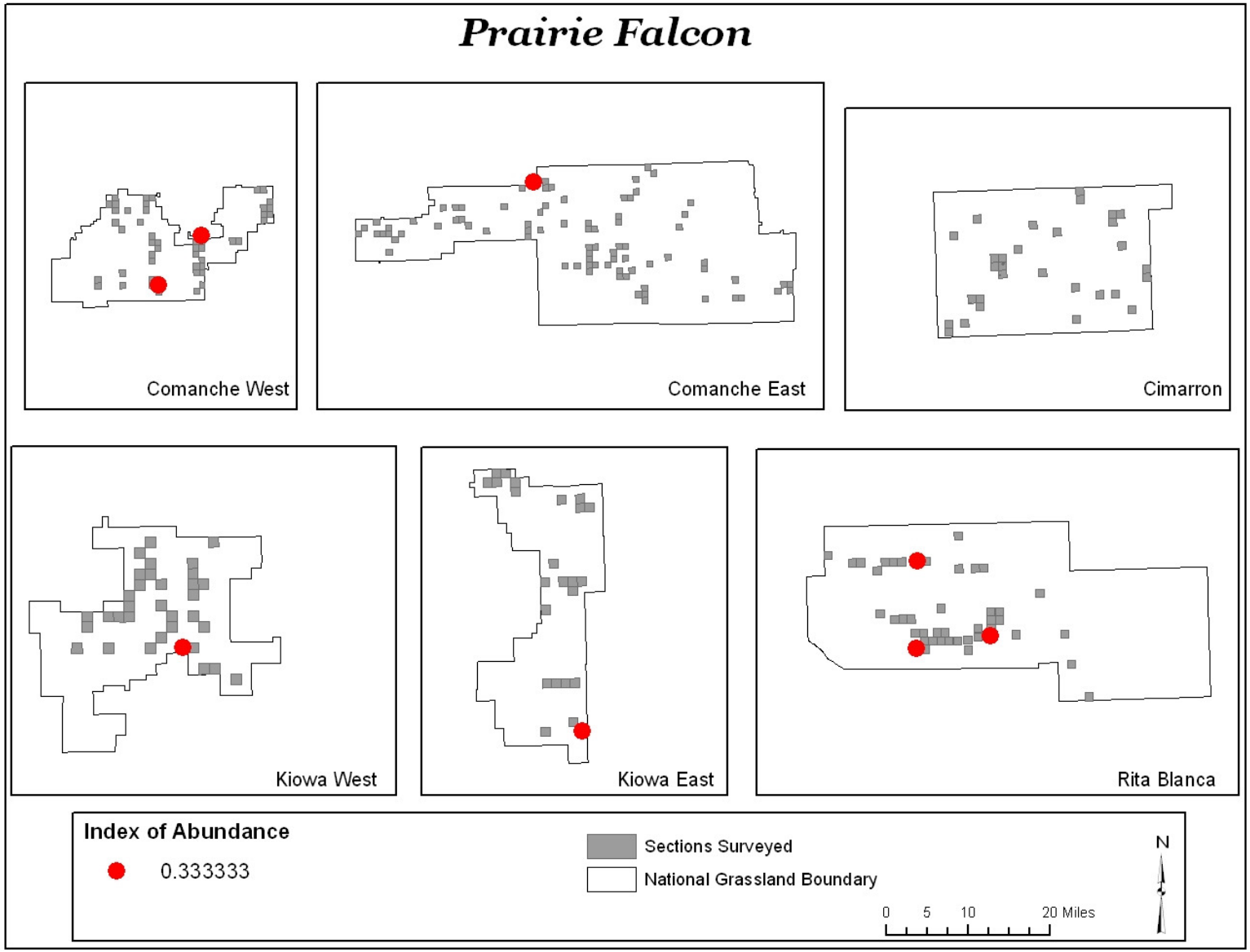
The following are species distribution maps that show observation locations and index of abundance at the section level for 2006. Index of abundance, represented by graded dots, is defined as the total number of a species detected on the section divided by the number of point counts conducted on that section. The index of abundance was created to adjust for the amount of effort on each of the sections.

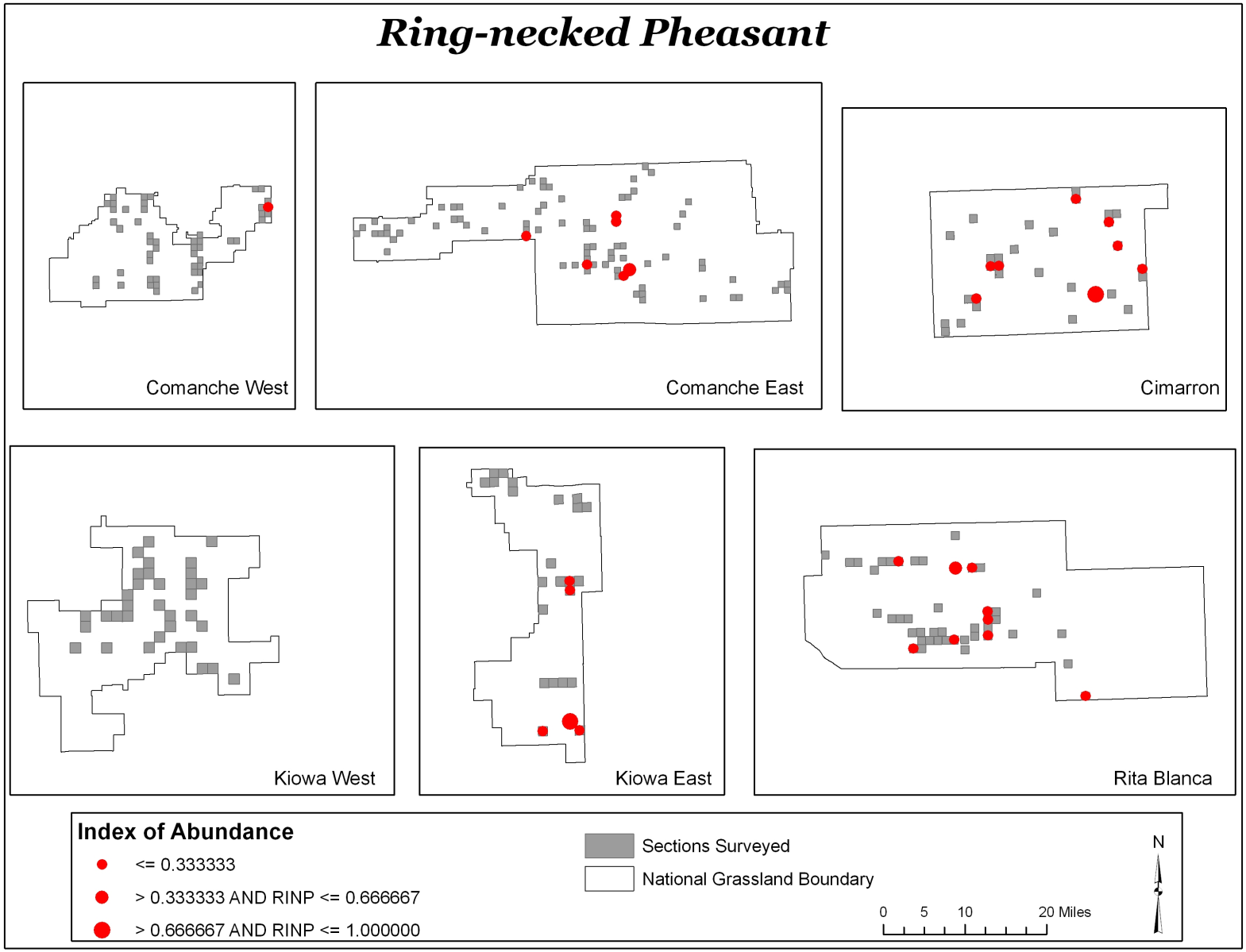

Swainson's Hawk
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333
0.333334 - 0.666667
Sections Surveyed
National Grassland Boundary
0 5 10 20 Miles
N

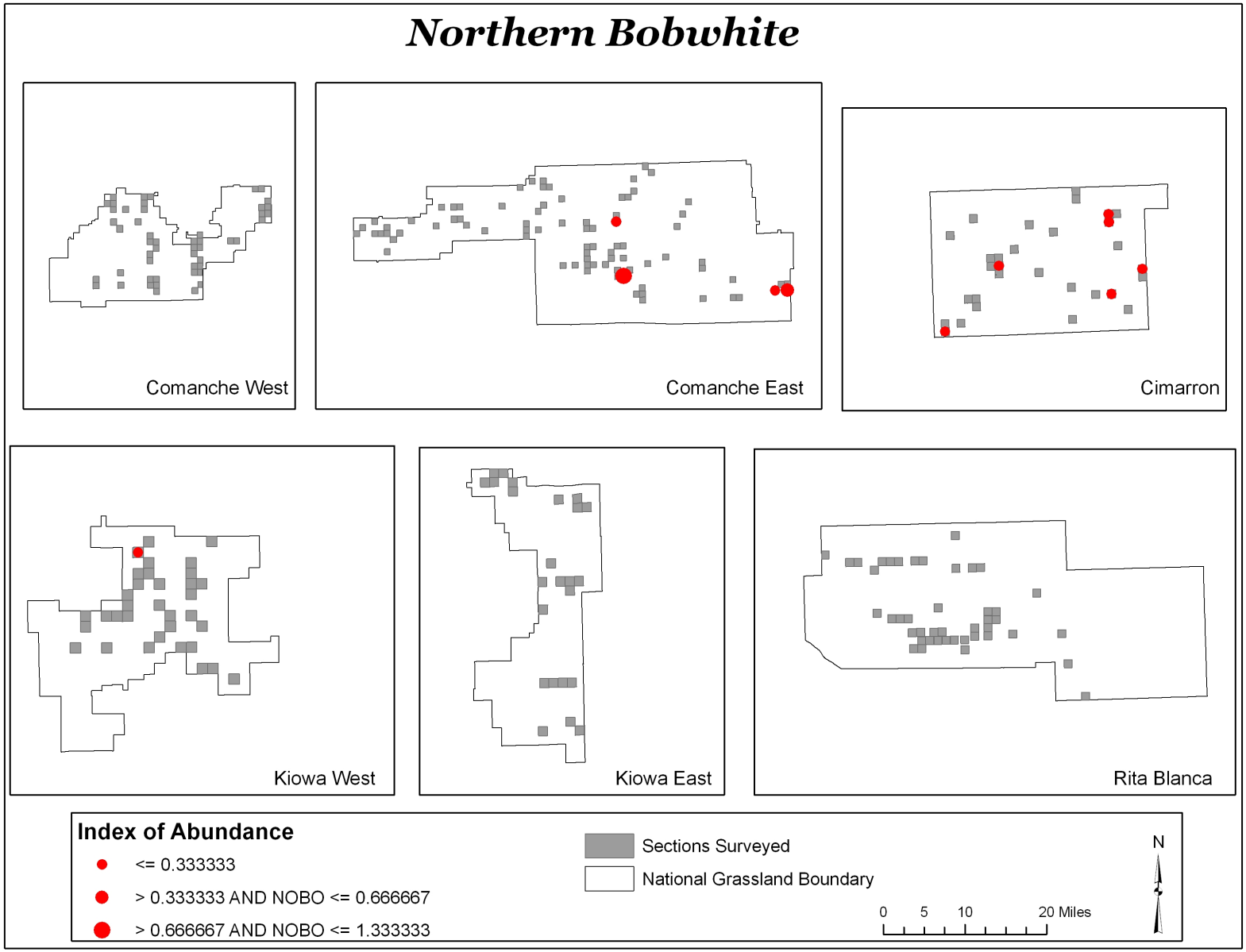

Red-tailed Hawk
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles

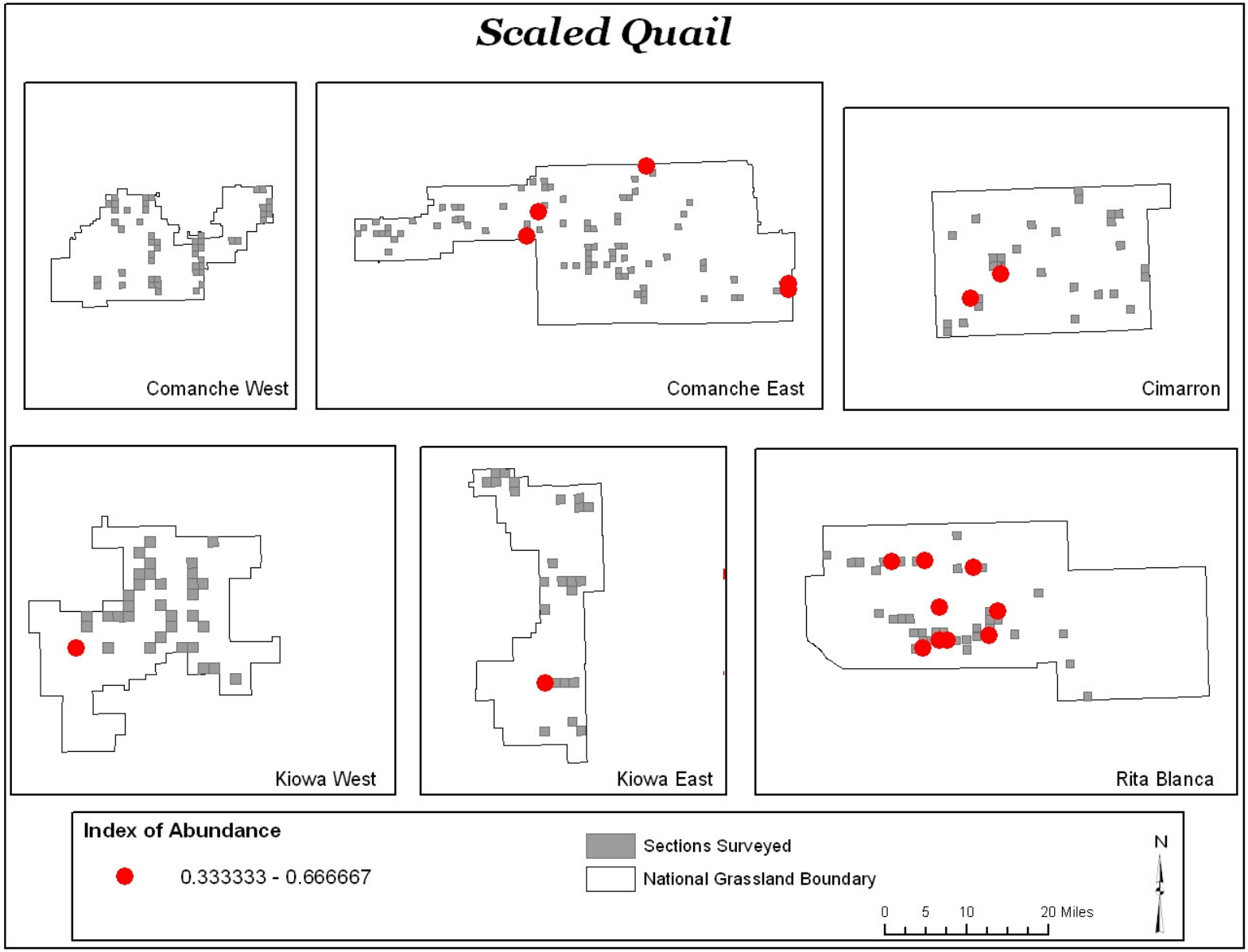

Ferruginous Hawk
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333
0.333334 - 0.666667
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles

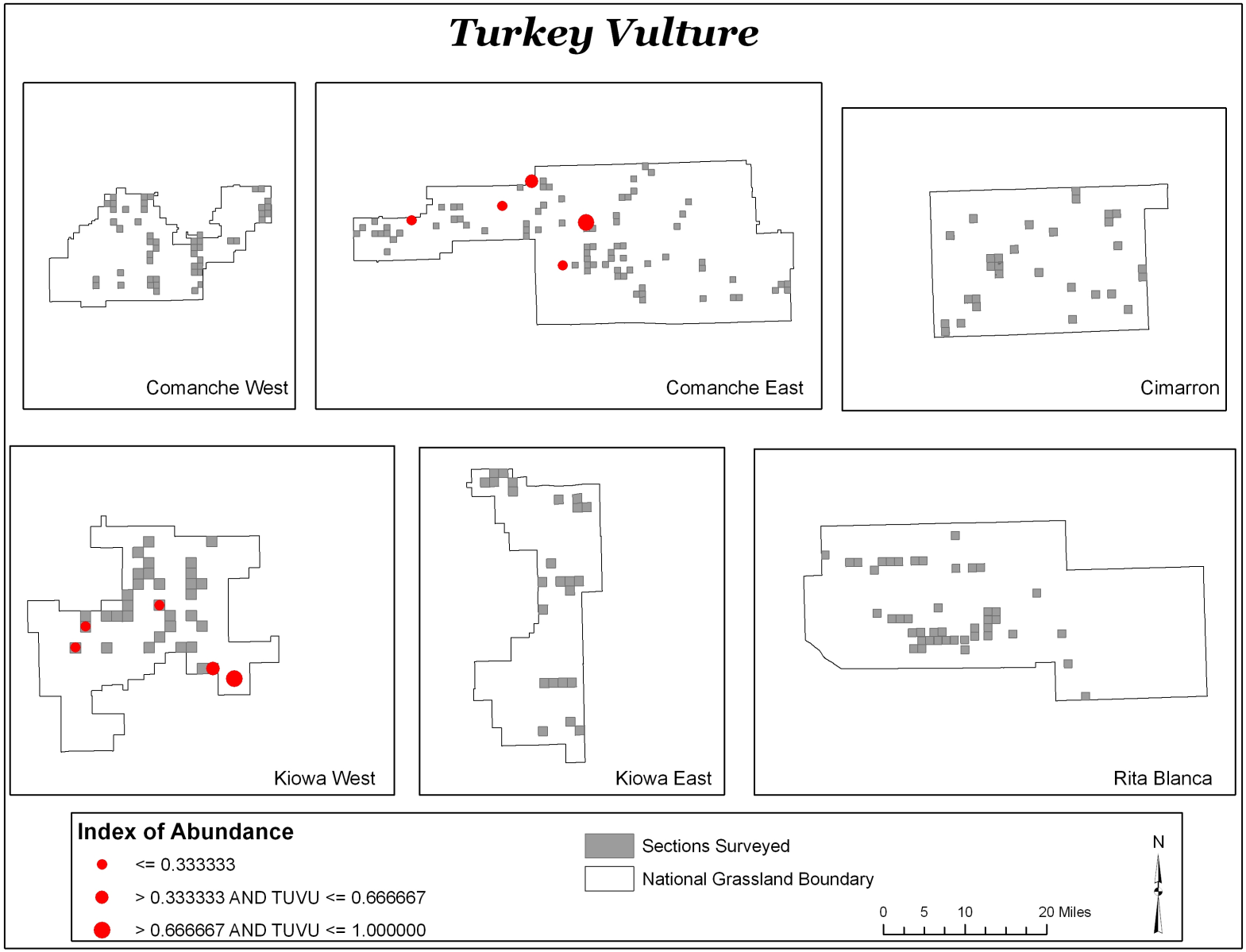

American Kestrel
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Prairie Falcon
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Ring-necked Pheasant
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.333333
> 0.333333 AND RINP <= 0.666667
> 0.666667 AND RINP <= 1.000000
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Northern Bobwhite
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.333333
> 0.333333 AND NOBO <= 0.666667
> 0.666667 AND NOBO <= 1.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Scaled Quail
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333 - 0.666667
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Turkey Vulture
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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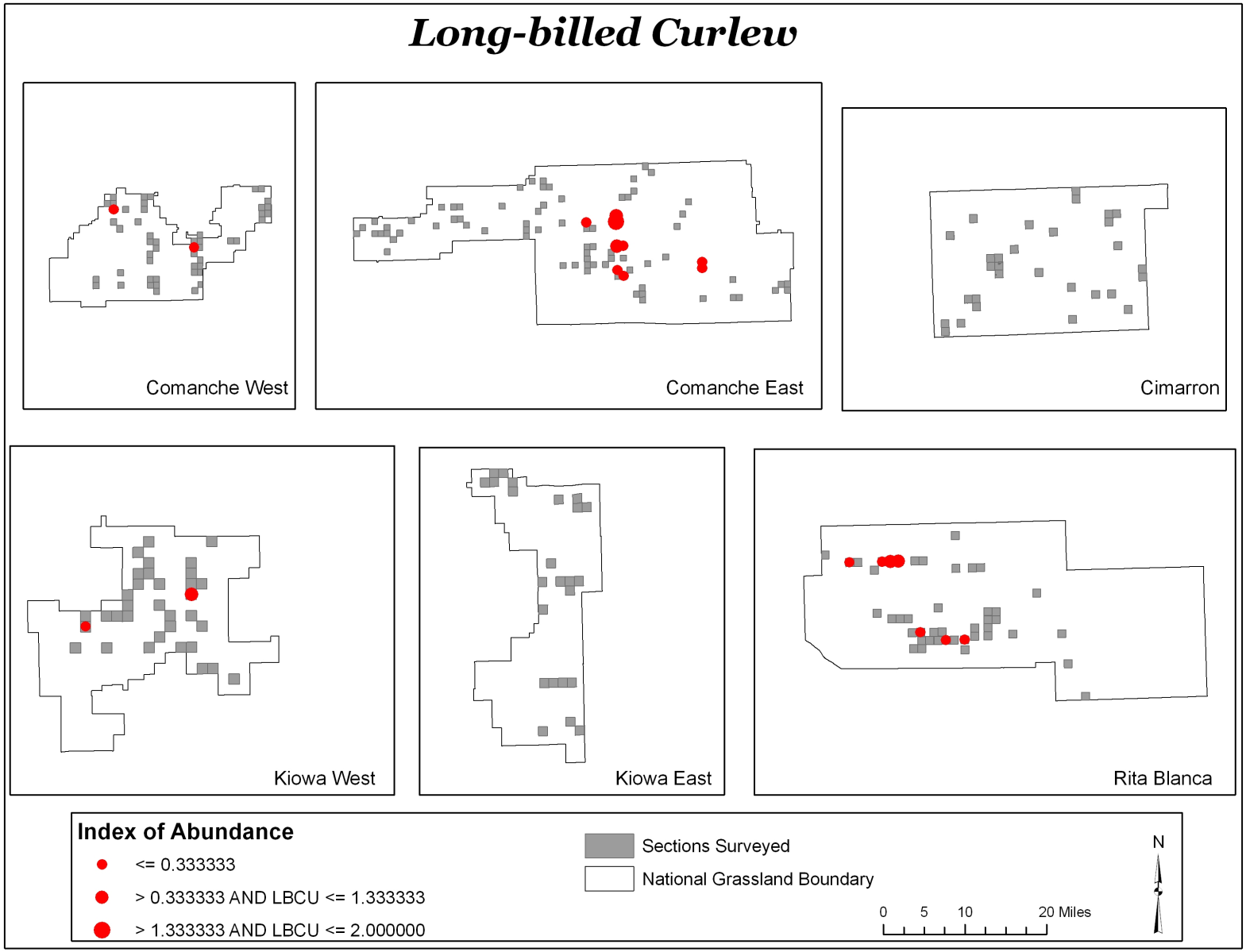
> 0.666667 AND TUVU <= 1.000000
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Long-billed Curlew
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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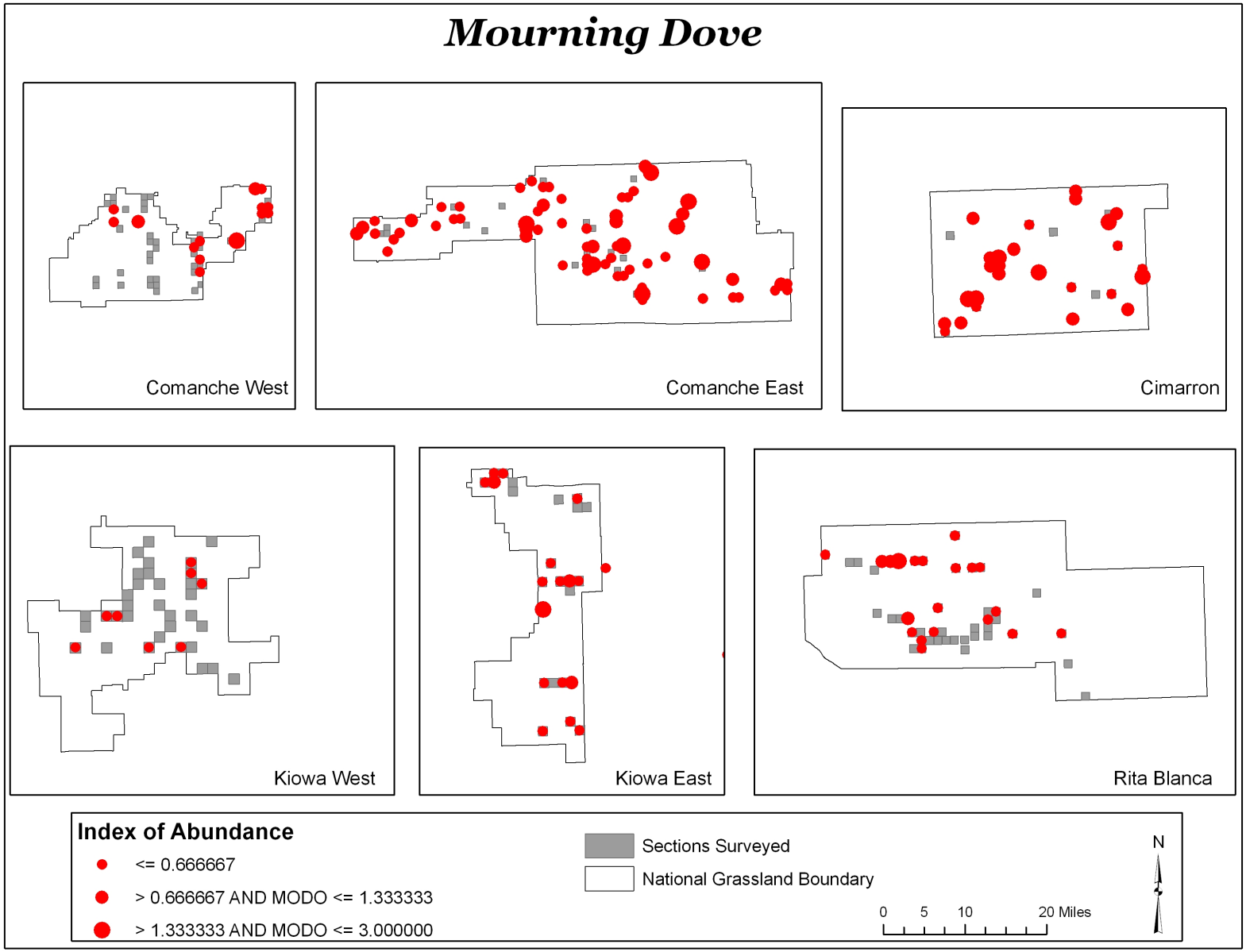
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Mourning Dove
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.666667
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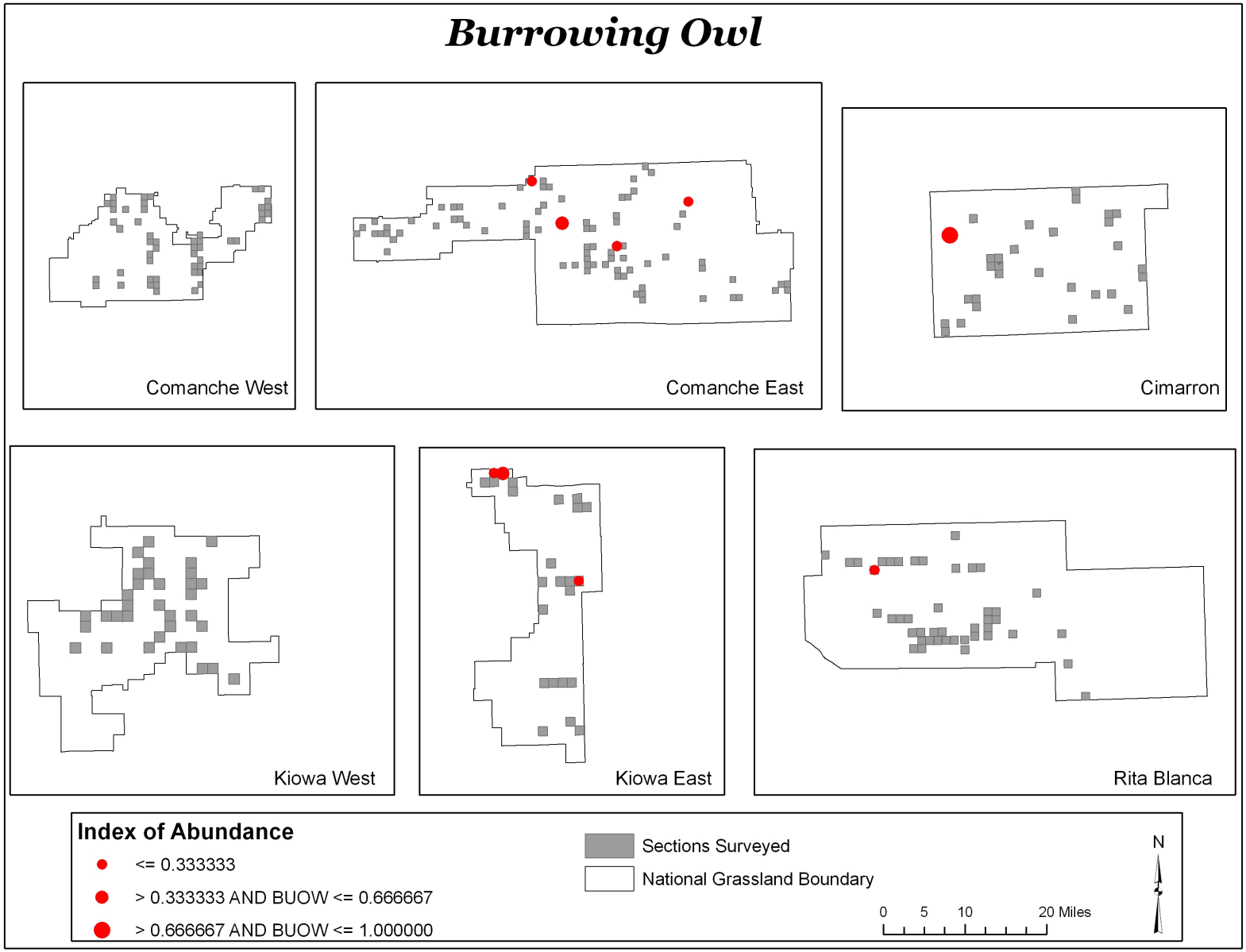
> 1.333333 AND MODO <= 3.000000
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Burrowing Owl
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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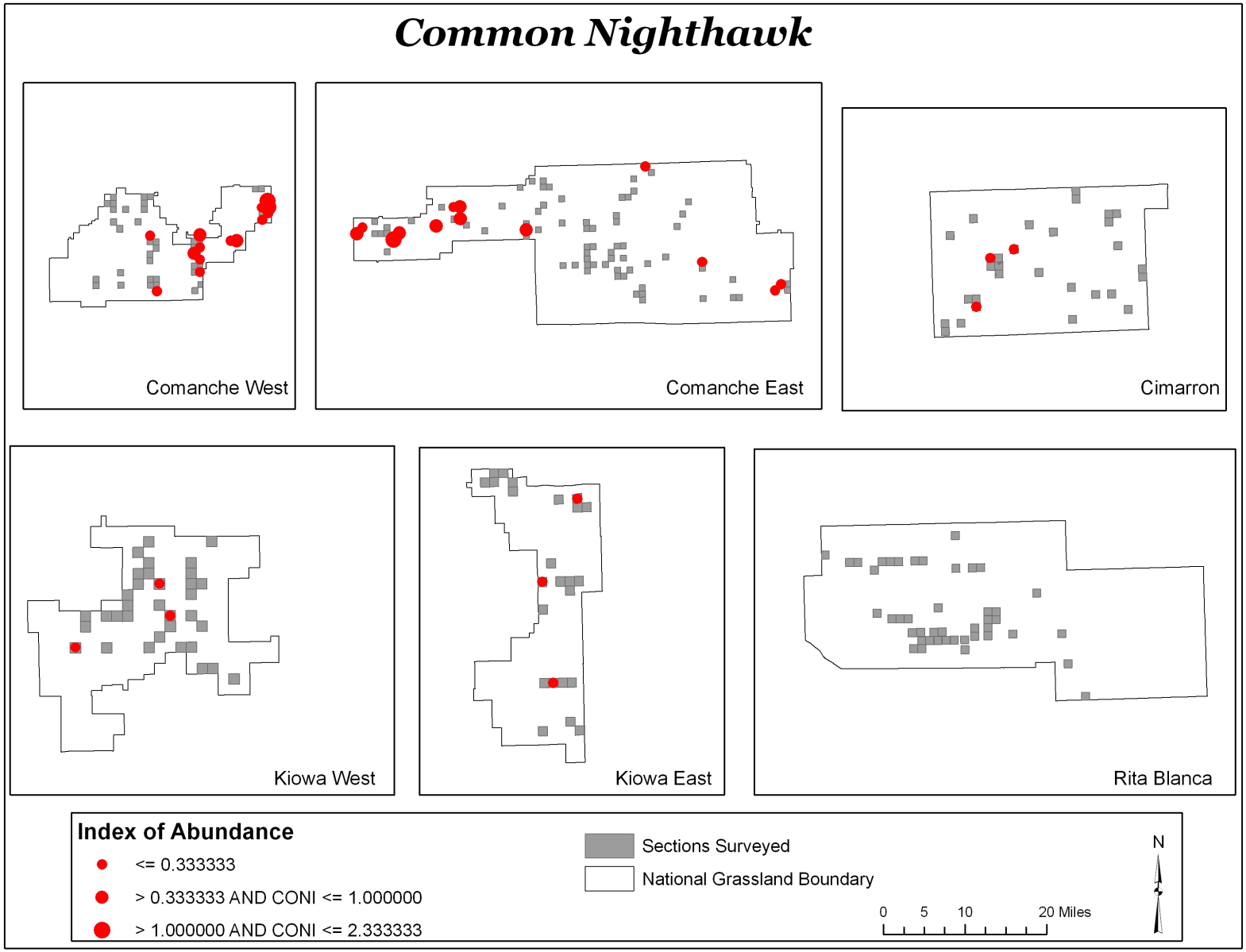
> 0.666667 AND BUOW <= 1.000000
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Common Nighthawk
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.333333
> 0.333333 AND CONI <= 1.000000
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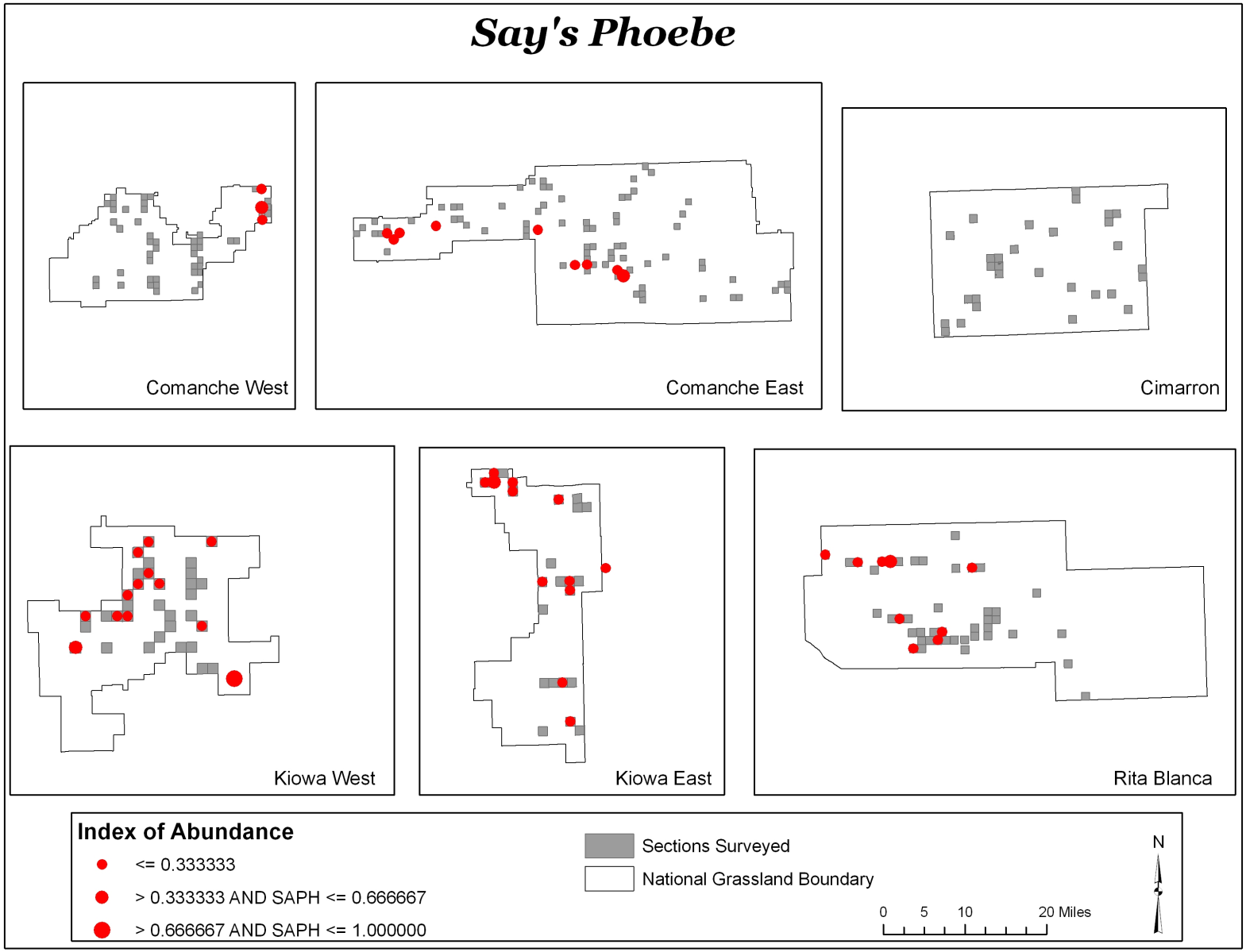
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles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Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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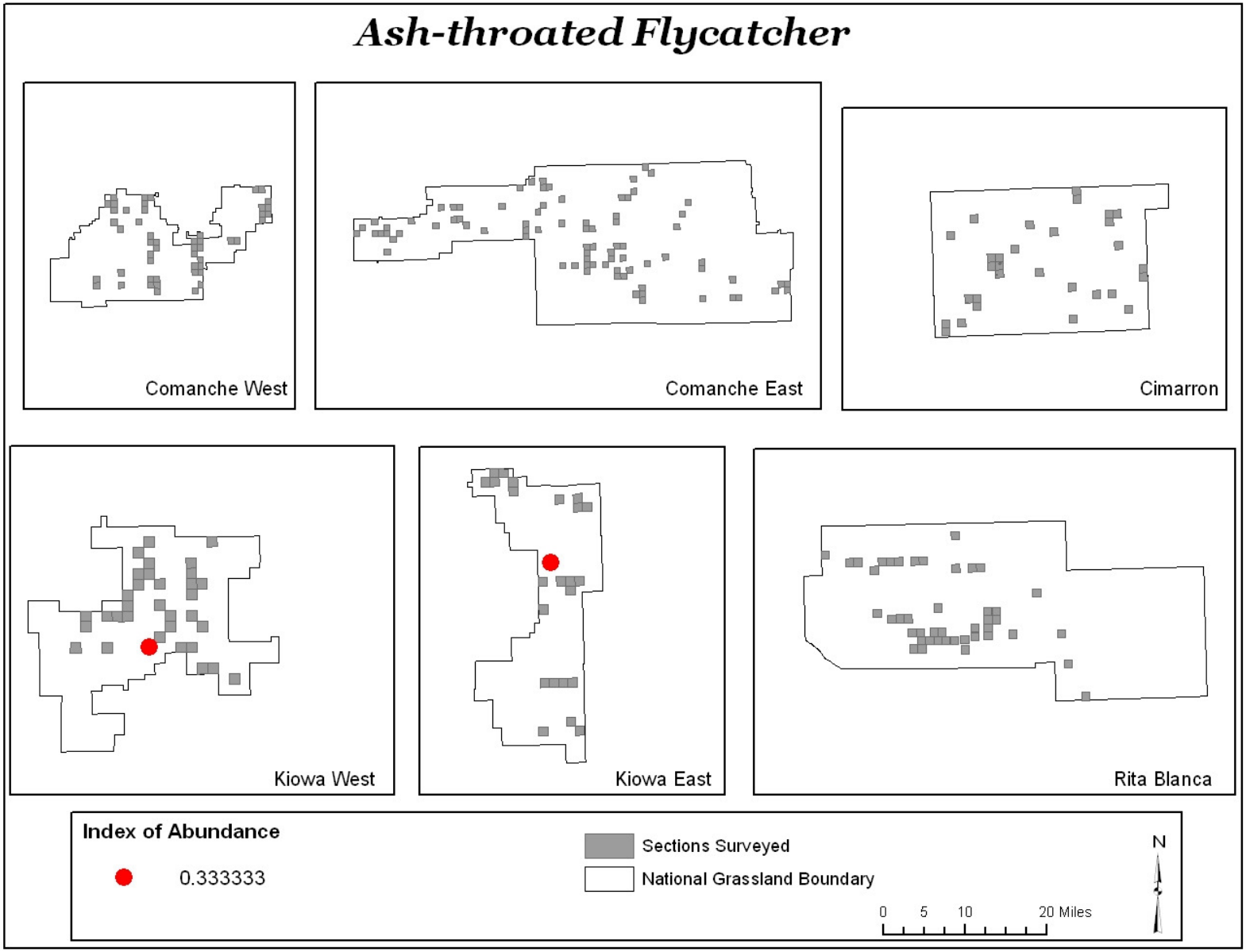
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Ash-throated Flycatcher
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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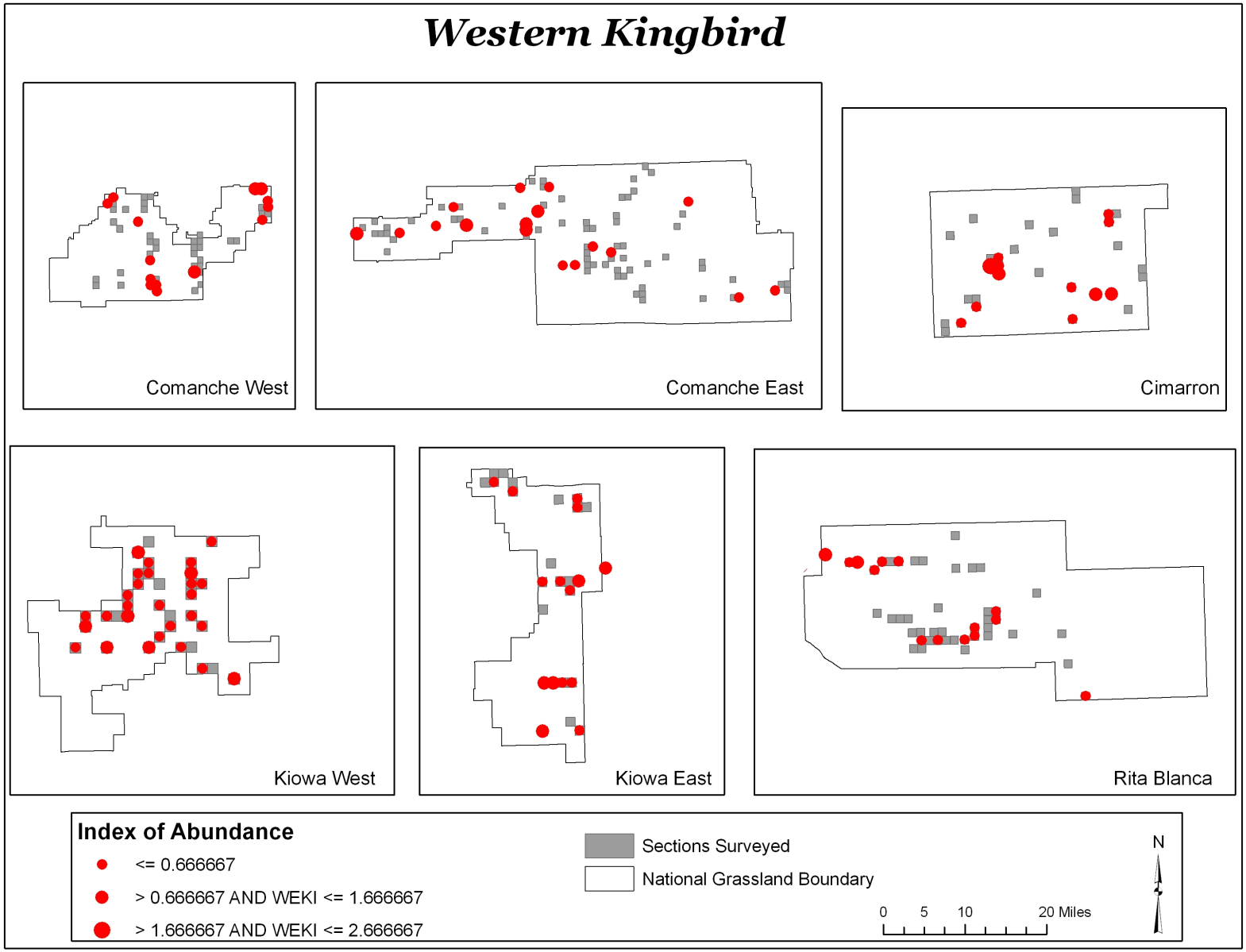
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Western Kingbird
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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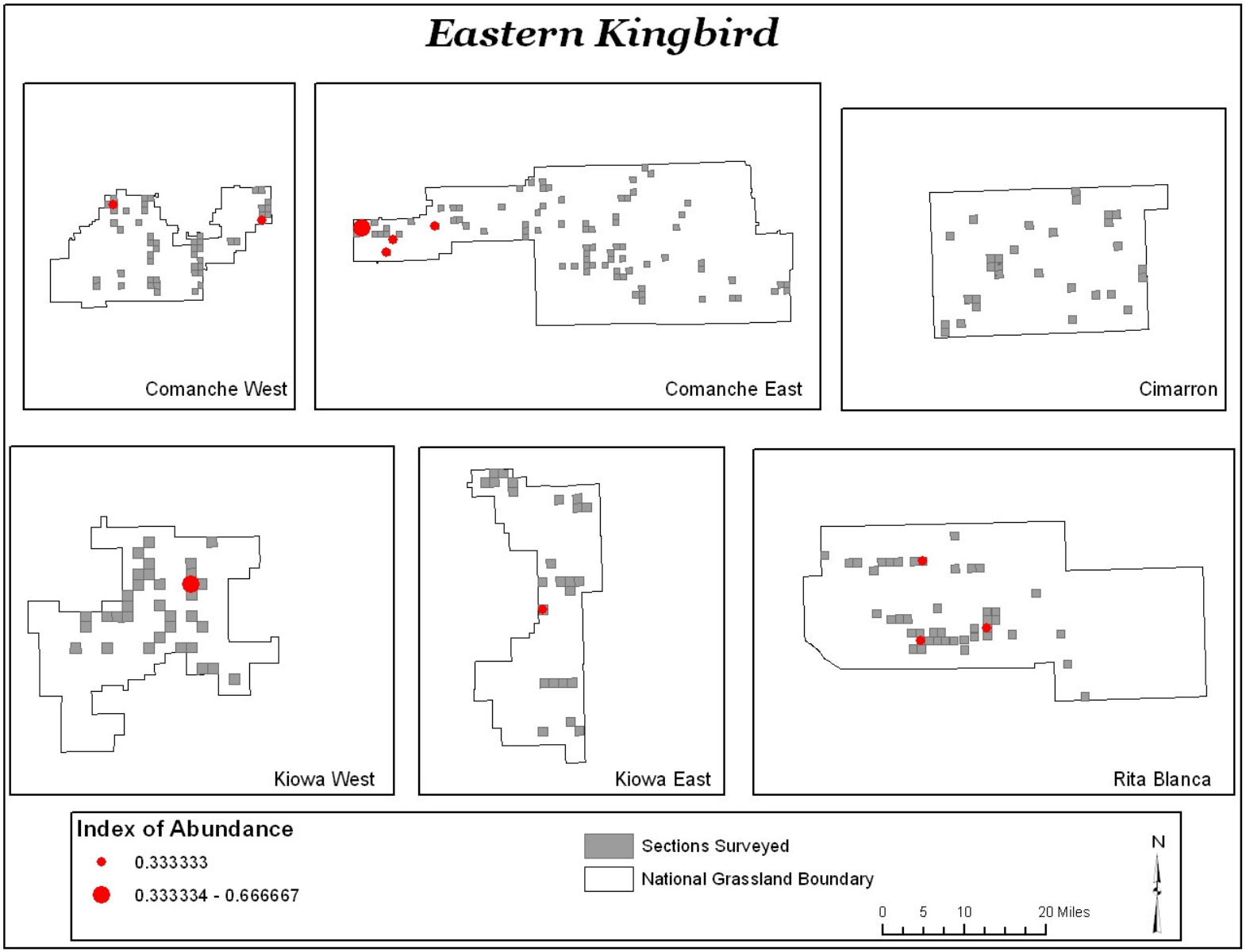
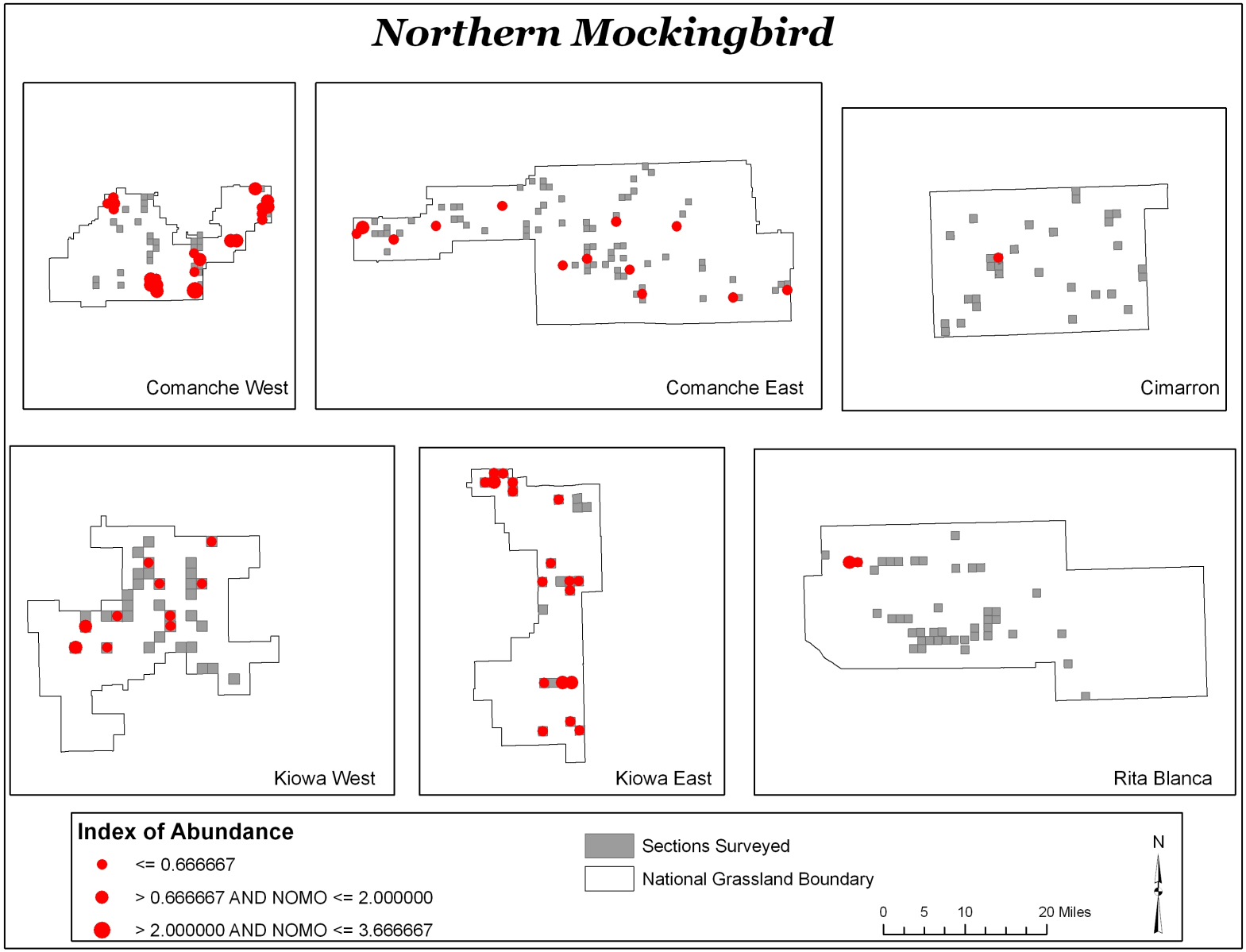
> 1.666667 AND WEKI <= 2.666667
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Eastern Kingbird
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333
0.333334 - 0.666667
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Northern Mockingbird
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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Sections Surveyed
National Grassland Boundary
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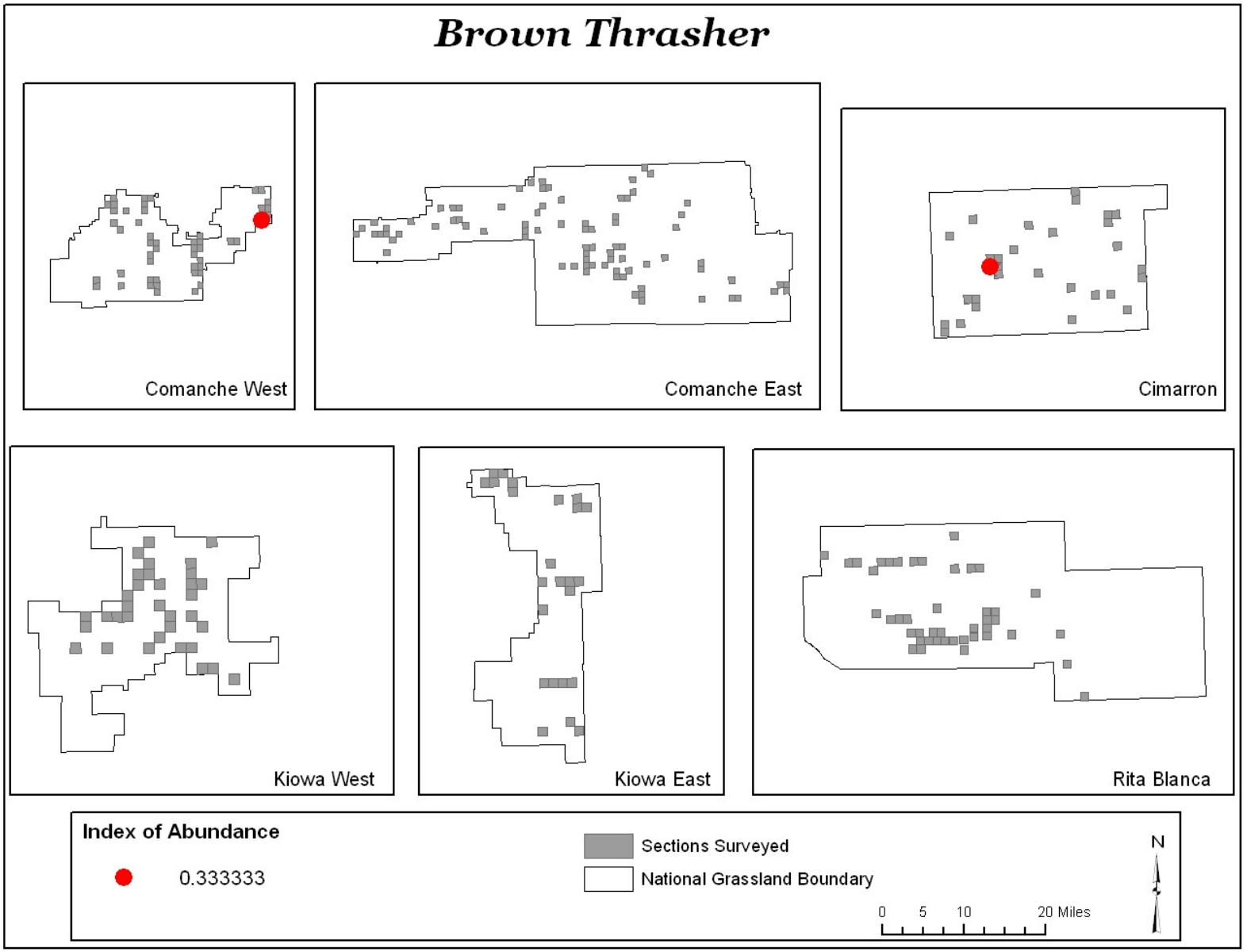
0 5 10 20 Miles


Brown Thrasher
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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Sections Surveyed
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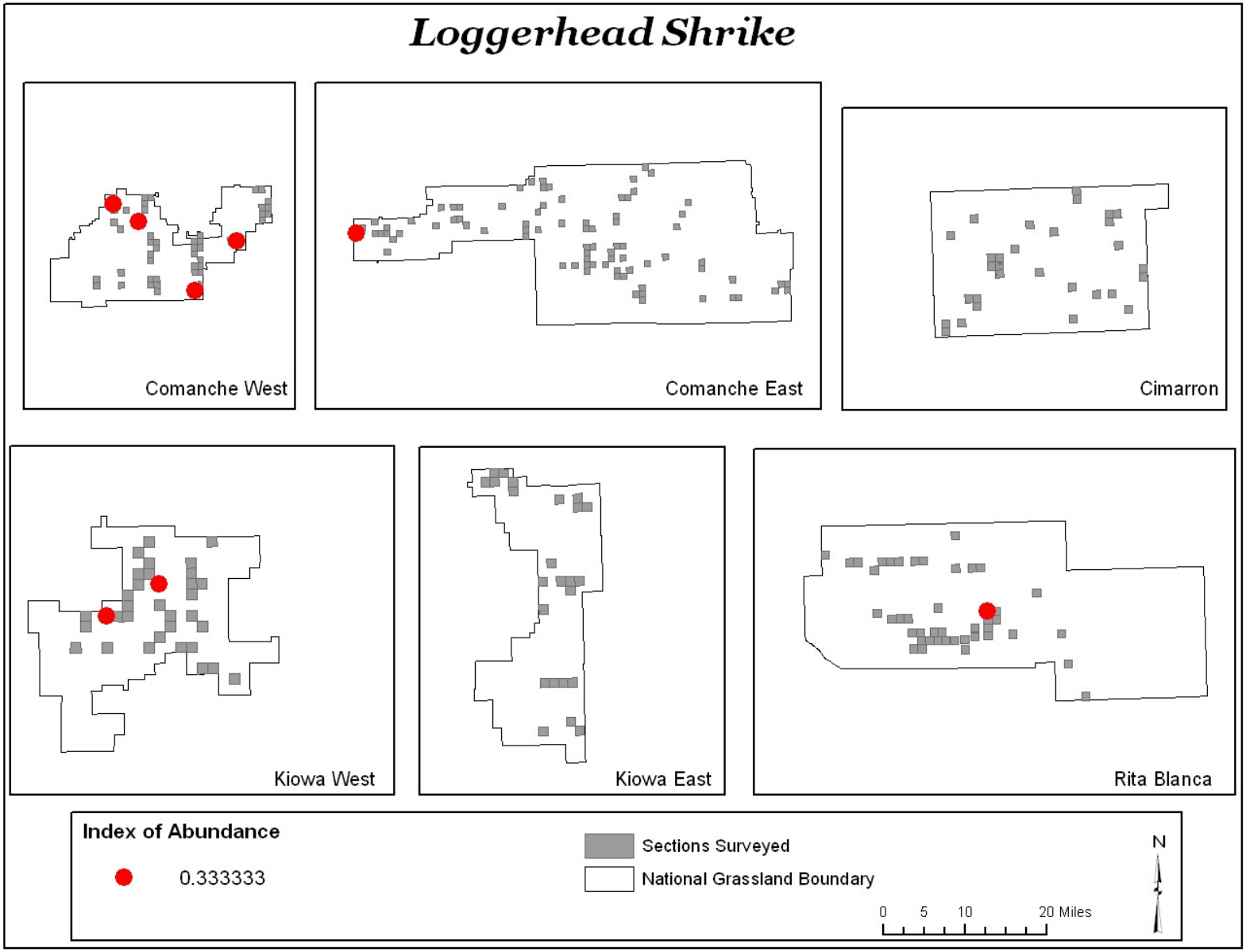
N
0 5 10 20 Miles


Loggerhead Shrike
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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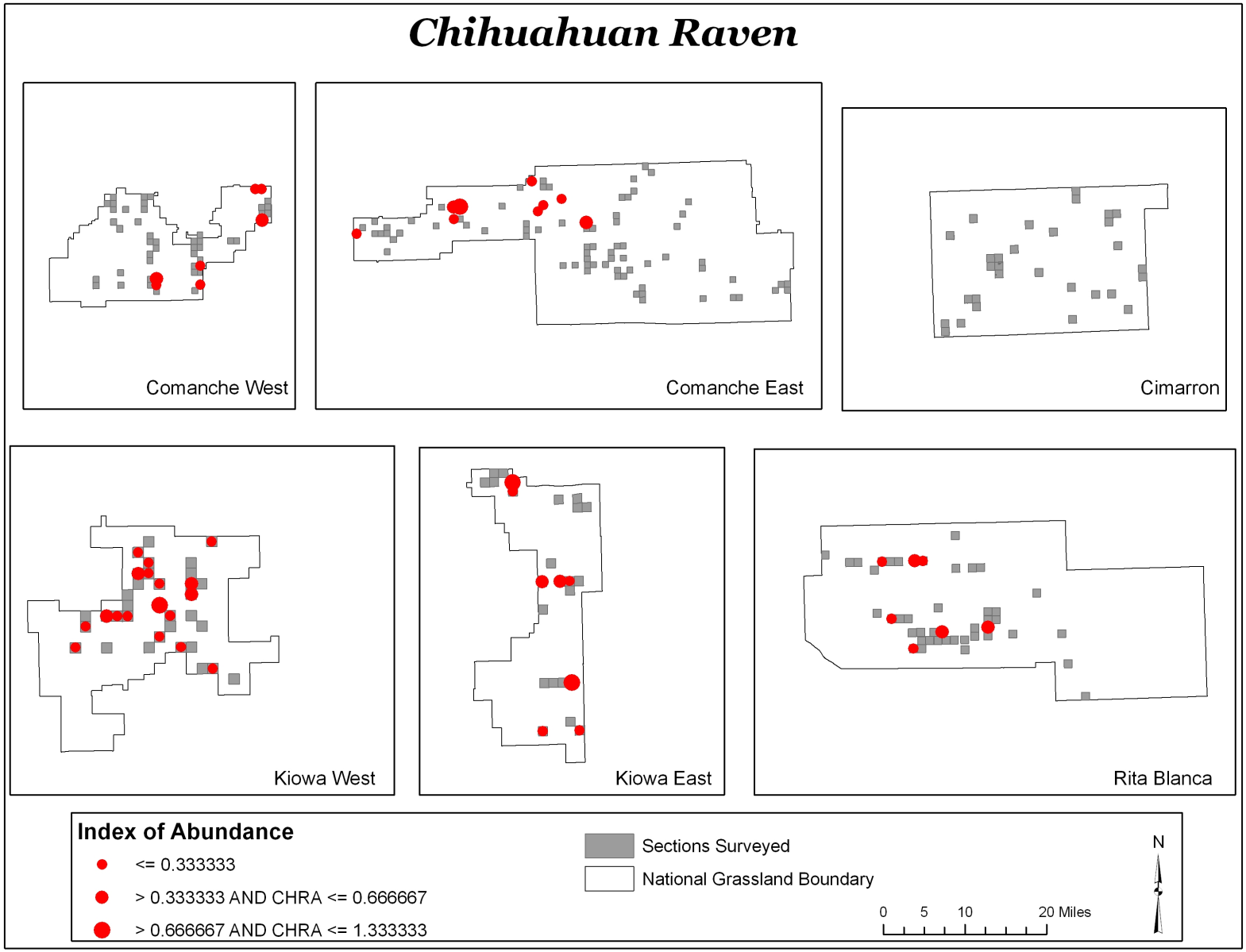
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Chihuahuan Raven
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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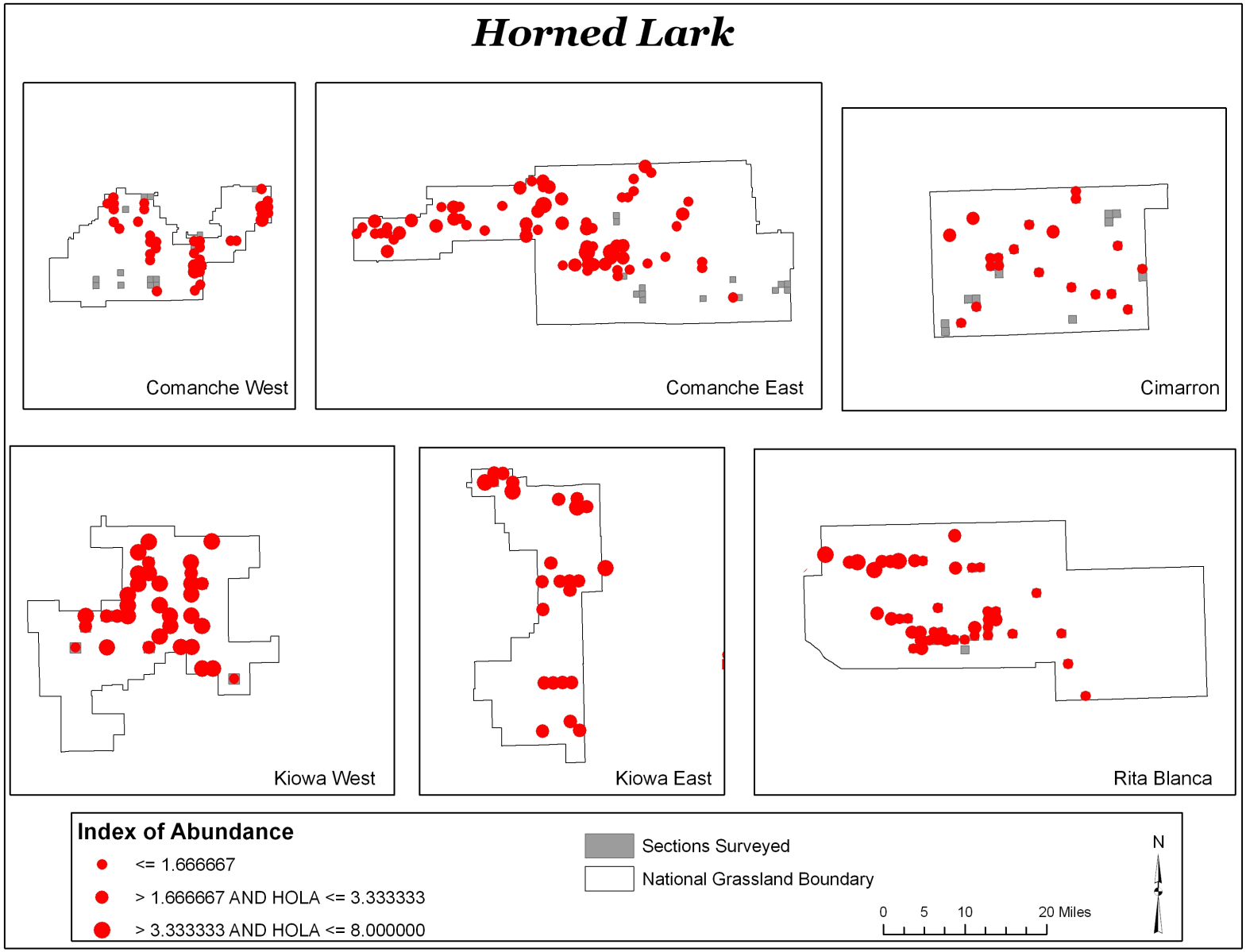
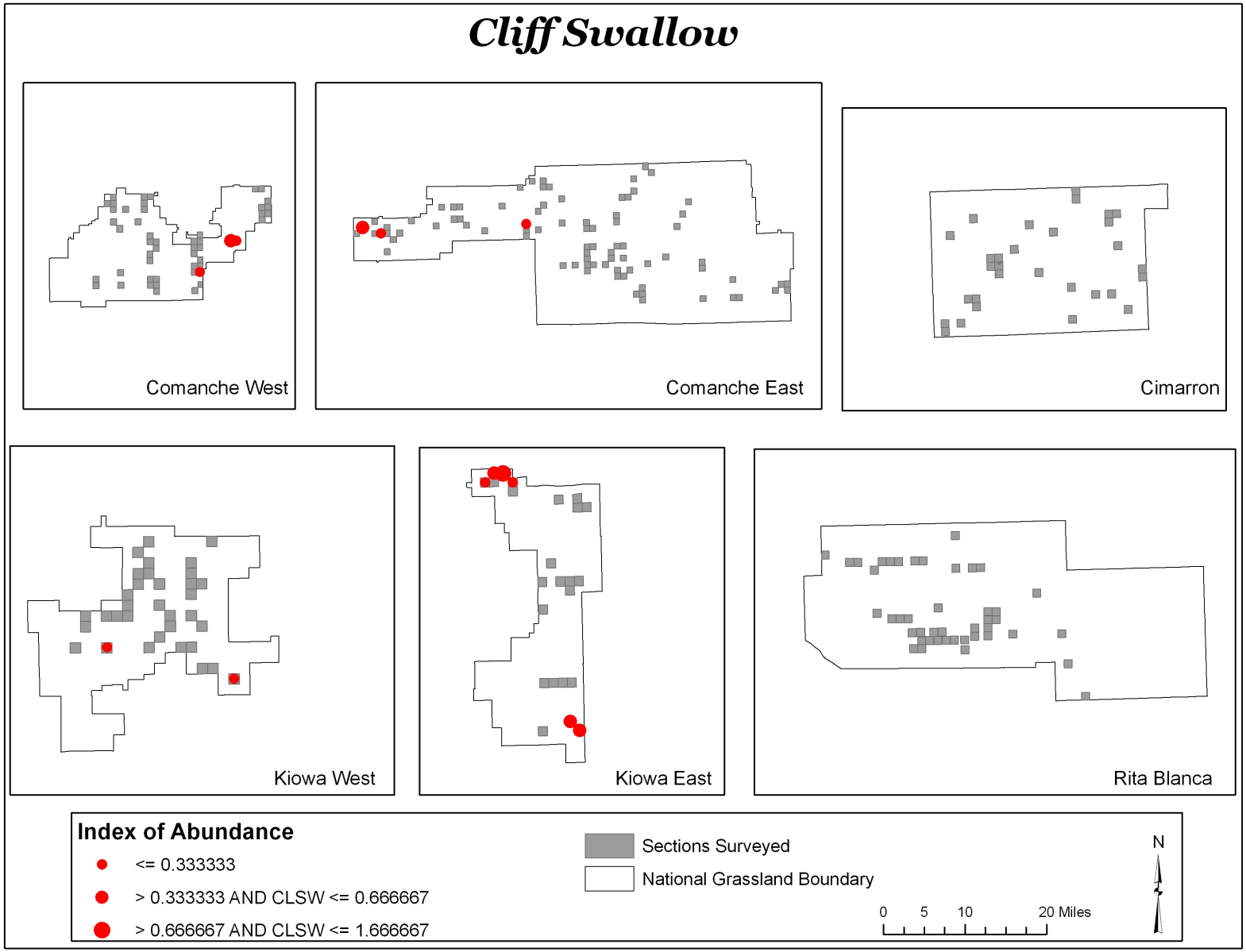
> 0.666667 AND CHRA <= 1.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Horned Lark
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 1.666667
> 1.666667 AND HOLA <= 3.333333
> 3.333333 AND HOLA <= 8.000000
Sections Surveyed
National Grassland Boundary
0 5 10 20 Miles
N


Cliff Swallow
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.333333
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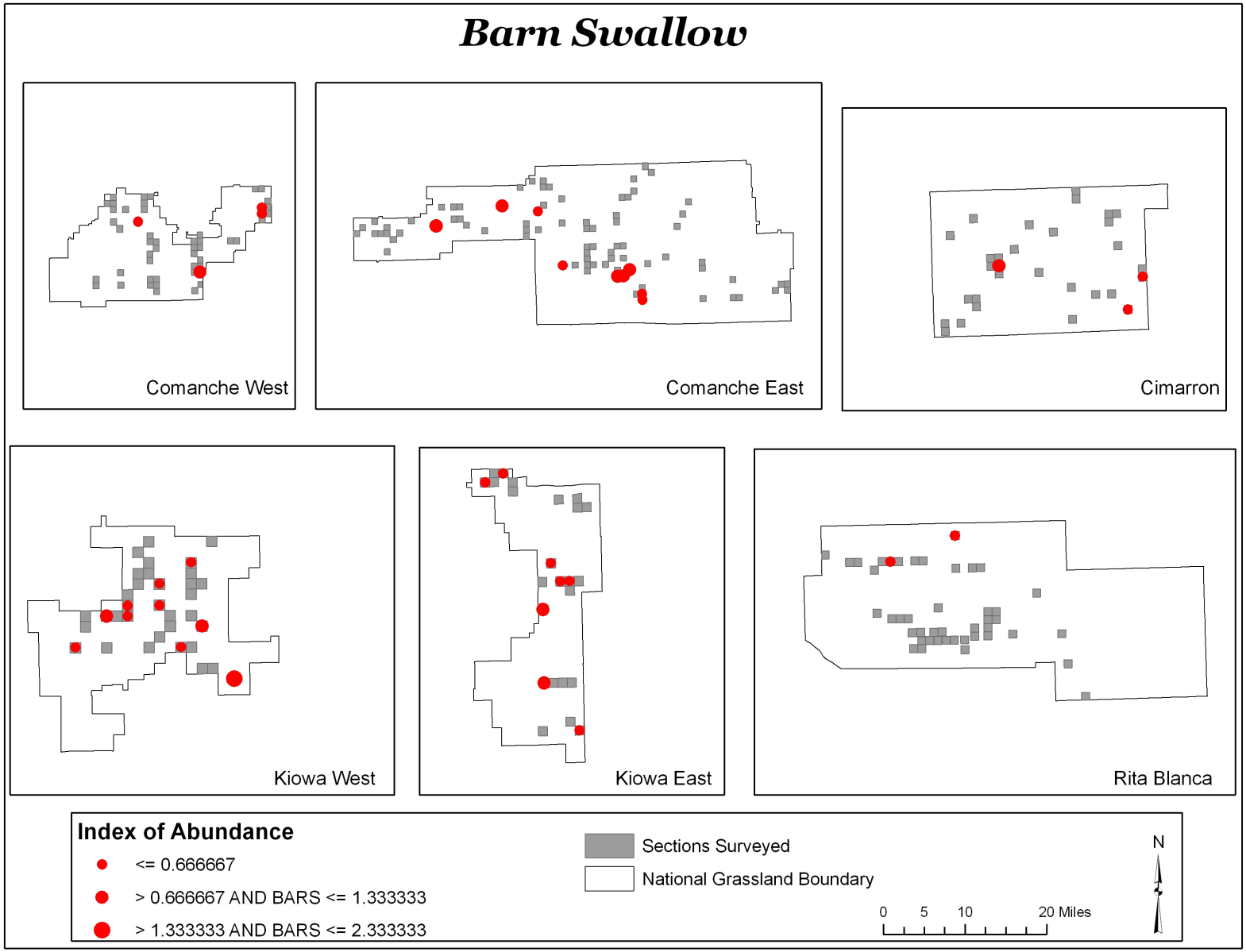
> 0.666667 AND CLSW <= 1.666667
Sections Surveyed
National Grassland Boundary
0 5 10 20 Miles
N


Barn Swallow
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
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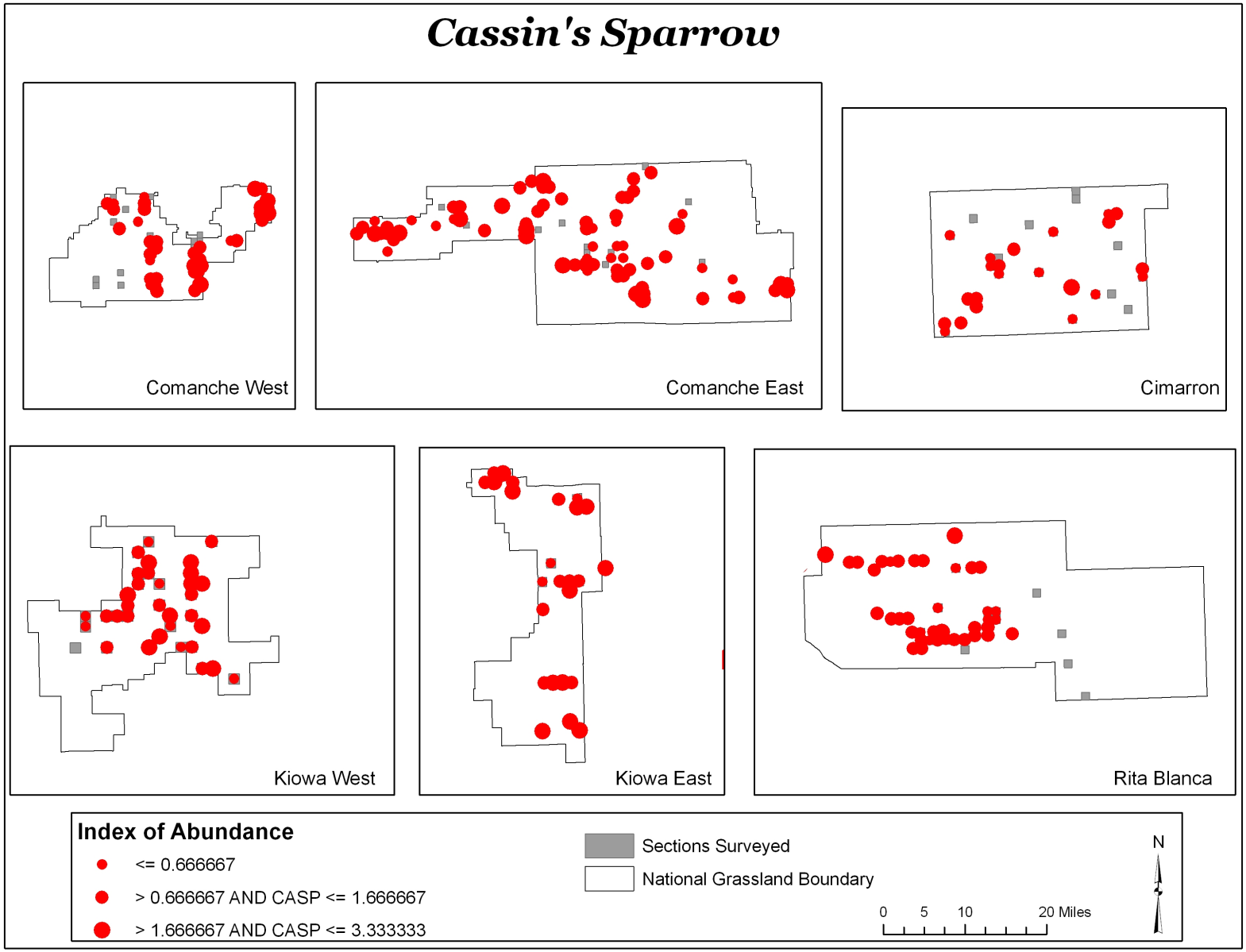
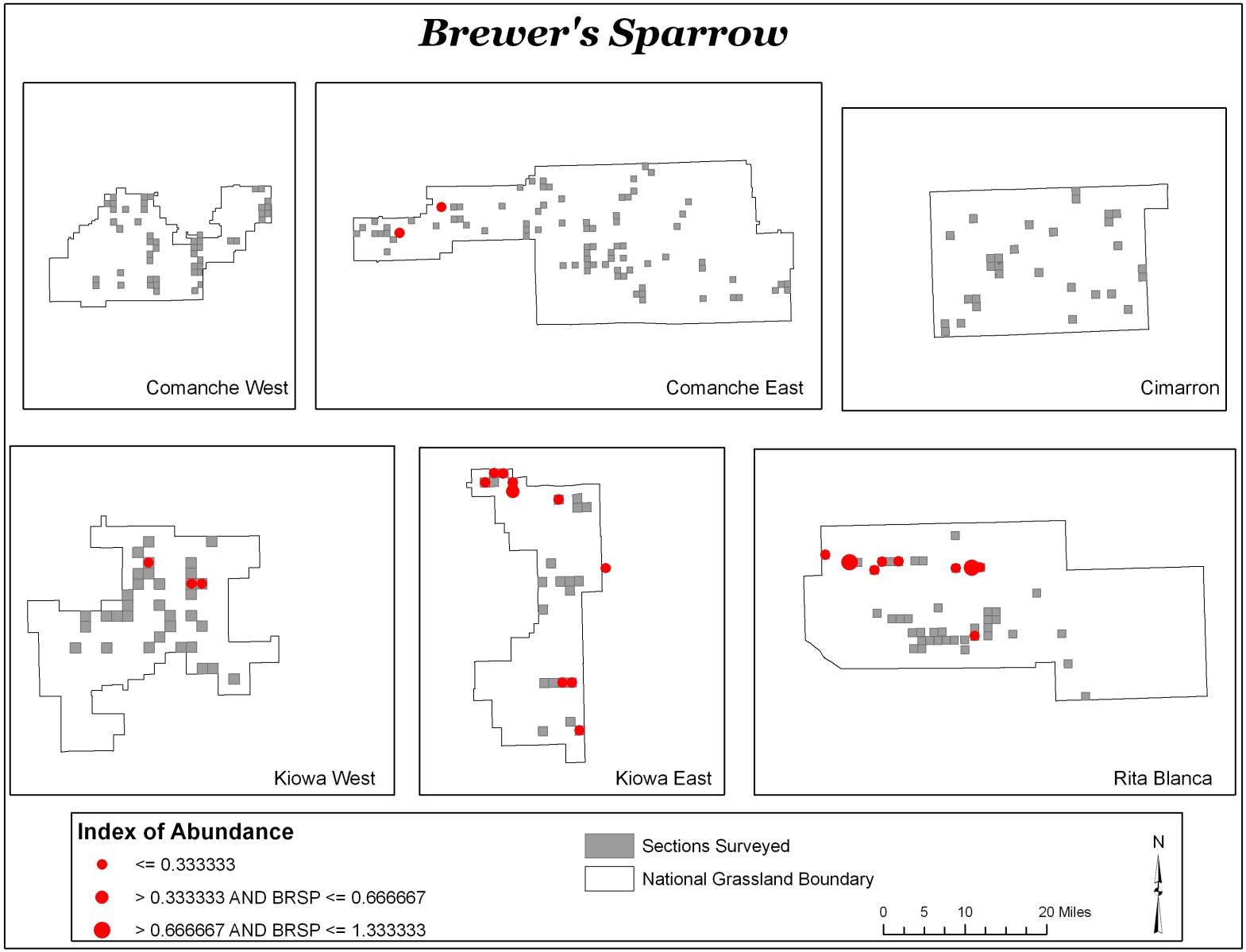
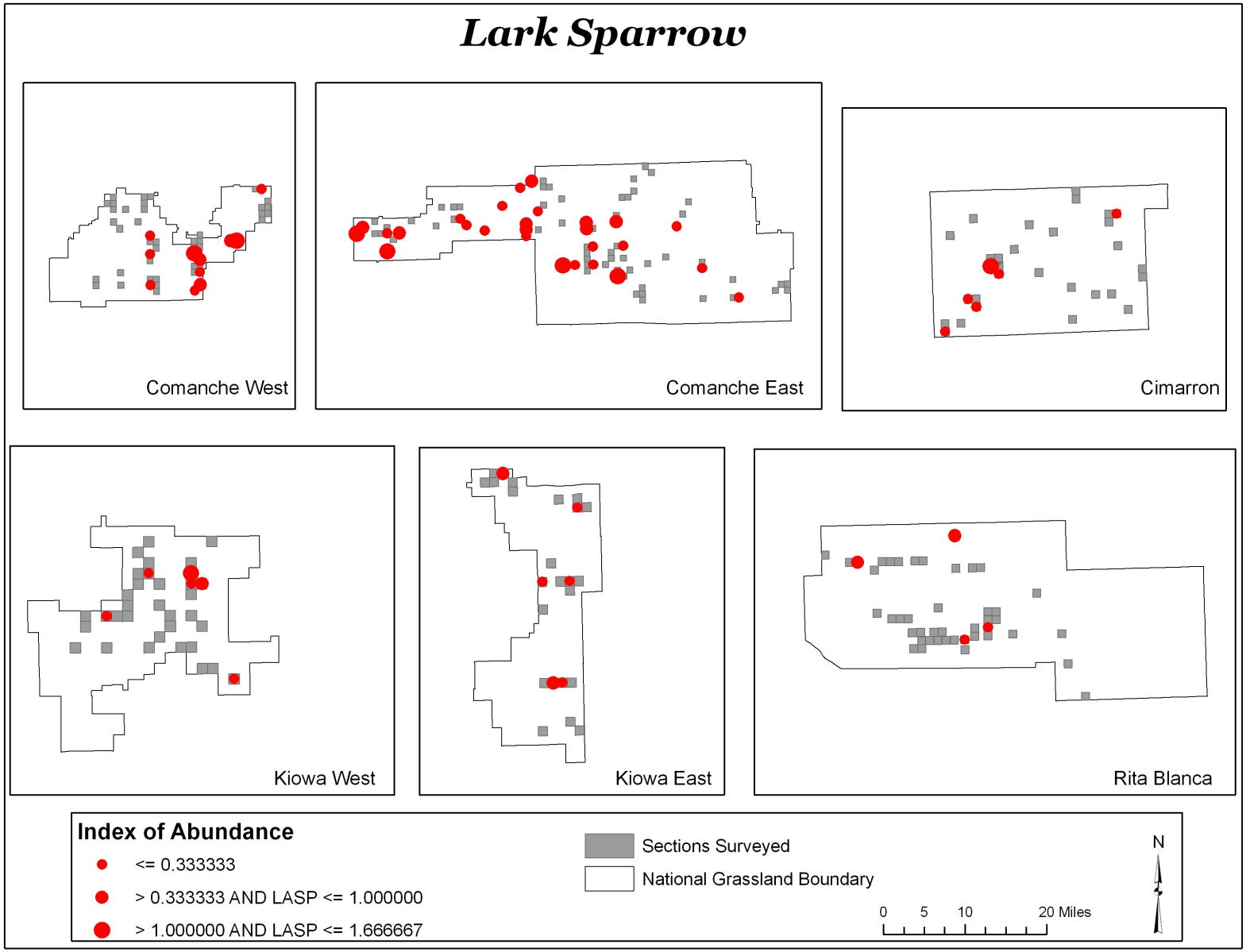
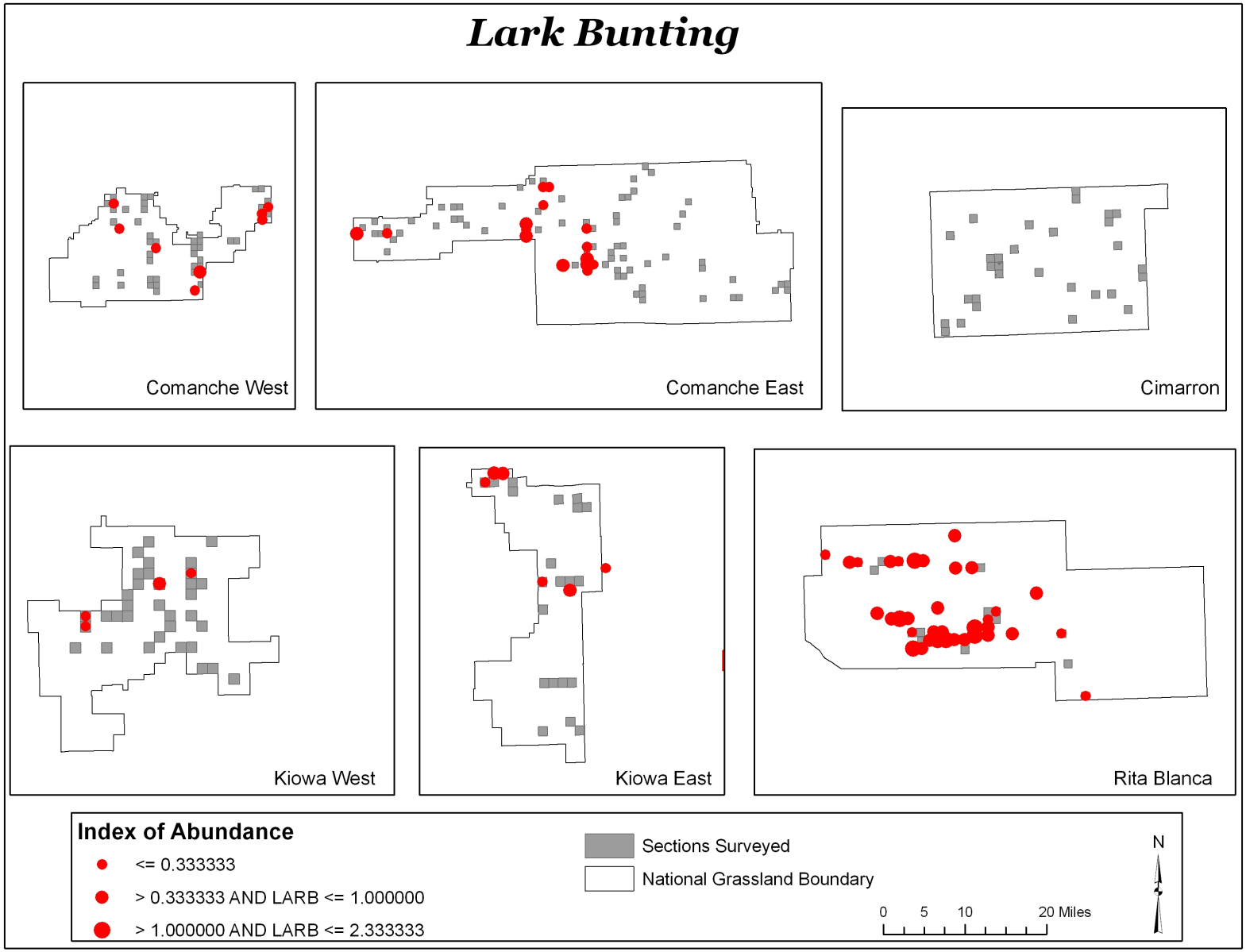
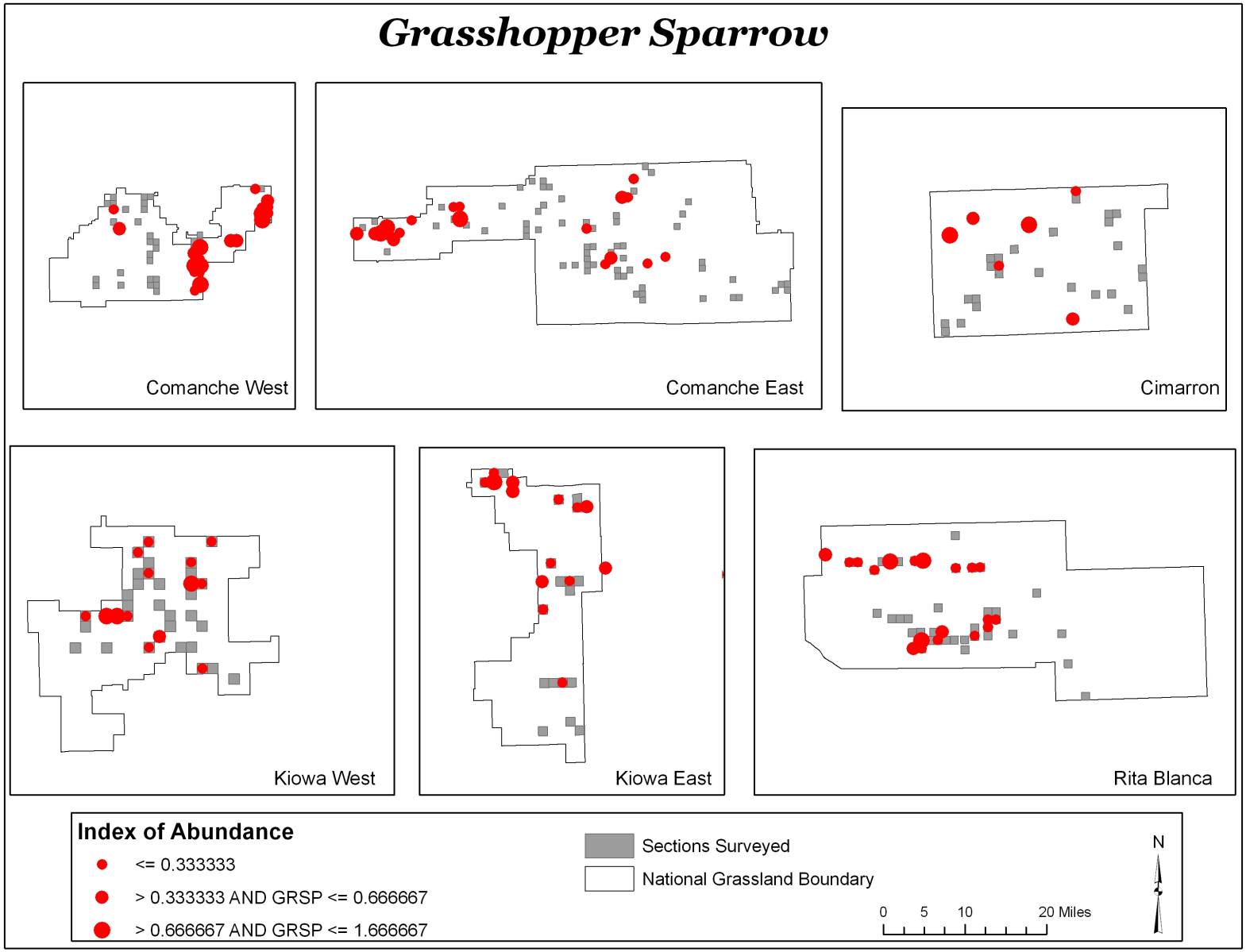
> 0.666667 AND BARS <= 1.333333
> 1.333333 AND BARS <= 2.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles

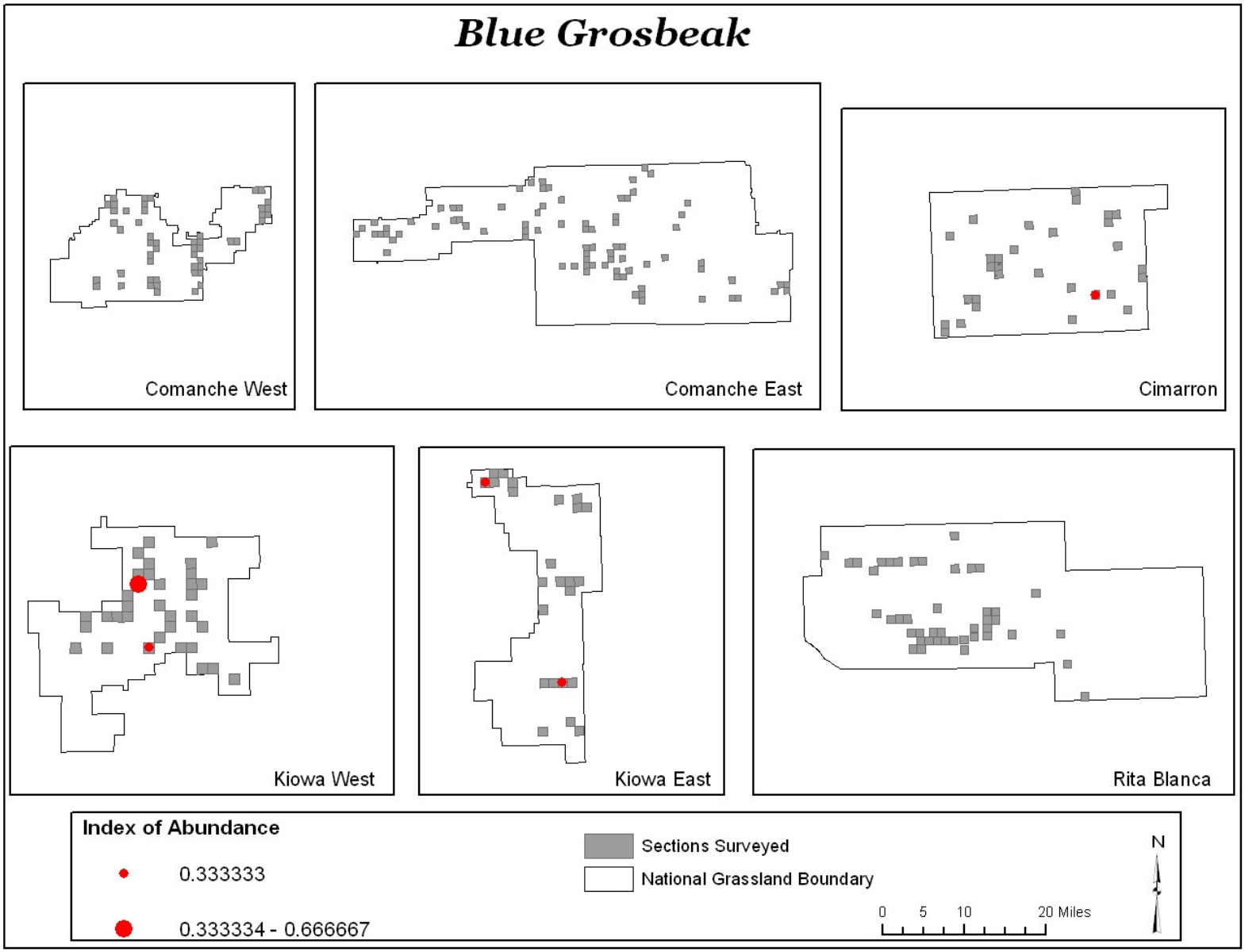

Cassin's Sparrow
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.666667
> 0.666667 AND CASP <= 1.666667
> 1.666667 AND CASP <= 3.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles

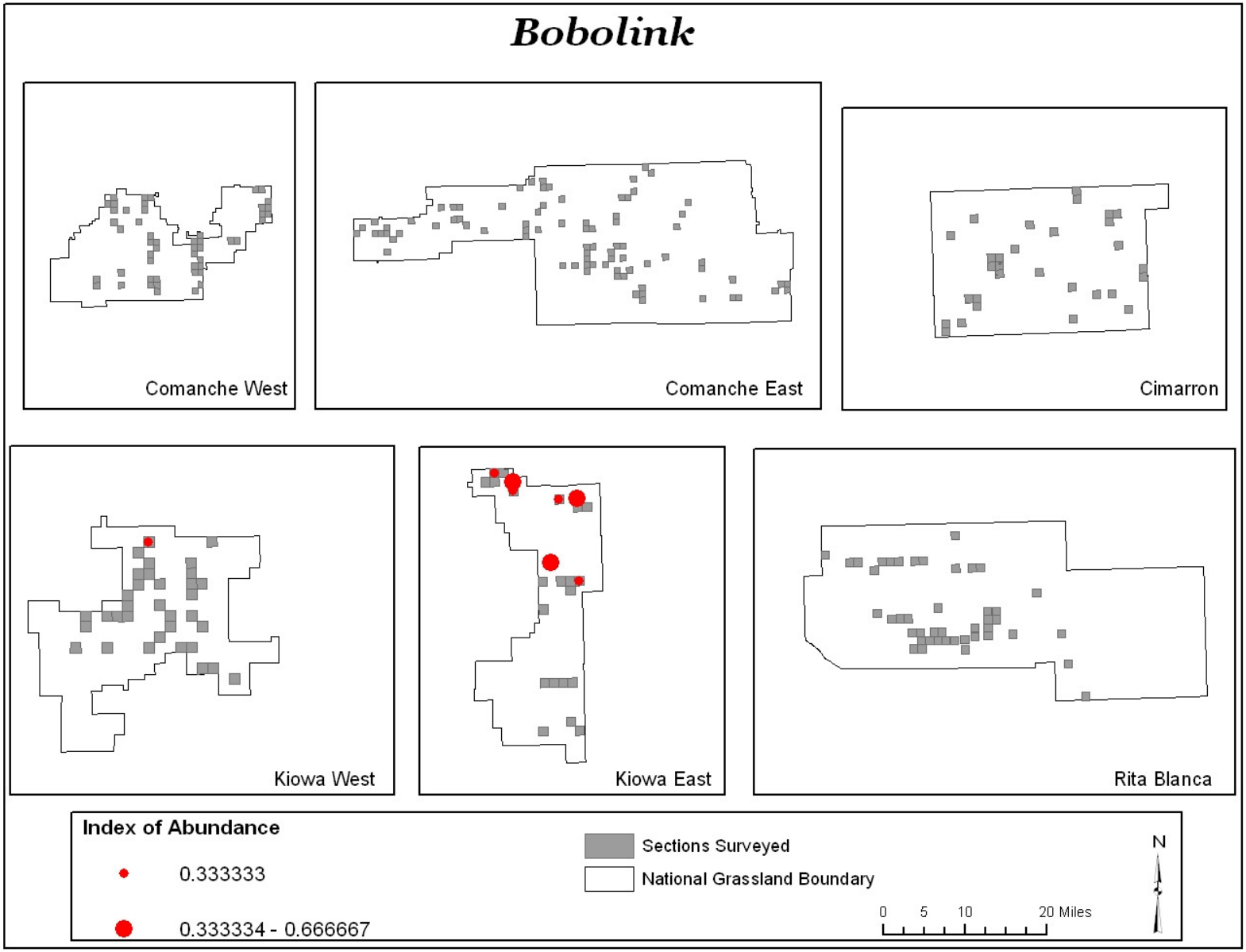

Brewer's Sparrow
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.333333
> 0.333333 AND BRSP <= 0.666667
> 0.666667 AND BRSP <= 1.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles

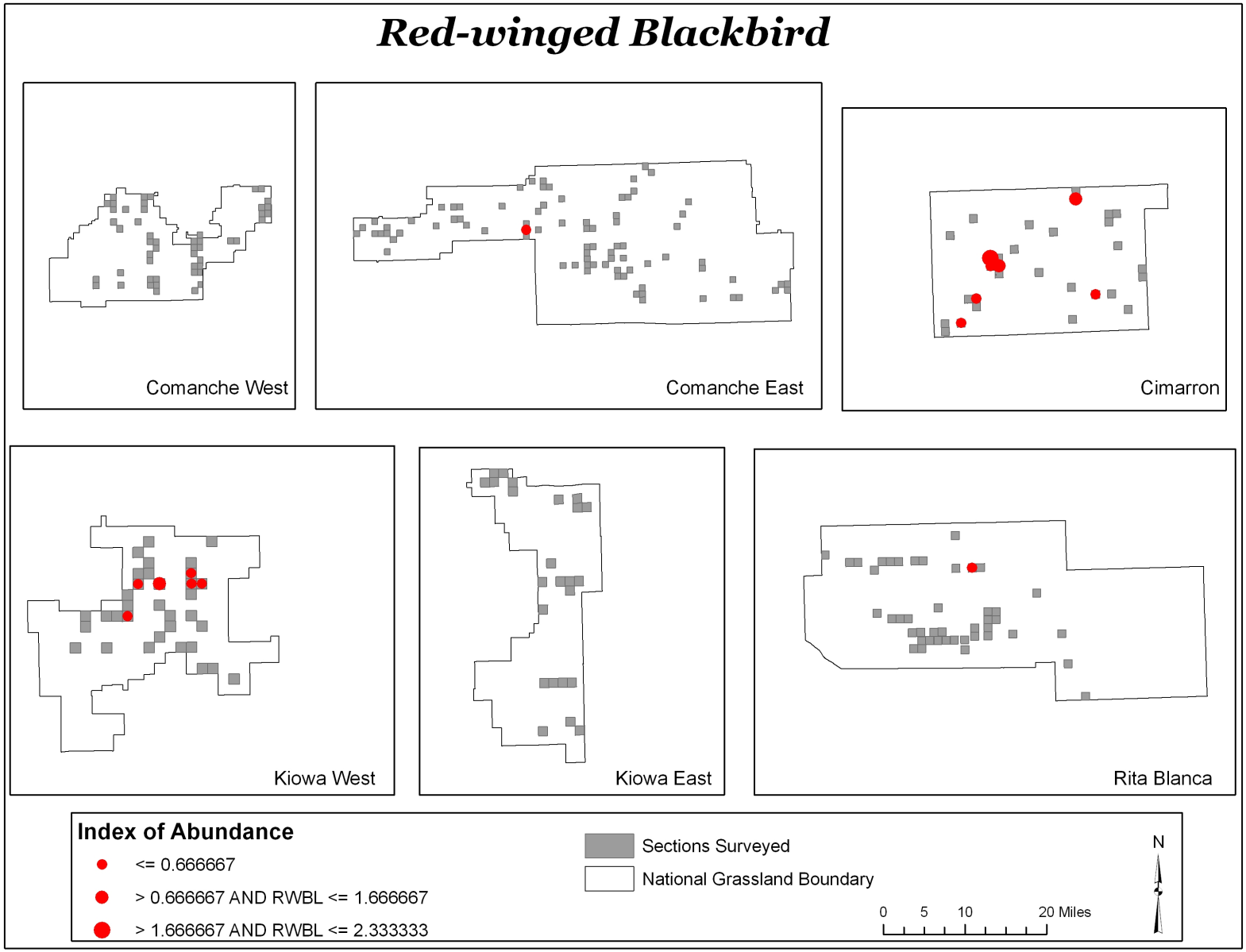

Lark Sparrow
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.333333
> 0.333333 AND LASP <= 1.000000
> 1.000000 AND LASP <= 1.666667
Sections Surveyed
National Grassland Boundary
0 5 10 20 Miles
N

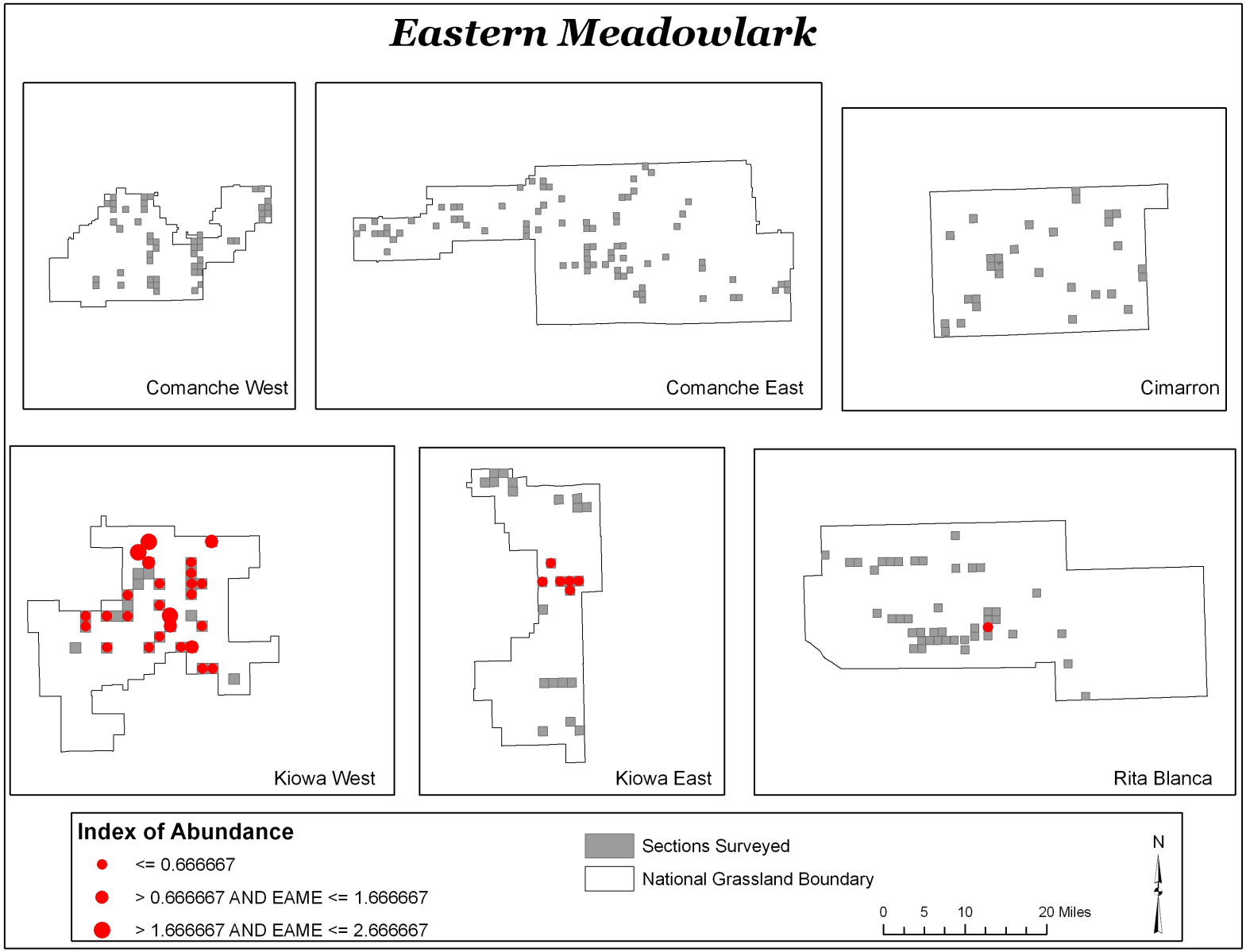

Lark Bunting
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.333333
> 0.333333 AND LARB <= 1.000000
> 1.000000 AND LARB <= 2.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles

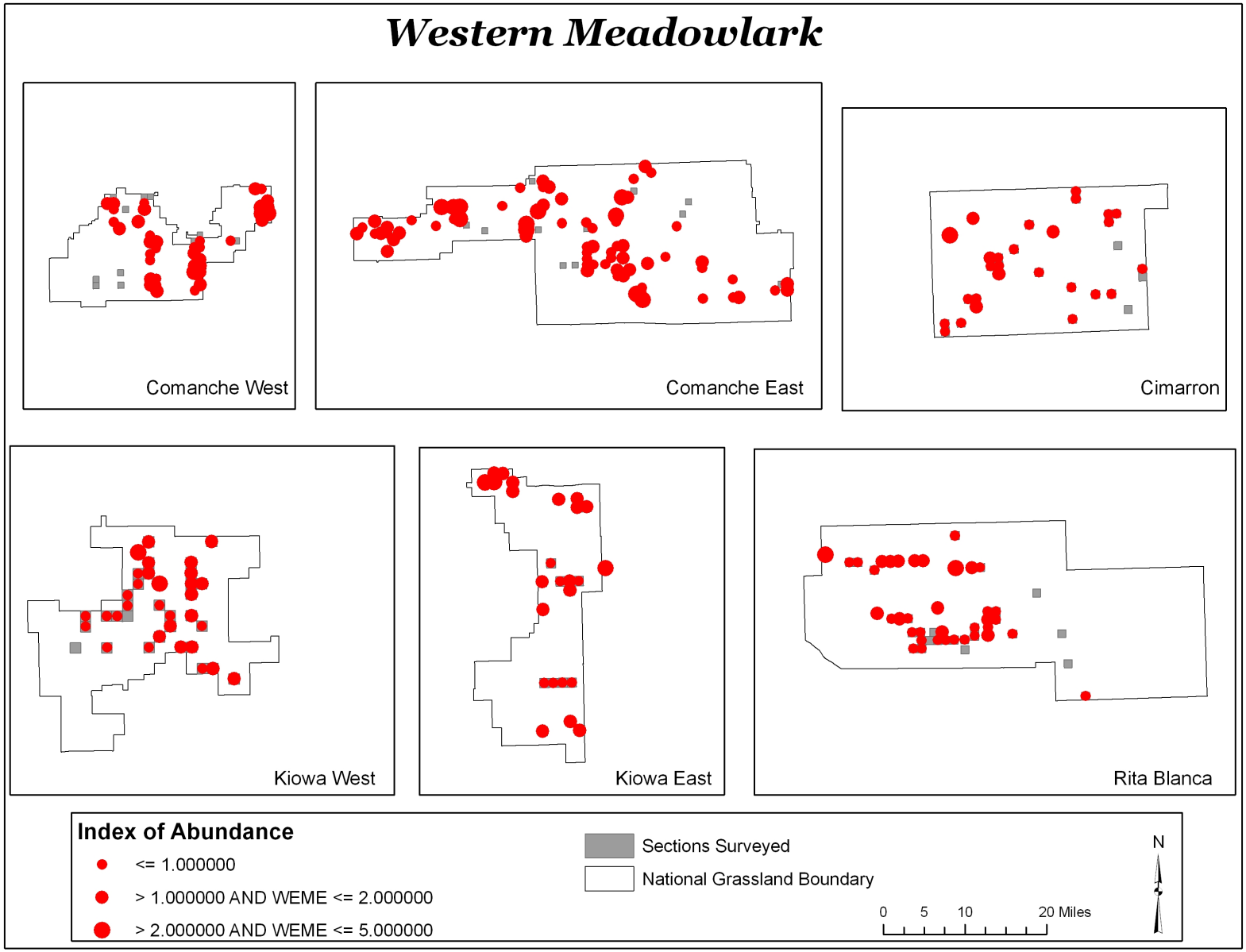

Grasshopper Sparrow
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.333333
> 0.333333 AND GRSP <= 0.666667
> 0.666667 AND GRSP <= 1.666667
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles

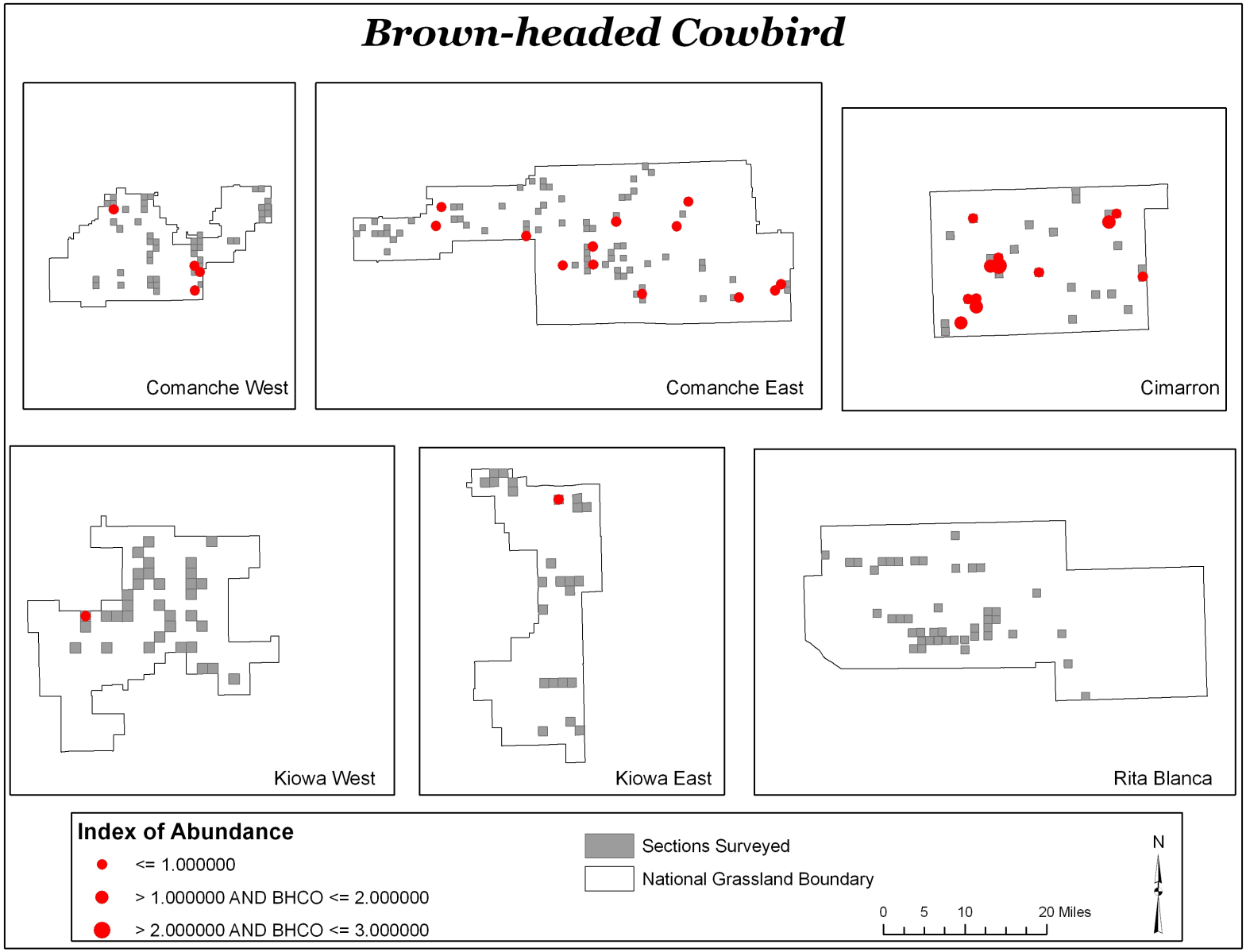

Blue Grosbeak
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333
0.333334 - 0.666667
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles

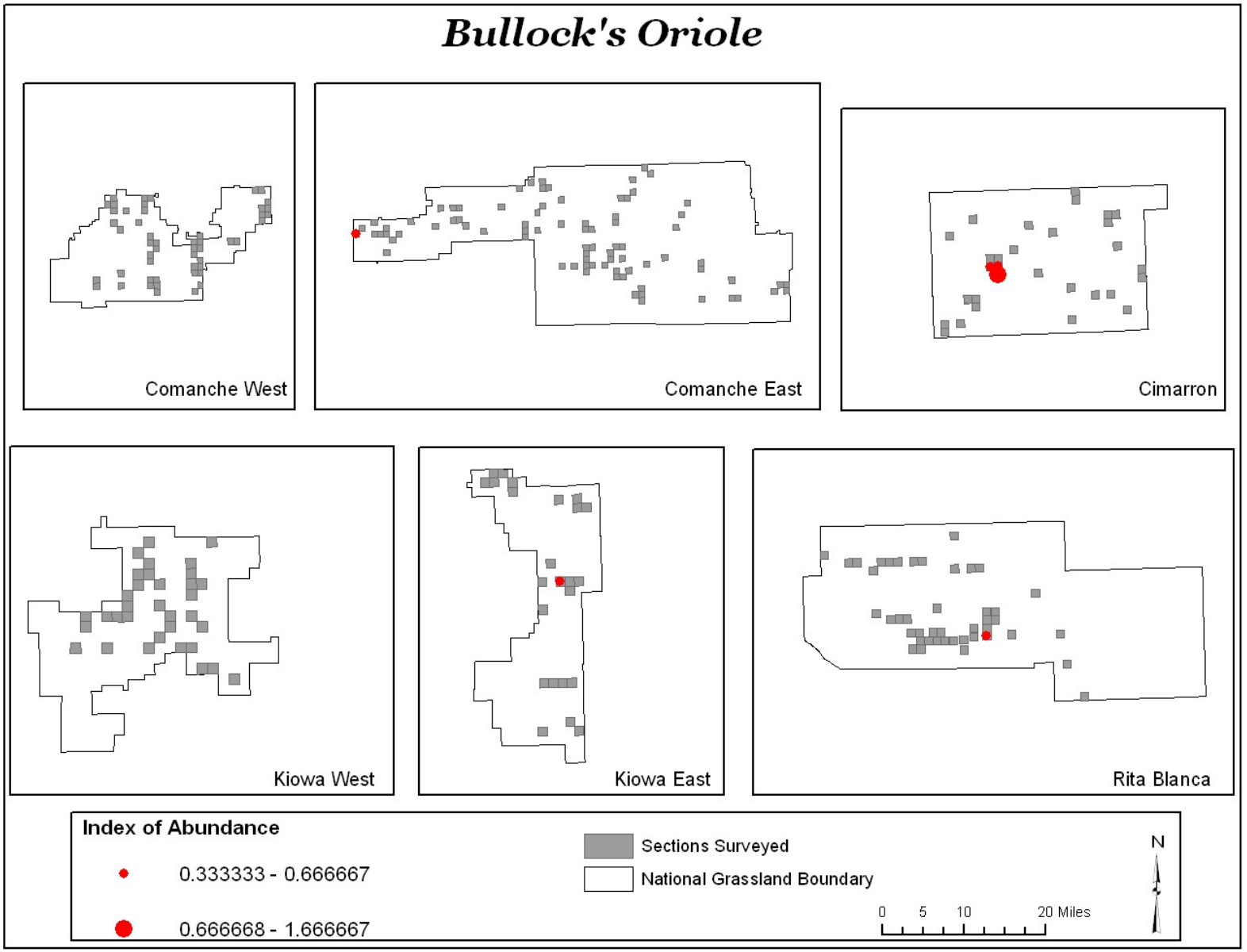

Bobolink
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333
0.333334 - 0.666667
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Red-winged Blackbird
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.666667
> 0.666667 AND RWBL <= 1.666667
> 1.666667 AND RWBL <= 2.333333
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Eastern Meadowlark
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 0.666667
> 0.666667 AND EAME <= 1.666667
> 1.666667 AND EAME <= 2.666667
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Western Meadowlark
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 1.000000
> 1.000000 AND WEME <= 2.000000
> 2.000000 AND WEME <= 5.000000
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Brown-headed Cowbird
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
<= 1.000000
> 1.000000 AND BHCO <= 2.000000
> 2.000000 AND BHCO <= 3.000000
Sections Surveyed
National Grassland Boundary
N
0 5 10 20 Miles


Bullock's Oriole
Comanche West
Comanche East
Cimarron
Kiowa West
Kiowa East
Rita Blanca
Index of Abundance
0.333333 - 0.666667
0.666668 - 1.666667
Sections Surveyed
National Grassland Boundary
0 5 10 20 Miles
N

APPENDIX B

Number of detections for all species detected on Comanche, Cimarron, Kiowa, and Rita Blanca National Grasslands (15 May – 4 July 2006).

Common Name	Scientific Name	Cimarron	Comanche	Kiowa	RitaBlanca	Total Count
Ring-necked Pheasant	Phasianus colchicus	8	7	5	9	29
Scaled Quail	Callipepla squamata	2	5	2	9	18
Northern Bobwhite	Colinus virginianus	6	4	1		11
Turkey Vulture	Cathartes aura		5	5		10
Northern Harrier	Circus cyaneus	1	1			2
Swainson's Hawk	Buteo swainsoni	1	7	1	3	12
Red-tailed Hawk	Buteo jamaicensis		1	1		2
Ferruginous Hawk	Buteo regalis	1	1	1		3
American Kestrel	Falco sparverius	1		1		2
Prairie Falcon	Falco mexicanus		3	2	3	8
Killdeer	Charadrius vociferus	1			1	2
Long-billed Curlew	Numenius americanus		11	2	7	20
Rock Pigeon	Columba livia	1	2			3
Mourning Dove	Zenaida macroura	26	78	25	20	149
Greater Roadrunner	Geococcyx californianus		1			1
Burrowing Owl	Athene cunicularia	1	4	3	1	9
Common Nighthawk	Chordeiles minor	3	27	6		36
Black-chinned Hummingbird	Archilochus alexandri			1		1
Red-headed Woodpecker	Melanerpes erythrocephalus	1				1
Northern Flicker	Colaptes auratus	1				1
Say's Phoebe	Sayornis saya		12	24	9	45
Ash-throated Flycatcher	Myiarchus cinerascens			2		2
Cassin's Kingbird	Tyrannus vociferans		2	15	26	43
Western Kingbird	Tyrannus verticalis	12	31	42	14	99
Eastern Kingbird	Tyrannus tyrannus		6	2	3	11
Loggerhead Shrike	Lanius ludovicianus		5	2	1	8
American Crow	Corvus brachyrhynchos		1			1
Chihuahuan Raven	Corvus cryptoleucus		16	26	7	49
Common Raven	Corvus corax		5			5
Horned Lark	Eremophila alpestris	20	104	58	43	225
Tree Swallow	Tachycineta bicolor		3		1	4
Bank Swallow	Riparia riparia		3			3
Cliff Swallow	Petrochelidon pyrrhonota		6	8		14
Barn Swallow	Hirundo rustica	3	13	18	2	36
Bushtit	Psaltriparus minimus			1		1

Common Name	Scientific Name	Cimarron	Comanche	Kiowa	RitaBlanca	Total Count
House Wren	Troglodytes aedon		1			1
American Robin	Turdus migratorius		1	1	1	3
Northern Mockingbird	Mimus polyglottos	1	34	28	2	65
Sage Thrasher	Oreoscoptes montanus		1	1	1	3
Brown Thrasher	Toxostoma rufum	1	1			2
Curve-billed Thrasher	Toxostoma curvirostre		2			2
Yellow Warbler	Dendroica petechia	1				1
Cassin's Sparrow	Aimophila cassinii	22	108	57	39	226
Brewer's Sparrow	Spizella breweri		2	12	9	23
Vesper Sparrow	Pooecetes gramineus		17	11	24	52
Lark Sparrow	Chondestes grammacus	6	38	12	4	60
Lark Bunting	Calamospiza melanocorys		23	9	35	67
Grasshopper Sparrow	Ammodramus savannarum	6	39	27	19	91
Blue Grosbeak	Passerina caerulea	1		4		5
Bobolink	Dolichonyx oryzivorus			8		8
Red-winged Blackbird	Agelaius phoeniceus	7	1	6	1	15
Eastern Meadowlark	Sturnella magna			32	1	33
Western Meadowlark	Sturnella neglecta	27	110	56	38	231
Brewer's Blackbird	Euphagus cyanocephalus		1	1	2	4
Common Grackle	Quiscalus quiscula	2	6	17	9	34
Great-tailed Grackle	Quiscalus mexicanus			1	1	2
Brown-headed Cowbird	Molothrus ater	12	17	2		31
Bullock's Oriole	Icterus bullockii	3	1	1	1	6
House Finch	Carpodacus mexicanus		1			1