



# BREEDING BIRD SURVEYS IN MISSOURI'S FOCAL GRASSLAND LANDSCAPES 2013 - 2017

REPORT TO THE MISSOURI DEPARTMENT OF CONSERVATION  
DECEMBER 2017



# GRASSLAND BIRD SURVEYS 2013-2017 EXECUTIVE SUMMARY



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Front Cover photo:  
Andrew Reago

The Missouri River Bird Observatory (MRBO) has conducted annual breeding bird surveys on public and private grasslands in Missouri since 2013. Surveys employ a line-transect Distance sampling methodology and are aimed at elucidating target species' population trends on Missouri's most important grasslands. MRBO also works directly with MDC Area Managers and private landowners to determine how plant communities, habitat structure, and yearly management activities influence grassland bird populations.

Over the past five years, MRBO has conducted surveys on a total of 94 grassland properties that include Conservation Areas, State Parks, Missouri Prairie Foundation holdings and private lands involved in MDC, Audubon, and Partners for Fish and Wildlife programs. Detailed descriptions of field methodology can be found in MRBO's reports to the MDC from 2014 to 2016. Most MDC properties within grassland Priority Geographies and Conservation Opportunity areas are currently on a one-year-on/on-year-off survey schedule. Exceptions include Conservation Areas that are part of the MDC's on going patch-burn grazing and Northern Bobwhite research. The data set resulting from these five years of surveys consists of 76,401 individual bird detections, including 46,098 detections of target species. Target species represent the guild of grassland obligate birds for which conservation concern is high.

The 2013-2017 data set allows us to observe trends in grassland bird populations throughout Missouri's focal areas. These landscape-scale areas include the Upper Osage Grasslands and Grand River Grasslands Comprehensive Conservation Strategy Priority Geographies as well as the Golden Prairie, Diamond Prairie, Cole Camp and Green Ridge Conservation Opportunity Areas (COA). This report shows changes in density for 11 grassland-obligate species on properties within those regions. The data also show some overall trends in grassland bird populations throughout the state. While these observed trends do not apply to every surveyed property, the trends are representative of the grassland focal areas as a whole.

- Our data suggest that grassland birds as a guild have experienced net increases in density in Missouri since 2013. This trend does not hold true in all regions; the Grand River Grasslands and the Cole Camp/Green Ridge area have displayed a decrease in grassland bird populations.
- The Dickcissel population exhibited the same trends as the guild. Indeed, their large numbers relative to other species likely contributed to the guild trends observed from 2013-2017. Dickcissel density has shown an overall increase over the course of the study period.
- Overall, Bell's Vireo, Eastern Meadowlark, Henslow's Sparrow, Field Sparrow and Northern Bobwhite densities have been maintained or have increased when observations from all sampled geographies are lumped.
- The Grasshopper Sparrow population has decreased significantly each year since 2013, and continues to do so. This may be, at least in part, a function of atypically wet growing season conditions that result in thick vegetation; Grasshopper Sparrow prefers a relatively sparse vegetation structure.
- Greater Prairie-Chicken, Loggerhead Shrike and Common Nighthawk continue to be extremely uncommon during grassland surveys. Detections of these species were slightly higher in 2017 than in 2016.

This report also provides a summary of the continued examination of bird response to patch-burn grazing on six Missouri prairies. Results to date indicate that most species respond positively to the MDC's burn regimes and moderate grazing rates.

Since 2013, we have amassed spatial data representing exact locations of each individual bird detected. This allows us to map bird occurrence in conjunction with management information in ArcGIS Online (AGOL) to develop a better understanding of how management actions directly affect bird habitat use. The resulting maps enable Area Managers and landowners to plan habitat management according to the bird populations they are trying to maintain or increase. The AGOL mapping platform and MRBO grassland bird data are available to all MDC staff. An overview of how to access and utilize the extensive survey and management data is provided on page 23 of this report. MRBO staff continue to meet with Area Managers on a yearly basis to present survey results and provide instructions for accessing on-line spatial data.

# GRASSLAND BIRD USE OF PATCH-BURN GRAZE UNITS



In conjunction with the MDC Resource Science Division's (RSD) long-term patch-burn grazing (PBG) studies, MRBO initiated a parallel study to determine the effects of PBG on bird densities in 2015. The PBG study units are surveyed using the typical line-transect design but are surveyed twice each year in order to bolster sample sizes for further analysis. In 2016, MRBO initiated a nest-monitoring study on the Taberville PBG study units to investigate whether PBG may have an effect on grassland bird nest success. The results of the 2016 and 2017 nest-monitoring seasons are available as a supplement to this report.

Initial survey findings indicate that in 2015, most species, as well as the grassland obligate guild taken as a whole, displayed higher density in the ungrazed units. In 2016, most species had a higher density in the grazed units. Here, we present results for the obligate guild and for Dickcissel and Henslow's Sparrow. The full data set for each target species is available upon request. Continued monitoring of the PBG units throughout the duration of the RSD study should further clarify the effects of PBG on bird density.

## Density of birds on patch-burned graze and ungrazed units on Conservation Areas.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance.

indicates treatment unit where density was higher, but not significantly  
 indicates treatment unit where density was significantly higher (alpha < 0.05).

## Target Species Guild

PROPERTY	2015 Grazed			2015 Ungrazed			2016 Grazed			2016 Ungrazed			2017 Grazed			2017 Ungrazed		
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV
Diamond	149	1.102	0.14	200	1.593	0.11	156	1.038	0.16	155	1.011	0.11	220	1.423	0.1	248	1.222	0.14
Hi-Lonesome	118	1.084	0.1	104	0.895	0.11	171	1.423	0.22	186	1.312	0.13	87	1.198	0.18	46	0.623	0.16
Kickapoo/Providence	87	0.732	0.07	72	0.956	0.32	184	1.393	0.11	116	1.261	0.19	294	2.164	0.15	136	1.341	0.33
Taberville	121	1.357	0.15	54	1.075	0.19	185	2.266	0.02	91	0.989	0.12	246	2.414	0.19	113	1.671	0.05
Wah'Kon-Tah	75	0.841	0.07	121	1.205	0.12	105	1.059	0.06	151	1.241	0.09	141	1.383	0.04	211	1.56	0.07
All Properties	550	0.982	0.07	551	1.084	0.09	801	1.413	0.09	699	1.307	0.06	988	1.801	0.09	754	1.494	0.09

## Dickcissel

PROPERTY	2015 Grazed			2015 Ungrazed			2016 Grazed			2016 Ungrazed			2017 Grazed			2017 Ungrazed		
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV
Diamond	63	0.611	0.17	88	0.733	0.19	78	0.578	0.22	84	0.602	0.18	128	0.913	0.16	109	0.638	0.13
Hi-Lonesome	39	0.469	0.26	34	0.306	0.27	38	0.349	0.38	37	0.287	0.32	16	0.243	0.46	3	-	-
Kickapoo/Providence	37	0.408	0.17	41	0.569	0.3	124	1.045	0.22	89	1.063	0.25	191	1.549	0.18	89	1.042	0.36
Taberville	49	0.721	0.24	32	0.666	0.12	100	1.364	0.15	51	0.609	0.14	104	1.125	0.14	50	0.878	0.06
Wah'Kon-Tah	14	0.206	0.26	19	0.198	0.4	26	0.292	0.22	45	0.407	0.2	15	0.163	0.53	53	0.465	0.32
All properties	202	0.377	0.12	214	0.432	0.14	366	0.704	0.15	306	0.586	0.13	454	0.884	0.16	304	0.63	0.16

## Henslow's Sparrow

PROPERTY	2015 Grazed			2015 Ungrazed			2016 Grazed			2016 Ungrazed			2017 Grazed			2017 Ungrazed		
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV
Diamond	16	0.145	0.55	28	0.289	0.41	22	0.163	0.56	13	0.087	0.56	22	0.184	0.2	56	0.359	0.2
Hi-Lonesome	18	0.203	0.37	15	0.162	0.49	36	0.331	0.36	42	0.304	0.36	29	0.518	0.21	14	0.247	0.49
Kickapoo/Providence	9	-	-	10	0.166	0.86	7	-	-	4	-	-	12	0.115	0.89	17	0.218	0.57
Taberville	19	0.262	0.54	9	-	-	29	0.395	0.37	10	0.112	0.51	48	0.611	0.15	31	0.598	0.24
Wah'Kon-Tah	23	0.317	0.19	33	0.411	0.14	38	0.427	0.15	35	0.295	0.17	48	0.611	0.37	53	0.511	0.31
All properties	85	0.171	0.19	96	0.221	0.2	132	0.274	0.2	104	0.228	0.23	159	0.342	0.2	171	0.393	0.15

# GRASSLAND OBLIGATE GUILD

**Changes in density of the grassland obligate bird guild across years in Missouri's focal grassland landscapes.** n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If n, D or CV values are not presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color.

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Cole Camp &amp; Green Ridge Focus Areas</i>																
Brauer				138	1.544	0.1	100	0.979	0.09				121	0.95	0.15	-0.59
Bruns Tract	38	1.562	0.05	38	1.701	0.26	123	3.767	0.09				64	1.50	0.1	-0.059
Brysons Hope	72	1.446	0.08	104	1.552	0.09	94	1.227	0.14				116	1.16	0.11	-0.284
Clubine				54	1.125	0.32	29	0.621	0.33				36	0.53	0.22	-0.598
Drovers				38	2.427	0.02	22	1.229	0.26							-1.198
Friendly	9	-	-				14	1.012	0.02							
Grandfather	8	-	-				40	1.35	0.03							
Hartwell	23	0.923	0.39	27	1.209	0.56	70	0.927	0.18				53	0.83	0.12	-0.095
Haubein				45	0.806	0.28	31	0.485	0.22				70	0.84	0.31	0.035
Hi-Lonesome	352	2.828	0.39	202	1.809	0.12	291	1.108	0.09	401	1.442	0.1	180	1.02	0.14	-1.81
Ionia Ridge	66	1.325	0.1	72	1.612	0.09	148	1.449	0.08				116	1.74	0.23	0.418
Kearn (WR)	31	0.83	0.09	90	2.015	0.09	66	1.293	0.14				79	1.19	0.08	0.357
Mora	118	1.053	0.09	147	1.462	0.13	253	1.019	0.11				101	0.61	0.17	-0.448
Paintbrush	71	1.141	0.1	112	1.671	0.15	176	1.087	0.12				97	0.92	0.07	-0.222
Shackles				131	1.482	0.1	100	0.989	0.14				109	0.81	0.19	-0.668
<i>Diamond Grove Focus Area</i>																
Carver Prairie										54	0.444	0.47				
Diamond Grove (main unit)	49	0.437	0.23	175	1.424	0.11	450	1.661	0.08	345	1.086	0.06	353	1.28	0.1	0.841
Diamond Grove (grazed unit)	43	0.864	0.23	109	2.439	0.12	149	1.283	0.14	156	1.146	0.15	220	1.45	0.1	0.589
<i>Upper Osage Grasslands</i>																
Francis				36	1.162	0.61	33	0.59	0.24				63	0.86	0.19	-0.298
Linscomb				123	0.468	0.17	71	0.473	0.25	62	0.325	0.3	150	0.82	0.12	0.347
Monegaw							119	2.055	0.07	82	1.208	0.13				-0.847
Morton (Tillman Tract)	105	0.703	0.12	182	1.358	0.18				122	0.741	0.18				0.038
Schell-Osage				329	0.736	0.18	106	0.441	0.2	160	0.442	0.14	310	0.76	0.13	0.025
Sewell							97	1.057	0.08	112	1.041	0.17				-0.016
Taberville	239	0.914	0.08	516	2.199	0.1	669	1.248	0.08	752	1.794	0.13	838	1.94	0.09	1.024
Wah'Kon-Tah	432	0.723	0.06	936	1.643	0.06	1396	1.032	0.06	887	0.989	0.08	1482	1.46	0.05	0.738

Region/Property	2013			2014			2015			2016			2017			△
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b>Vernon/Barton Co. Complex</b>																
Buffalo Wallow	92	0.441	0.18	222	1.325	0.13				391	1.527	0.16				1.086
Bushwhacker	350	0.574	0.08	348	0.636	0.09				634	0.973	0.08				0.399
Clear Creek	80	0.583	0.17	174	1.146	0.11				238	1.446	0.16				0.863
Comstock	25	0.334	0.29							70	0.779	0.25				0.445
Drywood	1	-	-							4	-	-				
Little Osage	9	-	-							17	1.136	0.02				
Mo-No-I	49	0.984	0.19							104	1.367	0.24				0.383
Osage	251	0.753	0.08	236	0.782	0.07				465	1.195	0.1				0.442
Redwing	19	0.763	0.05							91	3.041	0.08				2.278
Shawnee Trail	341	0.83	0.07	674	1.231	0.06				1079	1.306	0.09				0.476
<b>Grand River Grasslands &amp; Surrounds</b>																
Dunn Ranch	1110	1.438	0.07	1585	2.405	0.04	1194	1.585	0.05				1413	1.44	0.06	-0.002
Frank	709	1.324	0.08	667	1.572	0.08				664	1.143	0.1				-0.181
Helton				79	0.589	0.25	82	0.535	0.14	125	0.709	0.2				0.12
Leuken-Hensley				211	1.574	0.24	186	1.213	0.17				264	1.32	0.13	-0.252
Pawnee Prairie CA	137	1.223	0.13	140	1.393	0.06	170	1.479	0.1	127	0.93	0.18				-0.293
Pawnee Prairie NA	75	0.669	0.25	173	1.721	0.15	134	1.167	0.12	160	1.047	0.15				0.378
Poteet Farms							298	1.434	0.1	283	1.167	0.12				-0.267
Runyon							41	1.041	0.29	31	0.632	0.19				-0.409
<b>Golden Prairie Focus Area</b>																
Coyne/Pennsylvania/Welch	69	0.616	0.25				172	1.348	0.16				260	1.56	0.13	0.947
Golden	89	0.715	0.16										362	2.18	0.06	1.462
Horse Creek	9	-	-				53	1.487	0.23							
Indigo	6	-	-							10	0.919	0.02				
Kickapoo	7	-	-	48	2.149	0.34	72	0.94	0.32	116	1.292	0.19	136	1.36	0.32	-0.786
Kremp				70	1.086	0.17	98	1.331	0.15				129	1.22	0.12	0.134
Niawathe	72	0.964	0.11	121	1.806	0.11	128	1.671	0.08							0.707
Providence	21	0.562	0.58	100	2.894	0.21	87	0.852	0.07	184	1.537	0.11	294	2.21	0.15	1.647
Shelton	98	1.312	0.13	213	3.178	0.12	123	1.627	0.11	226	2.549	0.12				1.237
Sloan	29	0.466	0.26	43	0.769	0.29	57	0.893	0.25							0.427
Stony Point				231	1.034	0.11	319	1.282	0.1	247	1.065	0.07	435	1.45	0.07	0.42
Talbot	210	0.296	0.13				288	0.438	0.1	322	0.409	0.11	610	0.72	0.09	0.428
Theurer				182	1.811	0.15	172	1.497	0.15				223	1.64	0.11	-0.175
<b>Other</b>																
Prairie Fork	83	0.667	0.21							57	0.357	0.17				-0.31
<b>All Properties</b>	<b>8271</b>	<b>0.885</b>	<b>0.03</b>	<b>9969</b>	<b>1.257</b>	<b>0.03</b>	<b>8321</b>	<b>1.159</b>	<b>0.03</b>	<b>8982</b>	<b>1.265</b>	<b>0.03</b>	<b>8820</b>	<b>1.60</b>	<b>0.03</b>	<b>0.716</b>

# BELL'S VIREO



Bell's Vireo (BEVI)

## Changes in Bell's Vireo density across years in Missouri's focal grassland landscapes.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color.

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Cole Camp &amp; Green Ridge Focus Areas</i>																
Brauer				0	-	-	1	-	-				0	-	-	
Bruns Tract	0	-	-	1	-	-	2	-	-				3	-	-	
Brysons Hope	1	-	-	0	-	-	3	-	-				12	0.141	0.29	
Clubine				0	-	-	0	-	-				1	-	-	
Drovers	0	-	-	0	-	-	0	-	-							
Friendly	0	-	-				0	-	-							
Grandfather	1	-	-				6	-	-							
Hartwell	2	-	-	2	-	-	3	-	-				1	-	-	
Haubein				2	-	-	2	-	-				2	-	-	
Hi-Lonesome	35	0.417	0.42	17	0.171	0.28	26	0.108	0.15	34	0.146	0.14	21	0.139	0.22	-0.278
Ionia Ridge	0	-	-	1	-	-	2	-	-							
Kearn (WR)	1	-	-	0	-	-	3	-	-				2	-	-	
Mora	15	0.198	0.21	11	0.123	0.27	32	0.138	0.19				17	0.119	0.24	-0.079
Paintbrush	7	-	-	10	0.168	0.14	23	0.152	0.24				18	0.199	0.43	
Shackles				0	-	-	0	-	-				3	-	-	
<i>Diamond Grove Area</i>																
Carver										1	-	-				
Diamond Grove (main unit)	2	-	-	7	-	-	8	-	-	9	-	-	6	-	-	
Diamond Grove (grazed unit)	0	-	-	3	-	-	3	-	-	3	-	-	5	-	-	
<i>Upper Osage Grasslands</i>																
Francis				6	-	-	1	-	-							
Linscomb				28	0.12	0.24	11	0.078	0.31	13	0.081	0.28	24	0.153	0.27	0.033
Monegaw							5	-	-	9	-	-				
Morton (Tillman tract)	9	-	-	14	0.117	0.28				13	0.094	0.3				
Schell-Osage				114	0.286	0.18	32	0.142	0.29	55	0.181	0.23	55	0.158	0.14	0.128
Sewell							0	-	-	0	-	-				
Taberville	16	0.091	0.29	35	0.167	0.21	70	0.139	0.31	52	0.148	0.19	73	0.198	0.19	0.107
Wah'Kon-Tah	51	0.127	0.16	84	0.166	0.12	227	0.179	0.11	107	0.143	0.12	201	0.232	0.1	0.105

Region/Property	2013			2014			2015			2016			2017			△
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b>Vernon/Barton Co. Complex</b>																
Buffalo Wallow	17	0.121	0.31	15	0.1	0.45				34	0.159	0.24				0.038
Bushwhacker	56	0.136	0.15	42	0.086	0.16				156	0.286	0.17				0.15
Clear Creek	5	-	-	36	0.329	0.24				38	0.276	0.24				-0.053
Comstock	0	-	-							12	0.159	0.23				
Drywood	0	-	-							0	-	-				
Little Osage	0	-	-							1	-	-				
Mo-No-I	2	-	-							4	-	-				
Osage	18	0.079	0.25	16	0.06	0.28				56	0.172	0.18				0.093
Redwing	2	-	-							6	-	-				
Shawnee Trails	33	0.119	0.22	81	0.166	0.17				61	0.088	0.16				-0.031
<b>Grand River Grasslands &amp; Surrounds</b>																
Dunn Ranch	14	0.027	0.49	3	-	-	12	0.017	0.37				17	0.020	0.26	-0.007
Frank	1	-	-	4	-	-				3	-	-				
Helton				2	-	-	2	-	-	8	-	-				
Leuken-Hensley				0	-	-	0	-	-				0	-	-	
Pawnee Prairie CA	2	-	-	1	-	-	1	-	-	6	-	-				
Pawnee Prairie NA	2	-	-	3	-	-	5	-	-	8	-	-				
Poteet Farms							0	-	-	0	-	-				
Runyon							0	-	-	0	-	-				
<b>Golden Prairie Focus Area</b>																
Coyne/Penn/Welch	0	-	-				1	-	-				0	-	-	
Golden	0	-	-										6	-	-	
Horse Creek	0	-	-				3	-	-							
Indigo	0	-	-							3	-	-				
Kickapoo	0	-	-	0	-	-	0	-	-	2	-	-	2	-	-	
Kremp				11	0.192	0.4	22	0.319	0.19				20	0.222	0.08	0.03
Niawathe	1	-	-	8	-	-	11	0.153	0.33							
Providence	3	-	-	9	-	-	13	0.136	0.26	14	0.139	0.38	17	0.149	0.37	0.013
Shelton	0	-	-	3	-	-	5	-	-	4	-	-				
Sloan	4	-	-	5	-	-	6	-	-							
Stony Point				25	0.126	0.31	53	0.227	0.15	49	0.252	0.13	59	0.231	0.1	0.105
Talbot	25	0.05	0.22				42	0.068	0.18	37	0.056	0.21	45	0.062	0.3	0.012
Theurer				0	-	-	0	-	-				0	-	-	
<b>Other</b>																
Prairie Fork	2	-	-							0	-	-				
<b>All Properties</b>	<b>449</b>	<b>0.055</b>	<b>0.08</b>	<b>603</b>	<b>0.087</b>	<b>0.07</b>	<b>636</b>	<b>0.101</b>	<b>0.08</b>	<b>798</b>	<b>0.128</b>	<b>0.07</b>	<b>625</b>	<b>0.128</b>	<b>0.07</b>	<b>0.073</b>

## Changes in Dickcissel density across years in Missouri's focal grassland landscapes.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color. Some data are not applicable (N/A) for 2013 as weather conditions resulted in a very late migration season, precluding accurate detections for this long-distance migrant on some properties.



Dickcissel (DICK)

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Cole Camp &amp; Green Ridge Focus Areas</i>																
Brauer				61	0.749	0.19	29	0.302	0.3				55	0.443	0.15	-0.306
Bruns Tract	20	0.981	0.3	17	0.835	0.3	20	0.652	0.18				18	0.432	0.14	-0.549
Brysons Hope	30	0.736	0.24	59	0.956	0.18	45	0.626	0.23				47	0.481	0.08	-0.255
Clubine				30	0.74	0.54	12	0.274	0.55				20	0.299	0.48	-0.441
Drovers	8	-	-	16	1.121	0.27	8	-	-							
Friendly	2	-	-				8	-	-							
Grandfather	3	-	-				21	0.755	0.05							
Hartwell	8	-	-	13	0.638	0.69	23	0.325	0.42				15	0.239	0.35	-0.399
Haubein				18	0.353	0.62	17	0.283	0.62				36	0.442	0.58	0.089
Hi-Lonesome	57	0.559	0.3	76	0.746	0.18	90	0.365	0.19	90	0.332	0.19	33	0.191	0.33	-0.368
Ionia Ridge	36	0.883	0.11	41	1.007	0.03	63	0.657	0.15				47	0.722	0.41	-0.161
Kearn (WR)	20	0.654	0.06	54	1.326	0.12	31	0.647	0.23				31	0.476	0.23	-0.178
Mora	43	0.469	0.22	80	0.873	0.2	110	0.472	0.18				35	0.214	0.27	-0.255
Paintbrush	19	0.373	0.34	43	0.704	0.15	73	0.48	0.12				20	0.194	0.4	-0.179
Shackles				53	0.658	0.11	49	0.517	0.28				54	0.412	0.19	-0.246
<i>Diamond Grove Area</i>																
Carver Prairie										14	0.118	0.55				
Diamond Grove (main unit)	5	N/A	-	88	0.785	0.11	178	0.7	0.11	187	0.604	0.08	151	0.558	0.12	-0.227
Diamond Grove (grazed unit)	19	N/A	-	64	1.572	0.03	63	0.578	0.17	78	0.587	0.17	128	0.864	0.14	-0.708
<i>Upper Osage Grasslands</i>																
Francis				10	0.491	0.6	17	0.324	0.42				25	0.351	0.29	-0.14
Linscomb				29	0.121	0.6	17	0.121	0.54	20	0.107	0.61	37	0.205	0.34	0.084
Monegaw							45	0.828	0.1	34	0.513	0.17				-0.315
Morton (Tillman tract)	64	0.523	0.21	82	0.671	0.24				63	0.392	0.25				-0.131
Schell-Osage				94	0.231	0.47	27	0.119	0.35	34	0.096	0.32	101	0.253	0.2	0.022
Sewell							49	0.569	0.16	39	0.372	0.25				-0.197
Taberville	119	0.556	0.1	220	1.029	0.09	298	0.592	0.11	380	0.929	0.13	376	0.888	0.1	0.373
Wah'Kon-Tah	184	0.376	0.11	361	0.695	0.09	428	0.337	0.1	324	0.371	0.11	465	0.469	0.12	0.093



Region/Property	2013			2014			2015			2016			2017			△
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b>Vernon/Barton Co. Complex</b>																
Buffalo Wallow	61	0.357	0.29	143	0.936	0.13				246	0.985	0.19				0.628
Bushwhacker	191	0.382	0.12	223	0.447	0.1				278	0.437	0.12				0.055
Clear Creek	21	N/A	0.42	76	0.679	0.19				104	0.648	0.23				-0.031
Comstock	6	N/A	-							29	0.331	0.45				
Drywood	0	-	-							3	-	-				
Little Osage	5	-	-							12	0.822	0.03				
Mo-No-I	31	0.76	0.23							62	0.835	0.25				0.075
Osage	127	0.461	0.13	153	0.557	0.07				252	0.664	0.11				0.203
Redwing	14	0.657	0.04							62	2.124	0.5				1.467
Shawnee Trail	248	0.737	0.08	435	0.872	0.07				685	0.85	0.09				0.113
<b>Grand River Grasslands &amp; Surrounds</b>																
Dunn Ranch	240	0.379	0.11	465	0.774	0.06	280	0.396	0.08				320	0.332	0.08	-0.047
Frank	169	0.385	0.12	178	0.46	0.11				145	0.256	0.12				-0.129
Helton				33	0.27	0.44	27	0.188	0.26	32	0.186	0.32				-0.084
Leuken-Hensley				78	0.638	0.32	54	0.356	0.24				76	0.389	0.23	-0.249
Pawnee Prairie CA	44	0.479	0.13	62	0.677	0.06	36	0.333	0.2	38	0.285	0.26				-0.194
Pawnee Prairie NA	21	0.229	0.26	59	0.644	0.21	52	0.482	0.3	37	0.248	0.2				0.019
Poteet Farms							42	0.215	0.24	37	0.156	0.3				-0.059
Runyon							12	0.324	0.2	11	0.23	0.32				-0.094
<b>Golden Prairie Focus Area</b>																
Coyne/Penn/Welch	36	0.392	0.27				83	0.693	0.18				154	0.946	0.16	0.554
Golden	71	0.696	0.19										251	1.542		0.846
Horse Creek	5	-	-				26	0.777	0.26							
Indigo	6	-	-							5	-	-				
Kickapoo	2	N/A	-	31	1.523	0.23	41	0.57	0.27	89	1.016	0.22	89	0.911	0.36	-0.612
Kremp				25	0.426	0.22	24	0.347	0.34				56	0.541	0.22	0.115
Niawathe	29	0.474	0.17	59	0.956	0.1	68	0.956	0.09							
Providence	9	N/A	-	50	1.637	0.14	37	0.386	0.17	124	1.062	0.18	191	1.467	0.17	-0.17
Shelton	57	0.932	0.15	96	1.571	0.14	77	1.085	0.13	183	2.117	0.16				1.185
Sloan	12	0.235	0.34	28	0.55	0.34	23	0.384	0.31							0.149
Stony Point				98	0.482	0.11	107	0.458	0.12	96	0.424	0.14	211	0.721	0.09	0.239
Theurer				42	0.458	0.2	75	0.696	0.21				133	0.998	0.16	0.54
Talbot	106	0.176	0.17				75	0.122	0.2	131	0.171	0.16	247	0.299	0.13	0.123
<b>Other</b>																
Prairie Fork	27	0.265	0.34							6	-	-				
<b>All properties</b>	3282	N/A	0.03	4125	0.557	0.03	2860	0.426	0.04	3952	0.597	0.05	3497	0.674	0.05	0.117

# EASTERN MEADOWLARK



Eastern Meadowlark (EAME)

## Changes in Eastern Meadowlark density across years in Missouri's focal grassland landscapes.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color.

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Cole Camp &amp; Green Ridge Focus Areas</i>																
Brauer				24	0.194	0.19	59	0.306	0.26				37	0.219	0.32	0.025
Bruns Tract	3	-	-	8	-	-	29	0.711	0.27				11	0.193	0.48	
Brysons Hope	15	0.241	0.18	21	0.227	0.29	23	0.24	0.32				28	0.209	0.24	-0.032
Clubine				12	0.195	0.52	7	-	-				7	-	-	
Drovers	2	-	-	5	-	-	6	-	-							
Friendly	2	-	-				3	-	-							
Grandfather	1	-	-				2	-	-							
Hartwell	2	-	-	0	-	-	14	0.149	0.36				5	-		
Haubein				4	-	-	0	-	-				9	-		
Hi-Lonesome	75	0.481	0.72	22	0.142	0.26	68	0.207	0.13	78	0.238	0.122	22	0.093	0.27	-0.388
Ionia Ridge	8	-	-	9	-	-	40	0.314	0.12				28	0.314	0.39	
Kearn (WR)	6	-	-	12	0.194	0.37	19	0.298	0.14				22	0.247	0.24	0.053
Mora	9	-	-	13	0.093	0.51	33	0.106	0.26				5	-	-	
Paintbrush	6	-	-	7	-	-	20	0.099	38				11	0.078	0.45	
Shackles				10	0.082	0.37	23	0.182	0.24				17	0.095	0.33	0.013
<i>Diamond Grove Area</i>																
Carver										35	0.244	0.44				
Diamond Grove (main unit)	17	0.121	0.31	17	0.1	0.31	111	0.328	0.17	89	0.238	0.12	79	0.213	0.09	0.092
Diamond Grove (grazed unit)	7	-	-	16	0.259	0.45	41	0.263	0.2	42	0.262	0.11	44	0.217	0.14	-0.042
<i>Upper Osage Grasslands</i>																
Francis				1	-	-	2	-	-				1	-	-	
Linscomb				0	-	-	2	-	-	5	-	-	6	-	-	
Monegaw							20	0.276	0.4	13	0.163	21				-0.113
Morton (Tillman)	9	-	-	23	0.124	0.26				6	-	-				
Schell-Osage				0	-	-	4	-	-	5	-	-	5	-	-	
Sewell							38	0.332	0.22	59	0.466	0.26				0.134
Taberville	43	0.131	0.19	61	0.188	0.18	117	0.175	0.14	124	0.251	0.14	123	0.212	0.13	0.081
Wah'Kon-Tah	71	0.095	0.14	139	0.176	0.14	188	0.111	0.12	126	0.119	0.13	192	0.141	0.1	0.046

Region/Property	2013			2014			2015			2016			2017			△
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b>Vernon/Barton Co. Complex</b>																
Buffalo Wallow	2	-	-	12	0.052	0.31				27	0.089	0.24				0.037
Bushwhacker	38	0.049	0.23	23	0.030	0.27				51	0.066	0.27				0.017
Clear Creek	4	-	-	15	0.088	0.46				12	0.062	0.34				-0.026
Comstock	1	-	-							11	0.104	0.41				
Drywood										0	-	-				
Little Osage	0	-	-							2	-	-				
Mo-No-I	7	-	-							17	0.189	0.18				
Osage	27	0.064	0.2	31	0.074	0.16				58	0.127	0.18				0.063
Redwing	2	-	-							11	0.312	0.09				
Shawnee Trail	29	0.056	0.3	74	0.098	0.15				94	0.096	0.11				0.04
<b>Grand River Grasslands &amp; Surrounds</b>																
Dunn Ranch	107	0.111	0.15	155	0.17	0.11	134	0.142	0.11				142	0.108	0.09	-0.003
Frank	69	0.103	0.17	56	0.095	0.15				106	0.155	0.13				0.052
Helton				3	-	-	4	-	-	3	-	-				
Leuken-Hensley				11	0.059	0.26	28	0.146	0.31				34	0.127	0.27	0.068
Pawnee Prairie CA	17	0.121	0.36	7	-	-	27	0.188	0.27	6	-	-				
Pawnee Prairie NA	10	0.071	0.39	16	0.115	0.14	16	0.111	0.25	17	0.095	0.22				0.024
Poteet Farms							65	0.25	0.2	51	0.178	0.15				-0.072
Runyon							4	-	-	9	-	-				
<b>Golden Prairie Focus Area</b>																
Coyne/Penn/Welch	11	0.078	0.47				31	0.195	0.41				48	0.215	0.17	0.137
Golden	5	-	-										44	0.197	0.21	
Horse Creek	1	-	-				10	0.225	0.11							
Indigo	0	-	-							2	-	-				
Kickapoo	1	-	-	2	-	-	14	0.146	0.52	11	0.104	0.55	14	0.105	0.19	-0.041
Kremp				7	-	-	10	0.109	0.42				18	0.127	0.29	
Niawathe	5	-	-	9	-	-	13	0.136	0.28							
Providence	2	-	-	9	-	-	15	0.118	0.08	18	0.128	0.19	43	0.241	0.18	0.123
Shelton	12	0.128	0.32	31	0.334	0.21	13	0.138	0.19	20	0.192	0.42				0.064
Sloan	4	0.051	0.47	0	-	-	2	-	-							
Stony Point				33	0.107	0.19	46	0.148	0.2	28	0.103	0.16	42	0.105	0.18	-0.002
Talbot	11	0.012	0.36				19	0.023	0.31	26	0.028	0.24	72	0.064	0.19	0.052
Theurer				59	0.424	0.18	50	0.349	0.16				50	0.274	0.19	-0.15
<b>Other</b>																
Prairie Fork	5	-	-							2	-	-				
<b>All Properties</b>	<b>1034</b>	<b>0.081</b>	<b>0.07</b>	<b>1061</b>	<b>0.098</b>	<b>0.06</b>	<b>1350</b>	<b>0.139</b>	<b>0.06</b>	<b>1210</b>	<b>0.125</b>	<b>0.06</b>	<b>1179</b>	<b>0.158</b>	<b>0.05</b>	<b>0.077</b>

# FIELD SPARROW



Field Sparrow (FISP)

## Changes in Field Sparrow density across years in Missouri's focal grassland landscapes.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color.

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Cole Camp &amp; Green Ridge Focus Areas</i>																
Brauer				16	0.188	0.51	13	0.143	0.39				4	-	-	
Bruns Tract	1	-	-	0	-	-	1	-	-				0	-	-	
Brysons Hope	1	-	-	3	-	-	3	-	-				2	-	-	
Clubine				9	-	-	5	-	-				5	-	-	
Drovers	0	-	-	1	-	-	1	-	-							
Friendly	0	-	-				0	-	-							
Grandfather	3	-	-				3	-	-							
Hartwell	2	-	-	2	-	-	5	-	-				0	-	-	
Haubein				15	0.357	0.36	11	0.194	0.51				14	0.205	0.29	-0.152
Hi-Lonesome	58	0.626	0.5	7	-	-	17	0.073	0.32	27	0.111	0.33				-0.515
Ionia Ridge	0	-	-	5	-	-	4	-	-				11	0.202		
Kearn (WR)	0	-	-	6	-	-	0	-	-				5	-	-	
Mora	24	0.288	0.3	26	0.271	0.29	50	0.226	0.25				29	0.212	0.18	-0.076
Paintbrush	12	0.026	0.13	5	-	-	20	0.138	0.6	10	0.084	0.41	16	0.185	0.36	0.159
Shackles				15	0.178	0.46	5	-	-				4	-	-	
<i>Diamond Grove Area</i>																
Carver										1	-	-				
Diamond Grove (main unit)	0	-	-	0	-	-	2	-	-	2	-	-	3	-	-	
Diamond Grove (grazed unit)	0	-	-	0	-	-	0	-	-	0	-	-	2	-	-	
<i>Upper Osage Grasslands</i>																
Francis				9	-	-	9	-	-				21	-	-	
Linscomb				55	0.219	0.2	24	0.18	0.32	18	0.108	0.24	70	0.464	0.18	0.245
Monegaw							0	-	-	2	-	-				
Morton (Tillman)	11	0.099	0.35	12	0.093	0.39				23	0.159	0.25				0.06
Schell-Osage				95	0.223	0.15	35	0.164	0.28	58	0.183	0.18	128	0.383	0.17	0.16
Sewell							0	-	-							
Taberville	2	-	-	23	0.103	0.3	27	0.056	0.24	17	0.046	0.28	55	0.155	0.18	0.052
Wah'Kon-Tah	32	0.072	0.23	75	0.138	0.18	130	0.108	0.22	64	0.082	0.16	165	0.199	0.12	0.127

Region/Property	2013			2014			2015			2016			2017			△
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Vernon/Barton Co. Complex</i>																
Buffalo Wallow	6	-	-	10	0.062	0.41				19	0.085	0.32				0.023
Bushwhacker	21	0.046	0.26	15	0.029	0.29				61	0.107	0.17				0.061
Clear Creek	15	0.147	0.39	17	0.145	0.38				25	0.174	0.26				0.027
Comstock	6	-	-							5	-	-				
Drywood	1	-	-							1	-	-				
Little Osage	0	-	-							0	-	-				
Mo-No-I	0	-	-							1	-	-				
Osage	7	-	-	3	-	-				13	0.038	0.34				
Redwing	0	-	-							4	-	-				
Shawnee Trails	10	0.033	0.34	37	0.071	0.24				50	0.069	0.18				0.036
<i>Grand River Grasslands &amp; Surrounds</i>																
Dunn Ranch	30	0.052	0.54	7	-	-	23	0.034	0.31				42	0.052	0.23	0
Frank	38	0.095	0.23	24	0.059	0.26				12	0.024	0.36				-0.071
Helton				30	0.235	0.25	28	0.205	0.27	47	0.305	0.16				0.07
Leuken-Hensley				2	-	-	0	-	-				4	-	-	
Pawnee Prairie CA	7	-	-	9	-	-	10	0.098	0.36	8	-	-				
Pawnee Prairie NA	2	-	-	5	-	-	12	0.117	0.32							
Poteet Farms							18	0.097	0.34	12	0.056	0.44				-0.041
Runyon							6	-	-	5	-	-				
<i>Golden Prairie Focus Area</i>																
Coyne/Penn/Welch	4	-	-				4	-	-				2	-	-	
Golden	0	-	-										0	-	-	
Horse Creek	0	-	-				0	-	-							
Indigo	0	-	-							0	-	-				
Kickapoo	1	-	-	2	-	-	1	-	-	4	-	-	9	-	-	
Kremp				14	0.228	0.21	22	0.335	0.29				23	0.266	0.15	0.038
Niawathe	2	-	-	3	-	-	9	-	-							
Providence	0	-	-	0	-	-	2	-	-	5	-	-	10	-	-	
Shelton	1	-	-	2	-	-	1	-	-	7	-	-				
Sloan	7	-	-	5	-	-	19	0.334	0.19							
Stony Point				19	0.089	0.3	35	0.158	0.25	31	0.153	0.19	49	0.199	0.14	0.11
Talbot	47	0.086	0.2				106	0.181	0.14	97	0.141	0.13	152	0.22	0.1	0.134
Theurer				0	-	-	0	-	-				4	-	-	
<i>Other</i>																
Prairie Fork	27	0.291	0.29							30	0.215	0.3				-0.076
<b>All Properties</b>	<b>408</b>	<b>0.045</b>	<b>0.11</b>	<b>658</b>	<b>0.086</b>	<b>0.07</b>	<b>661</b>	<b>0.086</b>	<b>0.07</b>	<b>677</b>	<b>0.099</b>	<b>0.06</b>	<b>859</b>	<b>0.185</b>	<b>0.07</b>	<b>0.14</b>

# GRASSHOPPER SPARROW



Grasshopper Sparrow (GRSP)

**Changes in Grasshopper Sparrow density across years in Missouri's focal grassland landscapes.**  
 n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color.

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Cole Camp &amp; Green Ridge Focus Areas</i>																
Brauer				33	0.345	0.25	13	0.129	0.38				18	0.125	0.28	-0.22
Bruns Tract	4	-	-	1	-	-	0	-	-				0	-	-	
Brysons Hope	7	-	-	9	-	-	0	-	-				1	-	-	
Clubine				1	-	-	1	-	-							
Drovers	9	-	-	10	0.597	0.03	0	-	-							
Friendly	3	-	-				0	-	-							
Grandfather	0	-	-				1	-	-							
Hartwell	6	-	-	1	-	-	0	-	-				0	-	-	
Haubein				0	-	-	0	-	-				0	-	-	
Hi-Lonesome	96	0.879	0.54	12	0.1	0.24	11	0.042	0.72	12	0.039	0.65	3	-	-	-0.84
Ionia Ridge	9	-	-	4	-	-	0	-	-				0	-	-	
Kearn (WR)	1	-	-	11	0.23	0.52	4	-	-				0	-	-	
Mora	12	0.122	0.31	6	-	-	0	-	-				0	-	-	
Paintbrush	15	0.275	0.19	22	0.307	0.29	13	0.081	0.54				1	-	-	
Shackles				25	0.264	0.55	4	-	-				3	-	-	
<i>Diamond Grove Area</i>																
Carver										0	-	-				
Diamond Grove (main unit)	16	0.163	0.26	21	0.159	0.37	87	0.324	0.17	22	0.062	0.26	33	0.105	0.26	-0.058
Diamond Grove (grazed unit)	16	0.366	0.18	9	-	-	20	0.174	0.38	11	0.073	0.17	12	0.069	0.11	-0.297
<i>Upper Osage Grasslands</i>																
Francis							0	-	-				0	-	-	
Linscomb				2	-	-	5	-	-	3	-	-	0	-	-	
Monegaw							27	0.471	0.32	0	-	-				
Morton (Tillman tract)	3	-	-	19	0.132	0.4				0	-	-				
Schell-Osage				5	-	-	0	-	-	0	-	-	0	-	-	
Sewell							5	-	-	6	-	-				
Taberville	8	-	-	35	0.139	0.21	7	-	-	4	-	-	1	-	-	
Wah'Kon-Tah	17	0.032	0.36	48	0.078	0.27	59	0.044	0.26	23	0.023	29	25	0.022	0.36	-0.01

Region/Property	2013			2014			2015			2016			2017			△
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b>Vernon/Barton Co. Complex</b>																
Buffalo Wallow	4	-	-	2	-	-				0	-	-				
Bushwhacker	12	0.022	0.39	4	-	-				2	-	-				
Clear Creek	22	0.183	0.37	2	-	-				7	-	-				
Comstock	12	0.183	0.55							2	-	-				
Drywood	0	-	-							0	-	-				
Little Osage	4	-	-							0	-	-				
Mo-No-I	3	-	-							3	-	-				
Osage	37	0.126	0.21	3	-	-				6	-	-				
Redwing	1	-	-							0	-	-				
Shawnee Trails	1	-	-	0	-	-				0	-	-				
<b>Grand River Grasslands &amp; Surrounds</b>																
Dunn Ranch	183	0.27	0.1	197	0.279	0.11	111	0.149	0.16				52	0.047	0.22	-0.223
Frank	138	0.294	0.12	145	0.319	0.12				128	0.199	0.12				-0.095
Helton				2	-	-	8	-	-	13	0.067	0.54				
Leuken-Hensley				46	0.321	0.24	23	0.152	0.28				8	-	-	-0.169
Pawnee Prairie CA	27	0.275	0.24	17	0.158	0.34	12	0.105	0.55	3	-	-				
Pawnee Prairie NA	15	0.153	0.38	23	0.214	0.27	15	0.132	0.38	2	-	-				
Poteet Farms							84	0.408	0.19	83	0.309	0.15				-0.099
Runyon							12	0.307	0.41	2	-	-				
<b>Golden Prairie Focus Area</b>																
Coyne/Penn/Welch	12	0.122	0.45				37	0.293	0.3				15	0.079	0.4	-0.043
Golden	8	-	-										11	0.058	0.44	
Horse Creek	2	-	-				5	-	-							
Indigo	0	-	-							0	-	-				
Kickapoo	2	-	-	3	-	-	6	-	-	6	-	-	4	-	-	
Kremp				10	0.145	0.74	8	-	-				2	-	-	
Niawathe	9	-	-	9	-	-	3	-	-							
Providence	0	-	-	1	-	-	1	-	-	2	-	-	5	-	-	
Shelton	8	-	-	21	0.293	0.35	15	0.2	0.56	4	-	-				
Sloan	0	-	-	0	-	-	0	-	-							
Stony Point				16	0.067	0.38	26	0.106	0.4	9	-	-	11	0.032	0.41	-0.035
Talbot	17	0.026	0.28				38	0.058	0.29	8	-	-	34	0.036	0.32	0.01
Theurer				30	0.279	0.26	22	0.194	0.32				16	0.104	0.2	-0.175
<b>Other</b>																
Prairie Fork	1	-	-							0	-	-				
<b>All Properties</b>	<b>1310</b>	<b>0.139</b>	<b>0.07</b>	<b>935</b>	<b>0.117</b>	<b>0.07</b>	<b>683</b>	<b>0.094</b>	<b>0.08</b>	<b>391</b>	<b>0.054</b>	<b>0.1</b>	<b>274</b>	<b>0.047</b>	<b>0.1</b>	<b>-0.07</b>

# HENSLOW'S SPARROW



Henslow's Sparrow (HESP)

## Changes in Henslow's Sparrow density across years in Missouri's focal grassland landscapes.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color.

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Cole Camp &amp; Green Ridge Focus Areas</i>																
Brauer				1	-	-	1	-	-				5	-	-	
Bruns Tract	10	0.459	0.03	8	-	-	53	1.828	0.12				25	0.689	0.1	0.23
Brysons Hope	3	-	-	4	-	-	2	-	-				10	-	-	
Clubine				0	-	-	0	-	-				0	-	-	
Drovers	4	-	-	2	-	-	6	-	-							
Friendly	2	-	-				3	-	-							
Grandfather	0	-	-				4	-	-							
Hartwell	1	-	-	7	-	-	17	0.254	0.37				21	0.385	0.37	
Haubein				0	-	-	0	-	-				0	-	-	
Hi-Lonesome	27	0.248	0.49	58	0.609	0.13	50	0.214	0.25	85	0.294	0.22	62	0.411	0.19	0.163
Ionia Ridge	4	-	-	1	-	-	8	-	-				18	0.318	0.43	
Kearn (WR)	2	-	-	3	-	-	4	-	-				13	0.229	0.37	
Mora	8	-	-	5	-	-	12	0.054	0.59				13	0.091	0.43	
Paintbrush	12	0.221	0.43	19	0.333	0.25	19	0.132	0.35				24	0.267	0.32	0.046
Shackles				25	0.332	0.38	13	0.145	0.34				13	0.114	0.26	-0.218
<i>Diamond Grove Area</i>																
Carver										2	-	-				
Diamond Grove (main unit)	8	-	-	26	0.248	0.32	58	0.241	0.28	28	0.085	0.3	68	0.289	0.19	
Diamond Grove (grazed unit)	1	-	-	13	0.342	0.61	16	0.155	0.55	22	0.155	0.56	22	0.171	0.2	
<i>Upper Osage Grasslands</i>																
Francis				0	-	-	1	-	-				0	-	-	
Linscomb				4	-	-	6	-	-	1	-	-	1	-	-	
Monegaw							20	0.389	0.35	22	0.312	0.19				-0.077
Morton (Tillman)	6	-	-	16	0.140	0.42				14	0.081	0.48				
Schell-Osage				3	-	-	8	-	-	6	-	-	1	-	-	
Sewell							4	-	-	6	-	-				
Taberville	51	0.223	0.17	120	0.601	0.2	128	0.269	0.17	148	0.399	0.21	166	0.451	0.13	0.228
Wah'Kon-Tah	64	0.123	0.17	164	0.338	0.19	260	0.216	0.1	186	0.199	0.15	301	0.348	0.12	0.225



Region/Property	2013			2014			2015			2016			2017			△
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b>Vernon/Barton Co. Complex</b>																
Buffalo Wallow	2	-	-	31	0.217	0.43				50	0.188	0.4				
Bushwhacker	26	0.048	0.3	30	0.064	0.27				28	0.041	0.29				-0.007
Clear Creek	12	0.100	0.49	23	0.219	0.56				37	0.216	0.43				0.116
Comstock	0	-	-							6	-	-				
Drywood	0	-	-													
Little Osage	0	-	-							1	-	-				
Mo-No-I	6	-	-							14	0.177	0.75				
Osage	32	0.109	0.24	22	0.086	0.23				43	0.106	0.28				-0.003
Redwing	0	-	-							6	-	-				
Shawnee Trails	11	0.031	0.43	4	-	-				5	-	-				
<b>Grand River Grasslands &amp; Surrounds</b>																
Dunn Ranch	112	0.166	0.19	116	0.207	0.15	133	0.199	0.13				109	0.130	0.15	-0.036
Frank	40	0.086	0.36	36	0.099	0.35				56	0.093	0.35				0.007
Helton				3	-	-	0	-	-	0	-	-				
Leuken-Hensley				1	-	-	0	-	-				0	-	-	
Pawnee Prairie CA	8	-	-	5	-	-	45	0.441	0.19	20	0.141	0.43				
Pawnee Prairie NA	12	0.123	0.42	17	0.199	0.31	18	0.176	0.34	20	0.126	0.35				0.003
Poteet Farms							60	0.325	0.25	44	0.174	0.23				-0.151
Runyon							0	-	-	2	-	-				
<b>Golden Prairie Focus Area</b>																
Coyne/Penn/Welch	5	-	-				14	0.123	0.37				32	0.226	0.37	
Golden	5	-	-										28	0.197	0.31	
Horse Creek	0	-	-				5	-	-							
Indigo	0	-	-							0	-	-				
Kickapoo	0	-	-	9	-	-	9	-	-	4	-	-	17	0.200	0.56	
Kremp				0	-	-	1	-	-				4	-	-	
Niawathe	24	0.368	0.24	23	0.403	0.37	20	0.294	0.22							
Providence	6	-	-	29	1.016	0.45	9	-	-	7	-	-	12	0.106	0.89	
Shelton	19	0.291	0.48	47	0.823	0.41	7	-	-	6	-	-				
Sloan	0	-	-	0	-	-	0	-	-							
Stony Point				29	0.152	0.31	24	0.109	0.35	22	0.091	0.35	36	0.141	0.32	-0.011
Talbot	0	-	-				0	-	-	0	-	-	19	0.027	0.43	
Theurer				38	0.444	0.41	16	0.157	0.35				6	-	-	
<b>Other</b>																
Prairie Fork	18	0.166	0.38							11	-	-				
<b>All Properties</b>	<b>652</b>	<b>0.069</b>	<b>0.08</b>	<b>1024</b>	<b>0.128</b>	<b>0.08</b>	<b>1055</b>	<b>0.145</b>	<b>0.06</b>	<b>904</b>	<b>0.126</b>	<b>0.08</b>	<b>1030</b>	<b>0.188</b>	<b>0.07</b>	<b>0.06</b>

# NORTHERN BOBWHITE



Northern Bobwhite (NOBO)

**Changes in Northern Bobwhite density across years in Missouri's focal grassland landscapes.**  
 n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color.

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<i>Cole Camp &amp; Green Ridge Focus Areas</i>																
Brauer				3	-	-							2	-		
Bruns Tract	0	-	-	3	-	-	18	0.356	0.36				7	-		
Brysons Hope	1	-	-	5	-	-	15	0.127	0.57				15	0.096	0.36	
Clubine				2	-	-	4	-	-							
Drovers	0	-	-	1	-	-	1	-	-							
Friendly	0	-	-				0	-	-							
Grandfather	0	-	-				3	-	-							
Hartwell	2	-	-	2	-	-	8	-	-				7	-		
Haubein				2	-	-	1	-	-				7	-		
Hi-Lonesome	1	-	-	9	-	-	13	0.032	0.16	55	0.152	0.17	24	0.087	0.26	
Ionia Ridge	4	-	-	8	-	-	24	0.152	0.25				7	-		
Kearn (WR)	0	-	-	4	-	-	4	-	-				6	-		
Mora	3	-	-	6	-	-	16	0.042	0.29				2	-	-	
Paintbrush	0	-	-	5	-	-	8	-	-				7	-	-	
Shackles				3	-	-	6	-	-				15	0.072	0.37	
<i>Diamond Grove Area</i>																
Carver										0	-	-				
Diamond Grove (main unit)	1	-	-	8	-	-	6	-	-	8	-	-	11	0.025	0.28	
Diamond Grove (grazed unit)	0	-	-	3	-	-	6	-	-	0	-	-	6	-	-	
<i>Upper Osage Grasslands</i>																
Francis				10	-	-	3	-	-				10	-	-	
Linscomb				4	-	-	6	-	-	2	-	-	10	-	-	
Monegaw							2	-	-	2	-	-				
Morton (Tillman)	3	-	-	15	0.055	0.24				3	-	-				
Schell-Osage				18	0.019	0.46	0	-	-	2	-	-	18	0.028	0.31	0.009
Sewell							1	-	-	2	-	-				
Taberville	0	-	-	15	0.032	0.32	22	0.026	0.28	20	0.037	0.32	42	0.062	0.22	
Wah'Kon-Tah	13	0.012	0.33	64	0.056	0.11	96	0.046	0.13	55	0.047	0.17	128	0.081	0.14	0.069

Region/Property	2013			2014			2015			2016			2017			△
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b>Vernon/Barton Co. Complex</b>																
Buffalo Wallow	0	-	-	8	-	-				11	0.033	0.38				
Bushwhacker	6	-	-	11	0.009	0.35				55	0.065	0.16				
Clear Creek	1	-	-	5	-	-				13	0.061	0.3				
Comstock	0	-	-							5	-	-				
Drywood	0	-	-							0	-	-				
Little Osage	0	-	-							1	-	-				
Mo-No-I	0	-	-							1	-	-				
Osage	5	-	-	7	-	-				37	0.073	0.2				
Redwing	0	-	-							2	-	-				
Shawnee Trails	9	-	-	33	0.029	0.19				40	0.037	0.25				
<b>Grand River Grasslands &amp; Surrounds</b>																
Dunn Ranch	13	0.009	0.38	51	0.038	0.17	52	0.045	0.2				108	0.07	0.11	0.061
Frank	19	0.019	0.3	11	0.013	0.39				21	0.028	0.36				0.009
Helton				6	-	-	13	0.055	0.23	22	0.096	0.24				
Leuken-Hensley				5	-	-	6	-	-				12	0.038	0.41	
Pawnee Prairie CA	5	-	-	10	0.049	0.35	5	-	-	3	-	-				
Pawnee Prairie NA	0	-	-	9	-	-	5	-	-	12	0.061	0.41				
Poteet Farms							8	-	-	26	0.083	0.23				
Runyon							4	-	-	2	-	-				
<b>Golden Prairie Focus Area</b>																
Coyne/Penn/Welch	0	-	-				2	-	-				8	-	-	
Golden	0	-	-										13	0.049	0.05	
Horse Creek	0	-	-				1	-	-							
Indigo	0	-	-							0	-	-				
Kickapoo	1	-	-	0	-	-	0	-	-	0	-	-	1	-	-	
Kremp				3	-	-	11	0.096	0.29				5	-	-	
Niawathe	1	-	-	10	0.074	0.4	4	-	-							
Providence	1	-	-	2	-	-	10	0.063	0.12	14	0.090	0.19	15	0.072	0.32	
Shelton	0	-	-	12	0.088	0.47	3	-	-	2	-	-				
Sloan	2	-	-													
Stony Point				11	0.024	0.41	28	0.073	0.24	11	0.037	0.25	24	0.051	0.22	0.013
Talbot	4	-	-				8	-	-	16	0.016	0.3	24	0.012	0.22	
Theurer				3	-	-	2	-	-				5	-	-	
<b>Other</b>																
Prairie Fork	1	-	-							8	-	-				
All Properties	183	0.012	0.1	402	0.030	0.08	436	0.036	0.08	455	0.038	0.08	542	0.059	0.07	0.029

# UPLAND SANDPIPER

## Changes in Upland Sandpiper density across years in Missouri's focal grassland landscapes.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color. The range of the Upland Sandpiper potentially includes all COAs and CCSs surveyed but it is rarely encountered. The table below includes all Missouri properties where Upland Sandpipers were detected in 2013 - 2017 surveys.



	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b><i>Cole Camp &amp; Green Ridge Focus Areas</i></b>																
Brysons Hope	14	0.28	0.31	3	-	-	3	-	-				1	-	-	
Hi-Lonesome	3	-	-	1	-	-	15	0.051	0.48	16	0.032	0.6	2	-	-	
Ionia Ridge	3	-	-	3	-	-	4	-	-				0	-	-	
<b><i>Grand River Grasslands</i></b>																
Dunn Ranch	11	0.014	0.45	65	0.068	0.24	23	0.027	0.28				17	0.013	0.36	no change
Frank	0	-	-	0	-	-				2	-	-				
Leuken-Hensley				5	-	-	1	-	-				9	-	-	
Pawnee Prairie NA	0	-	-	1	-	-	0	-	-	0	-	-				
<b><i>Vernon/Barton Co. Complex</i></b>																
Shawnee Trails	0	-	-	1	-	-				0	-	-				
<b><i>Golden Prairie Focus Area</i></b>																
Horse Creek	0	-	-				3	-	-							
Shelton	0	-	-	0	-	-	2	-	-	0	-	-				
Theurer				6	-	-	7	-	-				6	-	-	no change



The Upland Sandpiper requires a continuum of vegetation structure during the nesting season, from short, sparse grass for foraging to taller, thicker stands for nesting. Grazing by cattle or bison can help provide the necessary suite of vegetative structure for this species.



# BOBOLINK

## Changes in Bobolink density across years in northern Missouri's focal grassland landscapes.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color. In Missouri, Bobolink breed only in the northern part of the state; they are passage migrants in the remainder.



Bobolink (BOBO)

	indicates higher density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) higher density than previous survey year
	indicates lower density than previous survey year, but difference is not significant
	indicates significantly (alpha < 0.05) lower density than previous survey year

Grand River Grasslands & Surrounds	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
Dunn Ranch	350	0.43	0.12	498	0.75	0.1	373	0.714	0.12				420	0.543	0.12	0.113
Frank	233	0.412	0.13	208	0.486	17				161	0.449	0.21				0.037
Helton				0	-	-	0	-	-	0	-	-				
Leuken-Hensley				41	0.304	0.4	44	0.414	0.25				78	0.497	0.27	0.193
Pawnee Prairie CA	24	0.203	0.3	29	0.286	0.31	32	0.402	0.25	29	0.344	0.4				0.141
Pawnee Prairie NA	10	0.085	0.38	38	0.375	0.52	6	-	-	9	-	-				
Poteet Farms							21	0.146	0.47	26	0.174	0.54				0.028
Runyon							3	-	-	0	-	-				
<b>All Properties</b>	<b>689</b>	<b>0.087</b>	<b>0.11</b>	<b>973</b>	<b>0.144</b>	<b>0.11</b>	<b>480</b>	<b>0.078</b>	<b>0.14</b>	<b>444</b>	<b>0.074</b>	<b>0.2</b>	<b>516</b>	<b>0.111</b>	<b>0.15</b>	<b>0.024</b>

# SEDGE WREN

## Changes in Sedge Wren density across years in Missouri's focal grassland landscapes.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n > 10 for a property. CV = coefficient of variance. If no n, D or CV values are presented, the property was not surveyed in that year.  $\Delta$  = overall change in density from first survey year to last survey year. If no value is presented, data were not sufficient to calculate density in one or more years, but suggested trends are indicated by color. The breeding range of the Sedge Wren includes northern and central Missouri. It is a highly nomadic species that typically undergoes two nesting cycles each breeding season, often moving long distances between cycles.



Sedge Wren (SEWR)

Region/Property	2013			2014			2015			2016			2017			$\Delta$
	n	D	CV	n	D	CV	n	D	CV	n	D	CV	n	D	CV	
<b>Cole Camp &amp; Green Ridge Focus Areas</b>																
Hi-Lonesome	0	-	-	0	-	-	0	-	-	4	-	-	0	-	-	
<b>Grand River Grasslands</b>																
Dunn Ranch	47	0.071	0.38	20	0.023	0.36	44	0.068	0.032				156	0.176	0.13	0.105
Frank	2	-	-	0	-	-				21	0.038	0.48				
Leuken-Hensley				0	-	-	6	-	-				5	-	-	
Pawnee Prairie CA	2	-	-	0	-	-	2	-	-	11	0.085	0.33				
Pawnee Prairie NA	3	-	-	2	-	-	5	-	-	47	0.325	0.21				
Poteet Farms							0	-	-	2	-	-				
<b>Vernon/Barton Co. Complex</b>																
Shawnee Trails	0	-	-	5	-	-				1	-	-				
<b>All Properties</b>	<b>56</b>	<b>0.006</b>	<b>0.33</b>	<b>36</b>	<b>0.004</b>	<b>0.26</b>	<b>57</b>	<b>0.007</b>	<b>0.27</b>	<b>88</b>	<b>0.01</b>	<b>0.24</b>	<b>179</b>	<b>0.031</b>	<b>0.16</b>	<b>0.027</b>

# UNCOMMON AND DECLINING SPECIES

There are several species considered grassland-obligate target species by MRBO and the MDC that have been extremely uncommon on 2013 - 2017 surveys. While readers of this report are aware of the scarcity of Greater Prairie-Chicken, the low numbers of Loggerhead Shrike and Common Nighthawk may be surprising. Below we provide observational data for each species as detected during transect surveys as well as opportunistically during the survey season.

## GREATER PRAIRIE-CHICKEN



Greater Prairie-Chicken (GRPC)

Region	2013	2014	2015	2016	2017
Grand River Grasslands	0	12	16	1	17
Osage Plains	0	7	8	12	5
Total	0	19	24	13	22

Greater Prairie-Chickens have been detected on Dunn Ranch, the Frank Ranch, Poteet Farms and Pawnee Prairie in the Grand River Grasslands CCS, on Taberville and Wah'Kon-Tah Prairies in the Upper Osage Grasslands CCS, and near Wade & June Shelton Memorial Conservation Area.

## LOGGERHEAD SHRIKE

Region	2013	2014	2015	2016	2017
Grand River Grasslands	0	10	5	2	8
Osage Plains	2	14	14	4	6
Total	2	24	19	6	14



Loggerhead Shrike (LOSH)

Loggerhead Shrikes have been detected on Dunn Ranch, the Leuken-Hensley Ranch, the Frank Ranch and Poteet Farms in the Grand River Grasslands CCS, on Hi Lonesome Prairie and Ionia Ridge in the Cole Camp Prairies COA, on Wah'Kon-Tah Prairie and the Morton property in the Upper Osage Grasslands CCS, and on the Theurer Ranch in the Golden Grasslands CCS.

## COMMON NIGHTHAWK

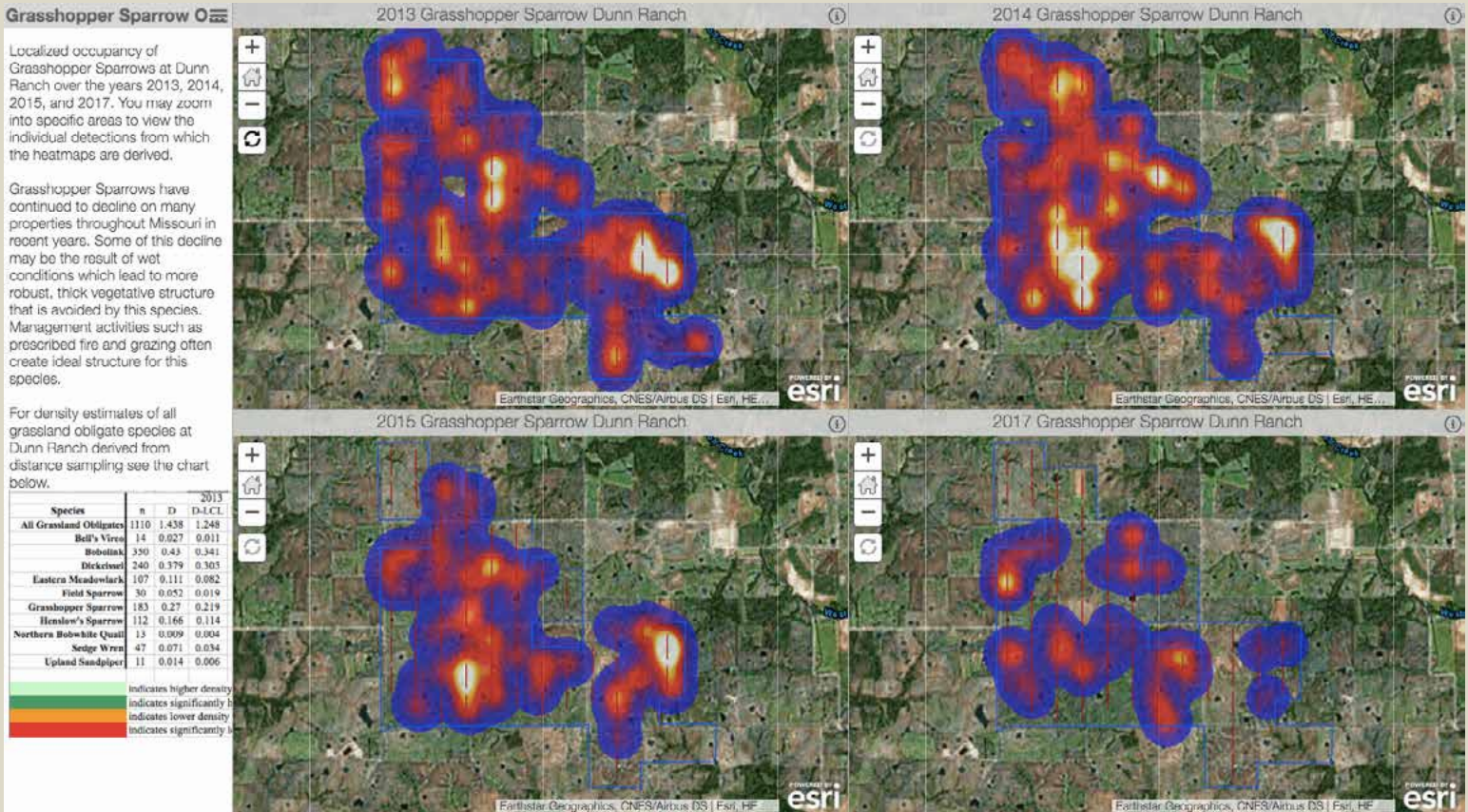


Common Nighthawk (CONI)

Region	2013	2014	2015	2016	2017
Grand River Grasslands	0	0	0	0	0
Osage Plains	0	6	0	4	10
Total	0	6	0	4	10

The Common Nighthawk was historically a bird of the prairies, old fields and traditional farmsteads. It is now very scarce in Missouri during breeding season and most often found in towns. This species has been documented at Linscomb, Diamond Grove, Osage Prairie, Shawnee Trail, Stony Point, Talbot and Wah'Kon-tah.

# USE OF GEOSPATIAL DATA IN ARCGIS ONLINE



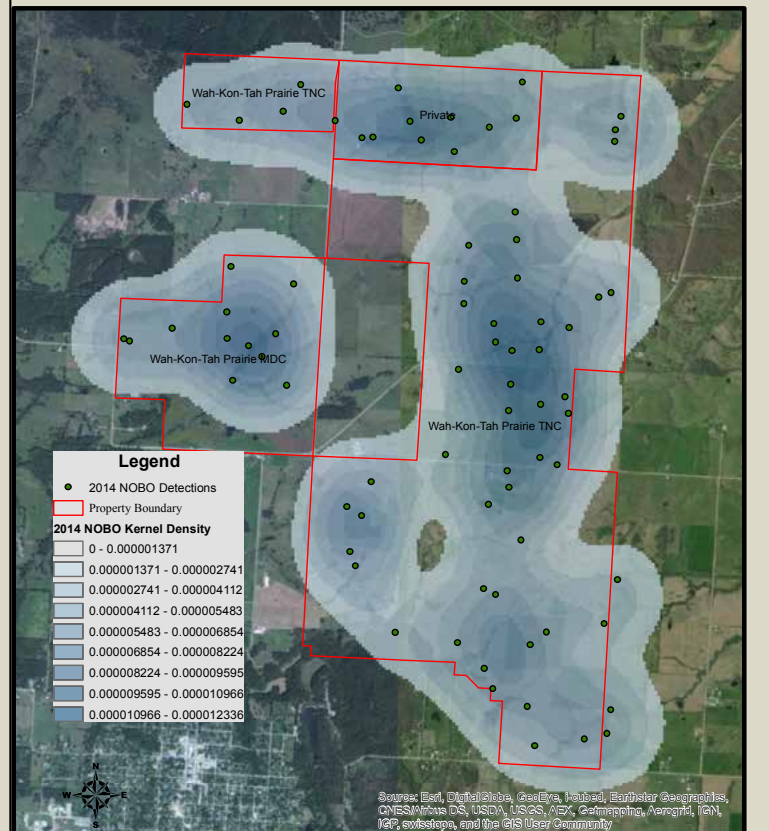
All bird detections are collected via ArcGIS Collector for iPad in the field, allowing seamless transition to ArcGIS Online (AGOL) and its various mapping features. MRBO's >75,000 grassland bird detections are available to Area Managers and other MDC staff via AGOL. Additionally, MRBO has worked with Managers to create management record layers in AGOL that can be used in conjunction with bird data to view the effects of management on bird use.

There are a nearly infinite number of map views and applications (apps) available that be created quickly in AGOL. The image above shows a typical comparison app. It contains a smooth kernel density occurrence map (heat-map) of Grasshopper Sparrows for 2013, 2014, 2015 and 2017 at Dunn Ranch. Managers can search any property surveyed within this app and quickly assess how species distribution has changed over time. For properties where management information has been provided, that information can be viewed in conjunction with species' heat-maps to examine the effects of management on bird distribution and localized density.

Another example, right, shows a simple heat-map filtered for Northern Bobwhite Quail. This particular view in the Upper Osage Grasslands CCS illustrates the contribution of both public and private lands within that landscape.

Maps of this type can be generated for all grassland obligate species from 2013 – 2017, and the spatially-explicit bird location data can be explored in a variety of other ways. Detailed instructions are provided in a supplemental document, "A Manual for Accessing MRBO's Grassland Bird Data Using ArcGIS Online".

## Northern Bobwhite Detections on Wah-Kon-Tah Prairie CA and Adjacent Private Land





A native prairie remnant on private property in southern Pettis County.