

GRASSLAND BIRD USE OF
THE COLE CAMP~GREEN RIDGE PRAIRIE COMPLEX
DURING THE MIGRATION AND BREEDING SEASONS
2015



MISSOURI RIVER
BIRD OBSERVATORY

REPORT TO THE MISSOURI DEPARTMENT OF CONSERVATION





CONTENTS

Introduction	2
Spring Migration Monitoring	3
Breeding Season Productivity and Survivorship Studies (MAPS)	8
Fall Migration Monitoring	12
Breeding and Migration Season Initiatives for 2015	15

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Front Cover: Hi-Lonesome
Conservation Area,
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Back Cover: Paint Brush
Prairie Conservation Area,
June 4th 2015.

INTRODUCTION

The Missouri River Bird Observatory (MRBO) has worked with the Missouri Department of Conservation (MDC) to examine prairie bird use on many of the MDC's grassland Conservation Areas since 2011. The bulk of MRBO's work has focused on assessing prairie bird response to habitat management during the breeding season. However, we have also conducted studies of spring and fall migration as well as more intensive studies of breeding productivity on a subset of prairie sites in the Cole Camp Prairies Conservation Opportunity Area and the nearby Green Ridge prairie complex.

Data Collection: Bird-banding, transect surveys and daily logs

MRBO uses a data collection system that allows for the documentation of accurate, spatially explicit bird survey data, and also employs bird-banding on a limited scale to answer questions of population demographics and measure long-term trends on a site-level basis. Though this method requires more effort on a finer scale than area surveys, it does help document difficult-to-detect migrants and assess breeding bird populations. Coupled with observational data, MRBO has been using the bird-banding approach to examine presence, timing, habitat associations, and response to management of breeding and migrant grassland birds.

Daily observation data are collected in conjunction with banding operations during spring migration. The Monitoring Avian Productivity and Survivorship (MAPS) bird-banding protocol, in addition to wide scale transect surveys, has been implemented for five breeding seasons (2011-2015) in the Cole Camp COA. Data were also collected using standard transect methodologies covering the entirety of each of five selected sites during fall migration in the Cole Camp/Green Ridge area. In this way we are able to document the temporal patterns of habitat use in a variety of seasons at several locations. These methods also allow us to generate density maps that effectively reveal high concentration areas for grassland obligate species on each CA. This information will be useful to Area Managers interested in examining bird response to management actions.

Data Reported Here: spring banding, breeding season MAPS study and fall migration surveys

This report provides information from spring and fall migration monitoring and the subset of breeding season MAPS studies within the Cole Camp/Green Ridge prairie complex. A full statewide breeding season survey report is available, please see MRBO's report *Prairie Bird Monitoring in Missouri 2015* (mrbo.org/mrbo-reports).

In conclusion, we provide detail on the study design and site selection process for all 2016 grassland bird monitoring activities conducted in partnership with the MDC. Please note, there are many more spatially-explicit grassland-obligate bird habitat use maps available than are included in this report. All data are currently available to MDC Wildlife Management Biologists and Private Land Conservationists via MRBO ArcGIS On-line accounts, and are available to additional MDC staff upon request.



SPRING MIGRATION MONITORING



Sedge Wren at Bruns Tract CA

Each year from early April to mid-May, MRBO operates two migration monitoring stations focused on tracking the arrival time, abundance, site fidelity and small-scale habitat use of migrating grassland birds. MRBO piloted spring migration banding and observational stations in the Cole Camp/Green Ridge area in 2013. The original stations in 2013 included the southeast corner of Hi-Lonesome CA and the north-central portion of Mora CA. The Mora site has undergone an extensive native reseeding effort and we anticipated that yearly monitoring of spring migrant use of this area would be of interest to the MDC. Prior to the 2014 spring season, Area Manager Steve Cooper advised that Bruns Tract was undergoing several management actions. We therefore discontinued the Hi-Lonesome CA banding station and established a spring 2014 monitoring station in a central area of Bruns Tract that would afford sampling of three different habitat types and management regimes. In 2015, we continued operations at both Mora and Bruns Tract. Each of these banding stations was

operated on 12 days during the period of 6 April to 12 May. This duration allows us to document the first of the incoming migrants and conclude when passage migrants have moved on and breeding birds remain in the area. Mora and Bruns Tract banding stations each have 12 mist-nets that are operated for a maximum of 5 hours each morning.

In addition to banding data, operators of the Bruns Tract and Mora spring migration stations kept a daily log of all birds seen or heard at each site. These are a standard addition to banding stations that increase the amount of available data for sites where bird captures are low. In complement, capture data add to the daily totals by documenting birds that typically display secretive, quiet behavior during migration, such as LeConte's, Henslow's, and Grasshopper Sparrows. While captures do remain relatively low at both sites, several patterns have emerged for bird use of both areas based on observational data in combination with banding data.

Birds captured at Mora Conservation Area migration banding station 2013-2015.
Grassland obligate species are denoted by bold type.

Species	2013		2014			2015			
	New Captures	Within Season Recaptures	New Captures	Within Season Recaptures	Returns from 2013	New Captures	Within Season Recaptures	Returns from 2014	Returns from 2013
American Goldfinch	4					32			
Barn Swallow	1								
Bell's Vireo	1				1	3	1		1
Black-capped Chickadee	1	1							
Brown Thrasher						1			
Brown-headed Cowbird						1			
Carolina Chickadee						1			
Common Yellowthroat	5					7	1		1
Dickcissel	1		2			1			
Eastern Meadowlark	1					1	2		
Eastern Phoebe						1			
Field Sparrow	16	11	8	6	1	12	6	1	1
Grasshopper Sparrow	3		1						
Gray Catbird			1			1			

Species	2013		2014		Returns from 2013	2015			
	New Captures	Within Season Recaptures	New Captures	Within Season Recaptures		New Captures	Within Season Recaptures	Returns from 2014	Returns from 2013
Henslow's Sparrow	6	6							
Indigo Bunting						3			
LeConte's Sparrow	1		2	1					
Lincoln's Sparrow			4			2			
Marsh Wren	1								
Merlin	1								
Northern Cardinal	2					4			
Northern Rough-winged Swallow	1								
Northern Waterthrush						1			
Orchard Oriole	1								
Red-winged Blackbird	2		1						
Ruby-throated Hummingbird						1			
Savannah Sparrow	5		1			2			
Sedge Wren	3								
Song Sparrow	4		8	2		5			
Sora						1			
Swamp Sparrow	9	3	18	7		7			
Tree Swallow	9								
White-eyed Vireo			1						
White-crowned Sparrow	1								
White-throated Sparrow			1			2			
Yellow-breasted Chat	1					1			
Yellow-rumped Warbler	1								
Total	81	21	48	16	2	90	10	1	3

Mist-netting effort at Mora Conservation Area, 2013-2015.

2013	2014	2015
16 days - 4/2 to 5/13	14 days - 4/7 to 5/7	12 days- 4/8 - 5/11
848.25 net hours	343.5 net hours	302 net hours
12.5 birds/100 net hours	19.2 birds/100 net hours	34.7 birds/ 100 net hours
25 Species	13 species	22 Species

A note on mist-netting results: Capture rates vary widely between banding stations depending on habitat and net placement in addition to the number of birds present in the area. Banding stations located in shrubland and some types of forest can experience capture rates of well over 100 birds/100 net hours. In more open habitat such as prairie or marsh, capture rates are typically much lower.

SPRING MIGRATION MONITORING

Birds captured at Bruns Tract Conservation Area spring migration banding stations in 2014 and 2015.
Grassland obligate species are denoted by bold type.

Species	2014		2015		
	New Captures	Within-Season Recaptures	New Captures	Within-season Recaptures	Returns from 2014
American Goldfinch	1		13	1	1
Bell's Vireo			5		
American Tree Sparrow	6				
Brown Thrasher	1		4	1	
Brown-headed Cowbird			6		
Common Yellowthroat	7		7	2	2
Dickcissel	10		11	3	1
Eastern Kingbird			1		
Eastern Meadowlark	2		4	2	
Field Sparrow	1				
Grasshopper Sparrow	7	1			
Gray Catbird			8	1	
Henslow's Sparrow			1		
Indigo Bunting	1				
Lincoln's Sparrow	4		4		
Northern Bobwhite			1		
Northern Cardinal			4		
Red-winged Blackbird	3		6		
Ruby-crowned Kinglet			1		
Savannah Sparrow	15		10		
Sedge Wren			1		
Song Sparrow			1		
Swamp Sparrow	6	1	7		
Western Palm Warbler	1				
White-crowned Sparrow	1		1		
Yellow-breasted Chat			3		
Total	66	2	99	10	4



2014	2015
12 days - 4/6 to 5/8	12 days - 4/7 to 5/12
259.25 net hours	360.5 net hours
26.2 birds/100 net hours	31.4 birds/ 100 net hours
15 Species	21 species

Mist-netting effort at Bruns Tract Conservation Area in 2014 and 2015.

SPRING MIGRATION MONITORING

Conclusions to Date

Three seasons at Mora CA and two seasons at Bruns Tract have provided an initial snapshot of the use of each area by migrants and incoming breeders. The data suggest trends in bird use that are likely a function of habitat and management variables. Capture data coupled with observational data provide an accurate picture of bird presence and abundance within the station operating areas, but can not be extrapolated to the remainder of each CA.

Mora Conservation Area Mean number of individuals detected per day

Species	2013	2014	2015
Bell's Vireo	0.25	0.43	1.00
Dickcissel	0.60	0.57	0.17
Eastern Meadowlark	1.75	2.00	1.08
Field Sparrow	3.60	3.64	4.42
Grasshopper Sparrow	0.65	0.07	-
Henslow's Sparrow	2.85	-	-
LeConte's Sparrow	0.05	0.50	-
Northern Bobwhite	0.05	1.29	0.50
Northern Harrier	0.75	0.14	0.42
Savannah Sparrow	0.25	0.07	0.17
Sedge Wren	0.40	0.07	0.08
Short-eared Owl	-	0.07	-

Mean number of individuals of grassland obligate species documented at Mora CA (above) and Bruns Tract CA (below). Data represented birds detected by sight and sound during the course of daily banding operations.

Bruns Tract Mean number of individuals detected per day

Species	2014	2015
Bell's Vireo	0.25	0.92
Bobolink	1.00	1.50
Dickcissel	2.25	2.25
Eastern Meadowlark	4.58	4.08
Field Sparrow	0.50	0.83
Grasshopper Sparrow	2.50	0.33
Henslow's Sparrow	2.75	5.33
Northern Bobwhite	1.42	2.75
Northern Harrier	0.92	0.75
Savannah Sparrow	2.17	1.92
Sedge Wren	0.08	0.83
Upland Sandpiper	0.25	-

Mora Conservation Area

The seasons of 2013-2015 have displayed a downward trend in use for many grassland bird species at the Mora CA monitoring site. In the north-central portion of Mora where operation takes place, a marked increase in grass and litter density coupled with significant shrub encroachment have likely led to the changes in bird use documented by MRBO. Henslow's Sparrows were not present at the site after 2013 and Grasshopper and LeConte's Sparrows were not detected there after 2014. Swamp Sparrow, a species most often documented by capture, peaked in 2014 and showed a decline in 2015. Dickcissel and Sedge Wren observations have both declined at this site. In contrast, observations and, to some extent, captures of Bell's Vireo and Field Sparrow increased at Mora. Our data, coupled with the habitat affinities of the aforementioned species suggest that the increase in shrubby vegetation at this site is reflected by the bird community.

Bruns Tract Conservation Area

The study site at Bruns Tract is characterized by increasingly thick grass cover but little woody encroachment. During the 2015 season, unusually wet conditions resulted in several marsh-like areas on the site. Both banding data and daily observations suggest an increase in bird use of Bruns Tract CA from 2014 to 2015. Specifically, numbers of Henslow's Sparrow, Northern Bobwhite, Bobolink, Field Sparrow and Sedge Wren increased between years. Dickcissel numbers remained constant while Eastern Meadowlark showed a slight decline. The most marked decline occurred in Grasshopper Sparrow. Based on the habitat preference of Grasshopper Sparrow for relatively sparse vegetation, the decline in this species is likely temporary until prescribed fire is applied to Bruns Tract in the future.



From left: Yellow-breasted Chat and Northern Bobwhite at Bruns Tract CA; Sora at Mora CA in late April.

MONITORING AVIAN PRODUCTIVITY & SURVIVORSHIP (MAPS)



Grasshopper Sparrow at Paint Brush Prairie

Measuring birds' reproductive success in a specific geographic area helps determine local population stability. The Monitoring Avian Productivity and Survivorship (MAPS) Program is a breeding season monitoring program aimed at determining vital rates via bird-banding and associated ageing, sexing, and mark-recapture rates. MAPS is coordinated by the Institute for Bird Populations (birdpop.org) and has been running since 1989. The MAPS protocol is designed to measure long-term demographic changes, return rates, and breeding success at a selected site. Important data gleaned from MAPS monitoring includes age and sex ratios of the sampled population, post-breeding survival of adults and fledglings, return rates, and measures of body condition. 2015 was the fifth and final year of operation for MRBO's three MAPS project sites located in the Cole Camp/Green Ridge prairie complex. Monitoring at Grandfather, Paint Brush, and Ionia Ridge CAs has provided the opportunity to intensively study grassland bird productivity, survivorship, and condition at three extremely different grassland sites. Beginning in 2013, we expanded on the banding effort by documenting all birds, by sight and sound, at each site during operation. We suggest that a combination of banding and survey data is necessary for continued examination of demographic rates.

Based on interest by both MRBO and MDC in examining other methodologies for assessing grassland bird productivity, we will shift from implementing breeding season MAPS studies to a more intensive nest-searching and monitoring study at Taberville Prairie CA in conjunction with the on-going Resource Science Division patch-burn grazing study, in 2016. Five seasons of MAPS data have allowed us to draw general conclusions (please see page 11), about the populations of several grassland obligates at Grandfather, Paint Brush and Ionia Ridge prairies. While MAPS operation has provided a large data set for a variety of grassland-obligate and facultative species, captures of both adults and young have proven too low to allow assessment of overall recruitment rates. While the MAPS protocol has been proven effective in shrub- and woodland environments, its use in an open prairie setting is limited. Further investigation into the reproductive success of grassland bird territory density and nesting activity in response to management necessitates increasingly intensive study methods, including direct analysis of nest success.

Grassland-obligate species captured at MAPS sites during 2012-2015 breeding seasons. Data from 2011 are not included here, as the net array changed significantly between 2011 and 2012, and a new site was established at Ionia Ridge.

Species	Grandfather				Ionia Ridge				Paintbrush			
	2012	2013	2014	2015	2012	2013	2014	2015	2012	2013	2014	2015
Bell's Vireo	4	3	2	7			1		31	5	11	2
Dickcissel	34	15	12	4	16	15	11	2	10	12	11	6
Eastern Meadowlark			1		2	1	3	3				
Field Sparrow	4	4		1	10			5	7	1	1	2
Grasshopper Sparrow	1	1			6	1	1			3	7	2
Henslow's Sparrow	1	2	1	8	1		3	2				3
Loggerhead Shrike		1			1							
Sedge Wren		1										
Western Meadowlark					2							
<i>Total Grassland Obligates</i>	44	27	16	20	38	17	19	12	48	21	30	15
<i>Other species</i>	101	48	28	44	25	30	18	27	176	75	49	49
Total captures	145	75	44	64	63	47	37	39	224	96	79	64



Example of spot-mapping data for Grasshopper Sparrow (GRSP) and Henslow's Sparrow (HESP) indicating individual territories surrounding the Ionia Ridge banding station in 2013 (above) and 2014 (below). The maps clearly show an increase in the density of Henslow's Sparrow territories in 2014, while the number of Grasshopper Sparrow territories remained the same, only shifting slightly in location. Study area denoted by red box.



Within-season recaptures and between-year returns of banded birds at MRBO's MAPS sites. The Grandfather and Paint Brush Prairie sites were operated every year from 2011-2015; the Ionia Ridge site was established in 2012 and operated each year through 2015.

Site/Species	2012		2013			2014				2015				
	recaptures	returns from 2011	recaptures	returns from 2012	returns from 2011	recaptures	returns from 2013	returns from 2012	returns from 2011	recaptures	returns from 2014	returns from 2013	returns from 2012	returns from 2011
Grandfather Prairie														
American Goldfinch		3		1	3									
Black-capped Chickadee		1												
Bell's Vireo		1		1										
Blue Grosbeak			1											
Brown-headed Cowbird		1				2	1							
Common Yellowthroat		8			7									1
Dickcissel	1	3	1	1	2		1	2	1	1	1			
Eastern Kingbird		1												
Field Sparrow		1			2									
Grey Catbird	2	5								1				
Indigo Bunting		3	2				1					1		1
Northern Cardinal		1												
Orchard Oriole		3			1									
Yellow-breasted Chat	3		2							1				2
Paintbrush Prairie														
American Goldfinch	2			3	1					2	1			
Bell's Vireo	5	1		4	2		1	2		1		1		1
Brown-headed Cowbird			1											
Common Yellowthroat	5	1					2		2					
Dickcissel	1		2		1						1			
Downy Woodpecker										1				
Field Sparrow	1													
Grey Catbird	3	6	5	4	3	1		1					1	
Henslow's Sparrow										1				
Lincoln's Sparrow	1													
Orchard Oriole		2												
Yellow-breasted Chat		2			2		2				1			
Ionia Ridge														
Common Yellowthroat			1					1		1				
Dickcissel	2		1	1		4	2							
Total	25	44	16	15	24	7	10	6	3	9	4	2	1	5

Based on the combination of banding results, daily observation logs and spot-mapping, MAPS 2011-2015 data suggest some trend information for the following grassland species. Conclusions are limited to the MAPS study areas and may not be indicative of trends on the entirety of each Conservation Area.

Bell's Vireo

- » Grandfather Prairie: Numbers remained low but constant; individual territories shifted in response to intensive management activities such as tree and shrub removal.
- » Ionia Ridge: Insufficient observations to make definitive statements; the site provides little shrubby cover as preferred by Bell's Vireo.
- » Paint Brush Prairie: Significant declines were observed, likely due to management which decreased the extent of available shrub cover.

Dickcissel

- » Grandfather Prairie and Ionia Ridge: both captures and observations of this species declined throughout the 2011-2015 period.
- » Paint Brush Prairie: this species showed slight declines, but was not present in high numbers in any year.
- » Notes: Though this species is a relative habitat generalist within the prairie ecosystem, MRBO documented Dickcissel declines throughout Missouri in 2015. Steep declines at the Grandfather and Ionia Ridge MAPS sites may have been in part due to net-wariness by territorial individuals as well as the overall drop in numbers.

Eastern Meadowlark

- » All MAPS sites: based on observational data, numbers of this species remained roughly constant throughout the study period of 2011-2015.

Field Sparrow

- » Grandfather Prairie: Numbers at this site declined in response to intensive management activities such as tree and shrub removal.
- » Ionia Ridge: Numbers fluctuated through 2011-2015 with many more individuals detected and captured during 2012 than any subsequent year. Most individuals were detected on the edges of the site; the majority of the study site provides little shrubby cover as preferred by Field Sparrow.
- » Paint Brush Prairie: Declines were observed, likely due to management which decreased the extent of available shrub cover.

Grasshopper Sparrow

- » Grandfather Prairie: Numbers have decreased slightly as the grass and forb components became thicker, while individuals shifted territory locations slightly to the southwest area of the property following fence and brush removal.
- » Ionia Ridge: There was a slight decrease in numbers at this site though individuals remain present in the more sparsely-vegetated areas. Wet conditions in 2015 resulted thicker grass and forb growth than in previous years, displacing some Grasshopper Sparrow territories.
- » Paint Brush Prairie: Grasshopper Sparrows remain present in similar numbers each year, shifting to areas that have recently been burned or otherwise thinned.
- » Note: Observational data collected by sight and sound provide a better picture of this species' trends than banding data.,

Henslow's Sparrow

- » Grandfather Prairie: Both observational and banding data indicate a significant increase in numbers since extensive management has been implemented.
- » Ionia Ridge: Slight increases each year resulted in more Henslow's Sparrow territories in 2015 than in any previous year.
- » Paint Brush Prairie: In 2015 we experienced our first captures of Henslow's Sparrow at this site, the number of territorial males has remained approximately constant since 2011.
- » Note: the overall trends indicated that Henslow's Sparrow has responded favorably to management at all three sites, particularly Ionia Ridge and Grandfather Prairie.

Loggerhead Shrike

- » Grandfather Prairie: Occasionally observed; approximately two sightings per season during 2011-2015.
- » Ionia Ridge: Typically observed on about half the operation days each year.
- » Paint Brush Prairie: This species was not observed at this site in any year.

Northern Bobwhite

- » Grandfather Prairie: Observational data suggest that numbers of this species remained stable throughout the 2011-2015 seasons.
- » Ionia Ridge and Paint Brush Prairie: Observational data suggest that numbers of Northern Bobwhite have increased slightly at both sites throughout the course of the study.

FALL MIGRATION MONITORING



Sedge Wren (center) at Hi-Lonesome CA on September 27th

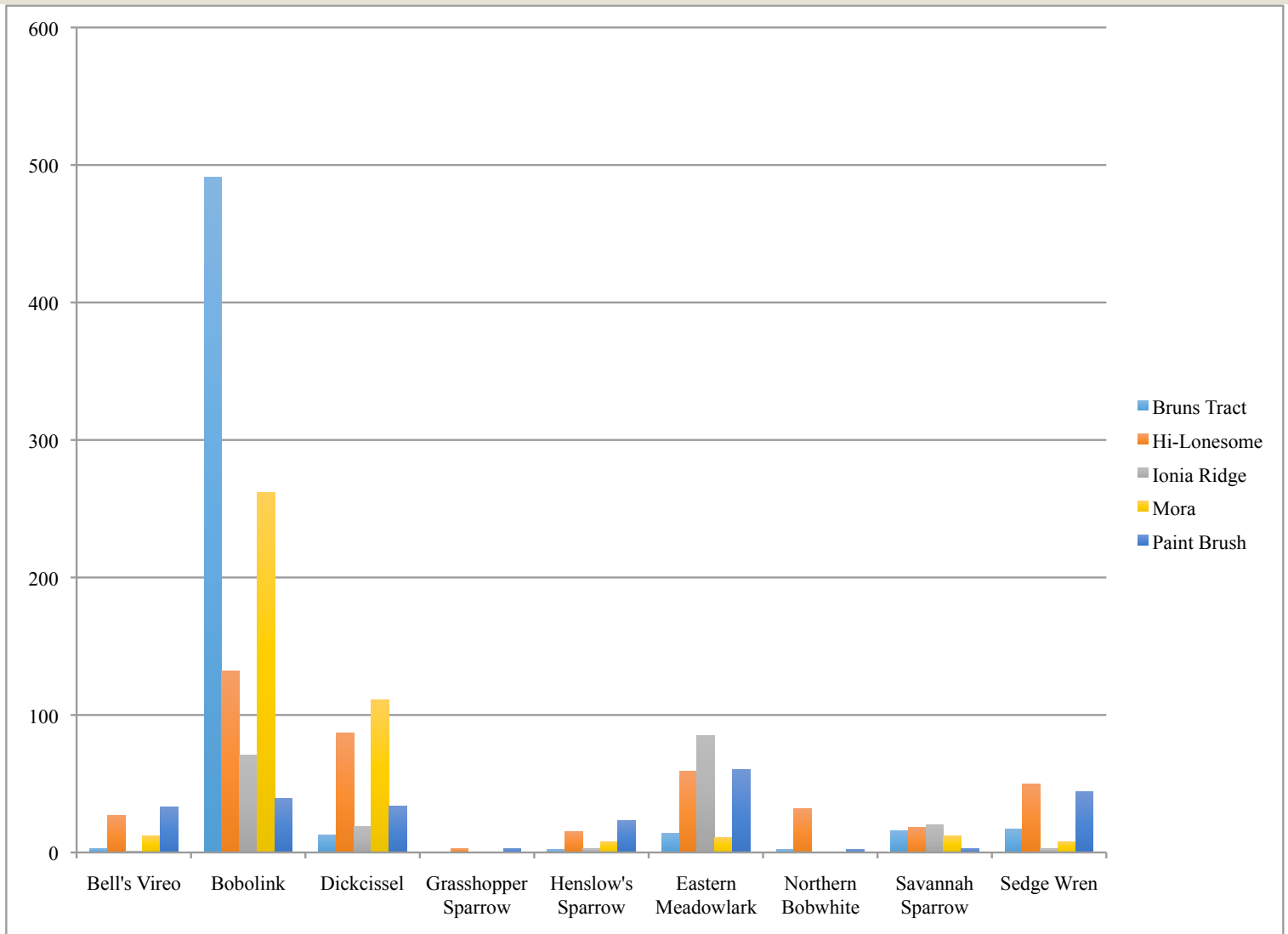
The period of fall migration represents a relatively drawn-out time period during which birds may make short movements of dispersal or long-distance movements towards a far-away wintering ground. The imperative driving quick migration towards breeding territories is not present; therefore, birds tend to stage and stopover for longer time periods in fall than in spring. This allows extended opportunity to more closely examine habitat selection during fall migration, information that is generally lacking for grassland birds.

In 2015, MRBO staff completed a third year of fall migration surveys on Hi-Lonesome Prairie, Bruns Tract, Paint Brush Prairie and Ionia Ridge, as well as a second year of surveys on Mora CA. We used line-transect survey methodology similar to breeding season surveys, allowing the notation of exact bird locations as well as derived density “hot-spots” indicating areas of highest use

for stopover or staging migrants. 2015 fall migration surveys were conducted from 1 September – 30 October, and each site received eight visits.

Densities were generated for all bird species documented as well as subsets of grassland obligate species and species of the Hirunid family (swallows and swifts). These density measures allow us to assess overall changes in bird use of the

Below: Detections of select grassland obligate species at each site surveyed by line transect during fall migration 2015.



FALL MIGRATION MONITORING

five sites over time and paint a broad picture of migrant use of each Area. Overall density for an area provides a picture of trends over time, but not of the precise portions of an area where migrants concentrated their activity. To address this, we used ArcGIS on-line to create smooth kernel density maps (“hot-spots”; please see page 14) indicating areas of concentrated use. Taken in context with management and habitat data, spatially explicit maps allow for the examination of the habitat conditions that make for useable space for the suite of grassland birds during migration.

Below: Density of all bird species, grassland obligates, hirunids (swifts and swallows) and individual grassland-obligate species on MDC properties in the Cole Camp/Green Ridge area during fall migration. Hirunids are included due to their reliance on prairies as foraging sites throughout the migration season. The results presented here are comprehensive through the 2012 and 2013 pilot seasons and the fully standardized 2014 season. Densities were generated for each category where there were >15 detections at a site in a given year.

	Mora		Bruns Tract			Hi-Lonesome			Ionia Ridge			Paint Brush		
	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
All Species	2.235	4.900	1.300	1.285	7.640	1.667	3.990	2.472	2.858	4.102	5.190	1.445	2.104	2.237
Grassland Obligates	0.758	1.654	0.089	0.111	5.547	0.835	1.002	1.035	0.961	1.464	1.119	0.347	0.563	0.888
Hirunids	0.390	0.752	-	-	-	0.943	1.005	0.461	0.079	0.480	3.079	0.126	0.942	-
Bobolink	0.179	0.701	-	0.049	3.941	-	0.255	0.212	-	-	0.285	-	-	0.104
Dickcissel	0.271	0.668	-	0.020	-	0.656	0.169	0.314	0.275	0.211	0.172	0.097	-	0.205
Eastern Meadowlark	0.042	0.013	-	-	-	-	0.066	0.029	0.071	0.327	0.077	0.064	0.091	0.027
Field Sparrow	0.130	0.159	-	-	-	-	0.141	0.066	-	0.058	-	0.069	0.144	-
Grasshopper Sparrow	-	-	-	-	-	-	0.029	-	-	-	-	-	-	-
Henslow’s Sparrow	0.038	-	-	-	-	-	0.069	0.054	-	-	-	-	-	0.138
Savannah Sparrow	-	-	-	-	0.185	-	-	0.042	0.906	0.418	0.116	-	-	-
Sedge Wren	0.052	-	-	-	0.250	-	0.052	0.147	-	-	-	-	-	0.217

Observations to Date

In 2015, **Bruns Tract** had a significantly higher density of grassland obligate species than any other site. While this trend proved true for the guild of grassland birds throughout spring migration and during the breeding season, in fall migration this high density was primarily due to a high number of Bobolink. Henslow’s Sparrow, a common species on Bruns Tract throughout the year, had mostly departed by the time fall surveys commenced. However, the site did provide good conditions for migration Sedge Wren, as evidenced by the relatively high density of this species.

Hi-Lonesome Prairie and Mora CA both provided a broad suite of habitat types used by migrants, as indicated by the number of species for which density estimates were possible. Between-year trends on Hi-Lonesome indicate mostly higher numbers of individual obligate species in 2014 than in 2013 or 2015, with the exception of Dickcissel, a species for which densities display the opposite. Dickcissel numbers contribute greatly to the overall increase in migrant density on Hi-Lonesome throughout the 2013-2015 period. Mora displayed higher densities of all obligate species in 2015 with the exception of Eastern Meadowlark, which had a small decline.

Ionia Ridge CA showed an increase in density of all bird species but an overall decrease in numbers of grassland obligates as a guild. Dickcissel showed a decline in density from 2013 to 2015, while Eastern Meadowlark experienced a significant increase from 2013 to 2014 followed by a decrease of similar magnitude from 2014 to 2015. Bobolink were detected for the first time in high enough numbers of generate density estimates in 2015. Similar to Bruns Tract, the Henslow’s and Grasshopper Sparrows known to breed at Ionia Ridge had departed by the beginning of fall migration surveys. Extensive Hirunid use of Ionia Ridge for staging and migratory stopover contributed greatly to the all-species density.

Paint Brush Prairie CA also exhibited a slight increase in the density of all species as well as a significant increase in the grassland obligate guild density. Henslow’s Sparrow and Sedge Wren were detected on this Area, as well as higher numbers of Bobolinks and Dickcissels than in 2013 or 2014.

Bruns Tract on October 22nd



FALL MIGRATION MONITORING: BIRD DENSITY HOT-SPOT EXAMPLE



Smooth kernel density functions derived from fall migration survey data display individual Eastern Meadowlarks plus density “hot-spots” on Ionia Ridge in 2014 (left) and 2015 (right). This species clearly shifted its use of the Area and declined in density. This example also indicates transect placement.



Smooth kernel density functions derived from fall migration survey data display individual Bobolinks plus density “hot-spots” on Bruns Tract (left) and Mora (right) in 2015. This view allows a comparison of relative density between areas as well as an indication of which portions of each Area were most heavily used.



MRBO has developed a gallery of map applications, housed at ArcGIS Online (<https://mrbo.maps.arcgis.com>), which contains data for all grassland obligate species similar to the examples displayed above. MRBO has provided Area Managers with ArcGIS accounts so that they may view maps, hot-spot analyses, or raw data. Any MDC staff member interested in accessing the on-line gallery, please contact ethan.duke@mrbo.org.

Since the publication of 2015 breeding season results in our January, 2016 report to the MDC, we have interacted extensively with Area Managers, private landowners, and Resource Science Division (RSD) staff to further refine MRBO's reporting of monitoring results. A significant development was the provision of ArcGIS accounts for all involved Area Managers, such that they are able to access all survey data and query the data in a variety of ways. This allows each Manager to use MRBO's bird survey data in a customized way in their own management assessment practices.

Spring migration monitoring will continue at Bruns Tract and Mora CAs within the Cole Camp/Green Ridge prairie complex. Daily observation data from each site, along with mist-netting to detect secretive, non-vocal migrants, will help us continue the assessment of how spring migrants use central Missouri grasslands. Area Manager Steve Cooper has been instrumental in providing us with up-to-date management information for his Areas; this in turn helps us determine net array locations and survey sampling effort.

Breeding season surveys will continue throughout the state (please see sidebar, *right*) with refined site selection criteria. In 2016, we are moving towards a two-years-on/one-year-off sampling framework. Thus, several sites that were not surveyed in 2015 are coming back into this year's sample, while sites that have been surveyed in a number of consecutive years will skip a year of surveys. Exceptions to this include prairies where RSD patch-burn grazing studies are on-going as well as sites undergoing active restoration. In general, survey sites are selected based on the following criteria:

- » a continued focus on sites within Comprehensive Conservation Strategy Priority Geographies and grassland Conservation Opportunity Areas
- » integration with the Resource Science Division's long-term patch-burn grazing study
- » inclusion of sites undergoing or slated to undergo significant grassland restoration within the next five years
- » private tracts with landowner indicating interest in conservation-based grazing management.
- » sites with on-going studies conducted by Area Managers

Transect placement was re-assessed on all areas and modified as needed during 2015 to provide smoother data integration with RSD studies and examination of management activity. Sites with concurrent RSD vegetation surveys will undergo two rounds of bird surveys annually.

Monitoring Productivity and Survivorship (MAPS) studies have concluded on Grandfather, Paint Brush and Ionia Ridge Conservation Areas. These sites will continue to receive standard breeding-season transect surveys on the two-years-on/one-year-off basis in 2016. MAPS studies are being replaced by the following pilot study.

Nest Productivity Assessment on Patch-Burn Grazing Units: MRBO will begin a nest productivity study of patch-burn grazing units in 2016. Approaches will include nest-searching, nest monitoring on an every-other day basis, and productivity analyses for grassland obligate birds in the Taberville PBG study units. Each patch will be approached as an experimental unit (e.g., current burn, one year since burn, two years since burn) with an adjacent unburned, ungrazed unit as a control. Units will receive equal effort in nest-searching. We anticipate that this will provide useful information on the response of nesting productivity to prescribed fire and grazing treatments.

Fall Migration Surveys are slated to continue with study sites to be advised by MDC staff. This season's surveys may continue in the Cole Camp/Green Ridge complex or be initiated in a different area of the state where Managers have interest in migrants' use of management units.

2016 BREEDING SEASON SURVEY SITES

Grand River Grasslands CCS & Surrounds

Helton Memorial CA
Pawnee Prairie CA
Pawnee Prairie NA
Private Lands (3)

Upper Osage Grasslands CCS

Linscomb WMA
Schell-Osage CA
Taberville CA
Wah'Kon-tah Prairie CA
Private Lands (2)

Cole Camp/Green Ridge CCS

Hi-Lonesome Prairie CA

Mystic Plains COA & Surrounds

Private Lands (2)

Southern Missouri

Diamond Grove Prairie CA
Indigo Prairie CA
Kickapoo Prairie CA
Providence Prairie CA
Shelton Memorial CA
Stony Point Prairie
Talbot CA

Little Drywood Creek COA & Surrounds

Buffalo Wallow Prairie CA
Bushwhacker Lake CA
Clear Creek CA
Mo-No-I Prairie CA
Osage Prairie CA
Redwing Prairie CA

Shawnee Trails COA

Shawnee Trail CA

Liberal COA

Comstock Prairie
Drywood CA

Prairie Forks COA

Prairie Fork CA

