

Prairie Bird Monitoring in Missouri 2015:
-Report to the Missouri Department of Conservation



**MISSOURI RIVER
BIRD OBSERVATORY**





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Front Cover Photo: Cattle grazing on Wah-Kon-Tah Prairie Conservation Area by Nic Salick.

ACKNOWLEDGEMENTS

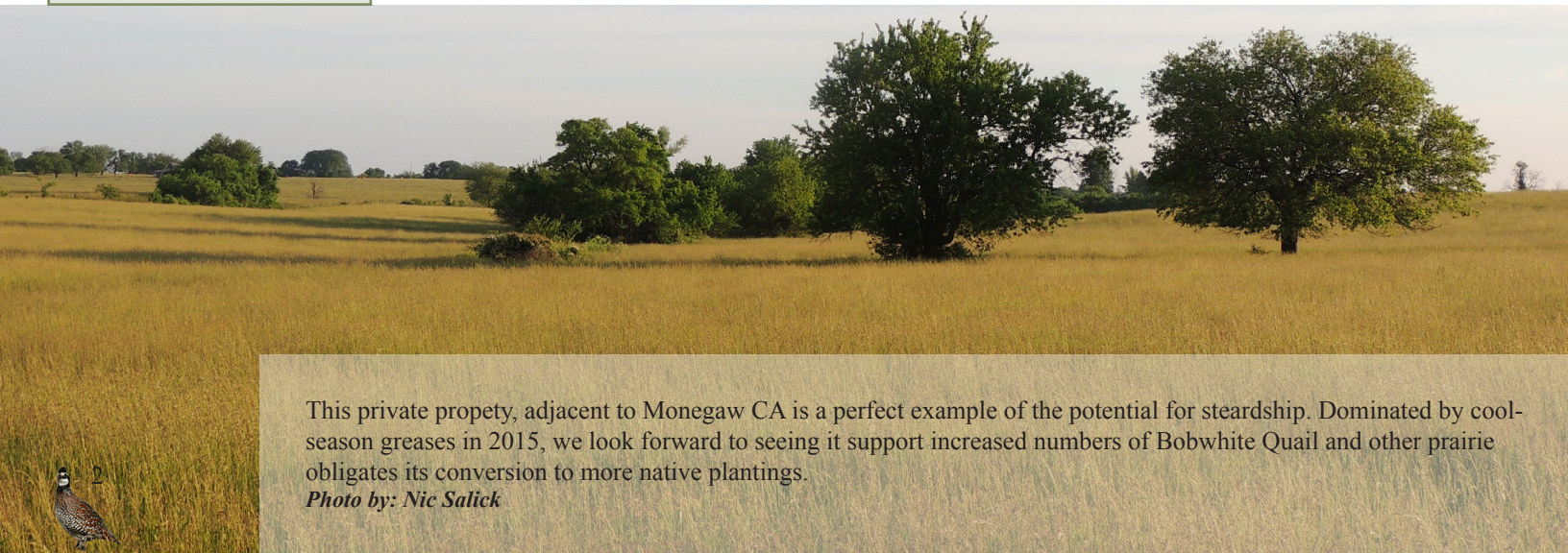
Our special thanks go to Max Alleger, Missouri Department of Conservation Grassland Coordinator and to the Private Land Services and Wildlife Division staff, private managers, and prairie stewards for their support of MRBO and their innovation and long-term development of grassland conservation plans.

We appreciate valued input from Tom Thompson, of the MDC’s Resource Science Division, many folks at the Missouri Prairie Foundation, and Randy Arndt and Hilary Haley of The Nature Conservancy.

The enormous amount of field work involved with this program would not have been possible without Nic Salick, Zeb Yoko, Veronica Mecko, Andrea Ambrose, and Emily Whilmoth. The support of the MRBO members enables us to continue education and outreach while maintaining a staunch commitment to monitoring efforts such as the prairie bird monitoring in this report.

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This private property, adjacent to Monegaw CA is a perfect example of the potential for stewardship. Dominated by cool-season greases in 2015, we look forward to seeing it support increased numbers of Bobwhite Quail and other prairie obligates its conversion to more native plantings.

Photo by: Nic Salick



INTRODUCTION

Current Objectives

The main objectives of the grassland bird survey project are 1) to assess the abundance and population trends of grassland obligates on CAs and CCSs; 2) to determine the habitat types and management activities that result in the highest density of target species, 3) to share data with MDC Area Managers and private landowners indicating the response of birds to their recent management actions, allowing for adaptive management strategizing where appropriate, and 4) to assess the long-term effects of public and private land management on target species populations within Missouri's larger priority geographies.

The tallgrass prairie is one of the most threatened bird habitats in North America (American Bird Conservancy 2015). Grassland-obligate birds show the most precipitous population declines of any group in North America (American Bird Conservancy 2012, Sauer et al. 2014). After decades of declines, grassland bird populations have flattened at a low level. Decline in populations is due to habitat loss from agriculture and development — with recent studies attributing further loss to large-scale applications of pesticides, herbicides, and fungicides (Mineau and Whiteside 2013). As Missouri prairie stakeholders meet the challenges of restoring and maintaining prairie and other grassland obligate birds are an ideal taxon for gauging the quality of wildlife habitat. Species within this guild are key indicators of grassland structure and composition and are often conspicuous in large enough numbers to afford statistically significant findings.

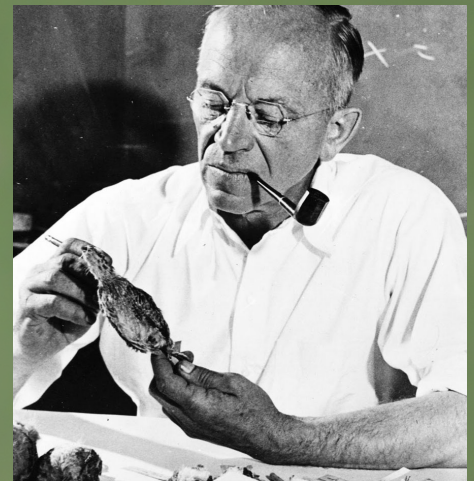
Regional population trend information is generated from long-term survey data, most notably Breeding Bird Surveys (BBS) and Christmas

“The farmer takes pride in his gadgets; that is, his radio, car, icebox, tractor, milker, etc. This is as it should be. He takes pride in his tame crops, and this is as it should be.

But how often do we find a farmer who takes pride in his wild crops, his woodlot, his stand of quail, his coon dens, the fish in his creek or ponds?

Until a majority of our farmers are as proud of having a flock of prairie chickens as of owning a new car, we shall not have the chickens. Conservation cannot come until the gameless farm is considered as unbalanced, until a farmer would no more tolerate erosion in his fields than he now tolerates a contagious disease in his flocks and herds.”

~Aldo Leopold 1938



Bird Counts (CBCs). Survey data gathered in this manner does not provide the most useful information about grassland birds in Missouri. These large-scale and long-term programs were not designed to inform management or provide data to support state-level trends for the majority of species. These programs also do not provide population correlates with habitat drivers at the scale at which management occurs. The Missouri River Bird Observatory’s surveys achieve the requisite resolution for different scales and typically result in far larger sample sizes. Notably, the unique and precise data collection methods used provide a powerful decision support tool to land managers seeking to understand the effect of their management activities on birds.

This report provides extensive data to address the lack of information on yearly density and abundance trends at property, regional, and state scales. We surveyed 31 public properties and 14 private properties in 2015 for the Missouri Department of Conservation (MDC) and the Audubon Society’s Prairie Bird Initiative (PBI). Results from all public lands surveys and selected private comparison properties are included. All private properties results will be reported in MRBO’s report to the National Audubon Society.

Background

In 2012, MRBO began monitoring prairie birds on private lands in partnership with the National Audubon Society by piloting a robust study design — while pioneering new data collection methodologies. The resulting windfall of data provided a powerful tool for conservation. In subsequent years, sample sizes of spatially explicit bird detections increased and became even more accurate.

In order to achieve effective habitat conservation results, MDC has strategically focused effort on core natural community landscapes with the greatest potential for sustainable stewardship on private and public lands. These areas are referred to as Conservation Opportunity Areas (COAs). A subset of COA geographies elevated for intensive conservation action are called Comprehensive Conservation Strategy (CCS) priority geographies.

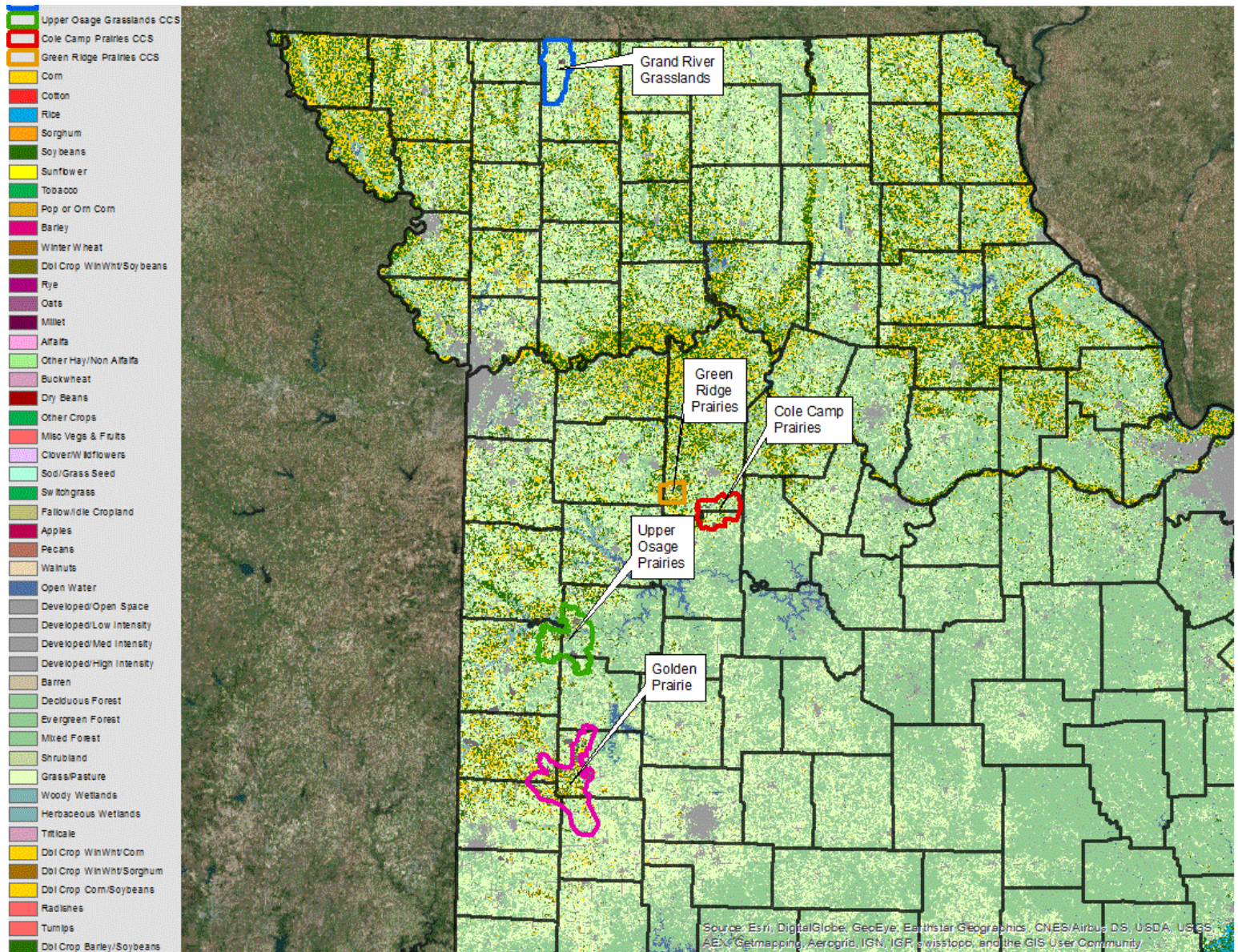
Understanding the effects of stewardship on wildlife is challenging, yet quantifiable. Perhaps a more important task is communicating these findings on threats and solutions to ecological issues to the public. In today’s world the conservation message needs to be succinct, even though the ecological principals are complex in nature. We endeavor to address this need through reports such as this, by serving mapped results via the web and through many public venues.

below: Species counts of grassland birds resulting from the Breeding Bird Surveys (BBS) and MRBO’s Breeding Season Surveys.

Species	BBS 2014	MRBO 2015	BBS 1966-2014	MRBO 2013-2015
Bell’s Vireo	31	673	989	1604
Bobolink	110	533	1871	1235
Common Nighthawk	15	0	478	3
Dickcissel	1796	2887	71053	8176
Eastern Meadowlark	1443	1377	81691	2649
Field Sparrow	769	695	30258	1511
Grasshopper Sparrow	230	737	12511	1822
Greater Prairie-Chicken	0	24	455	25
Henslow’s Sparrow	19	1097	493	2341
Loggerhead Shrike	10	19	2020	23
Northern Bobwhite	727	519	55784	872
Northern Harrier	0	9	47	12
Sedge Wren	0	68	122	127
unid. / Western Meadowlark	8	30	115	54
Upland Sandpiper	7	81	1015	111
Willow Flycatcher	6	65	127	84
Yellow-breasted Chat	397	297	11036	651
Grand Total	5568	9111	270065	21300



STUDY AREAS



above: 2015 Breeding Season Study Regions: Golden Prairies, Grand River Grasslands, Upper Osage Grasslands, Cole Camp, and Green Ridge Prairies grassland priority geographies with landuse map overlay (Cropscape 2014).

MDC has identified Grassland **priority geographies** throughout the Osage Plains, Central Dissected Till Plains, and Ozark Highlands regions (Partners in Flight 2012). Six primary Grassland COAs were originally designated as focal landscapes for Greater Prairie-Chicken recovery efforts; these, in addition to more recently defined areas of Northern Bobwhite Quail focus are recognized as providing a geographic context for landscape-scale conservation initiatives directed at grassland species in general. In this context, MDC Area managers and their staff work to restore and maintain healthy grassland systems throughout the MDC holdings.

MRBO breeding bird surveys targeted 44 properties within the priority geographies in 2015. We also perform additional monitoring during migration and breeding seasons on MDC lands in the Green Ridge and Cole Camp Prairies. Reports on these findings will accompany MRBO's Monitoring Avian Productivity and Survivorship (MAPS), post-breeding, and migration monitoring reports later in early 2016.



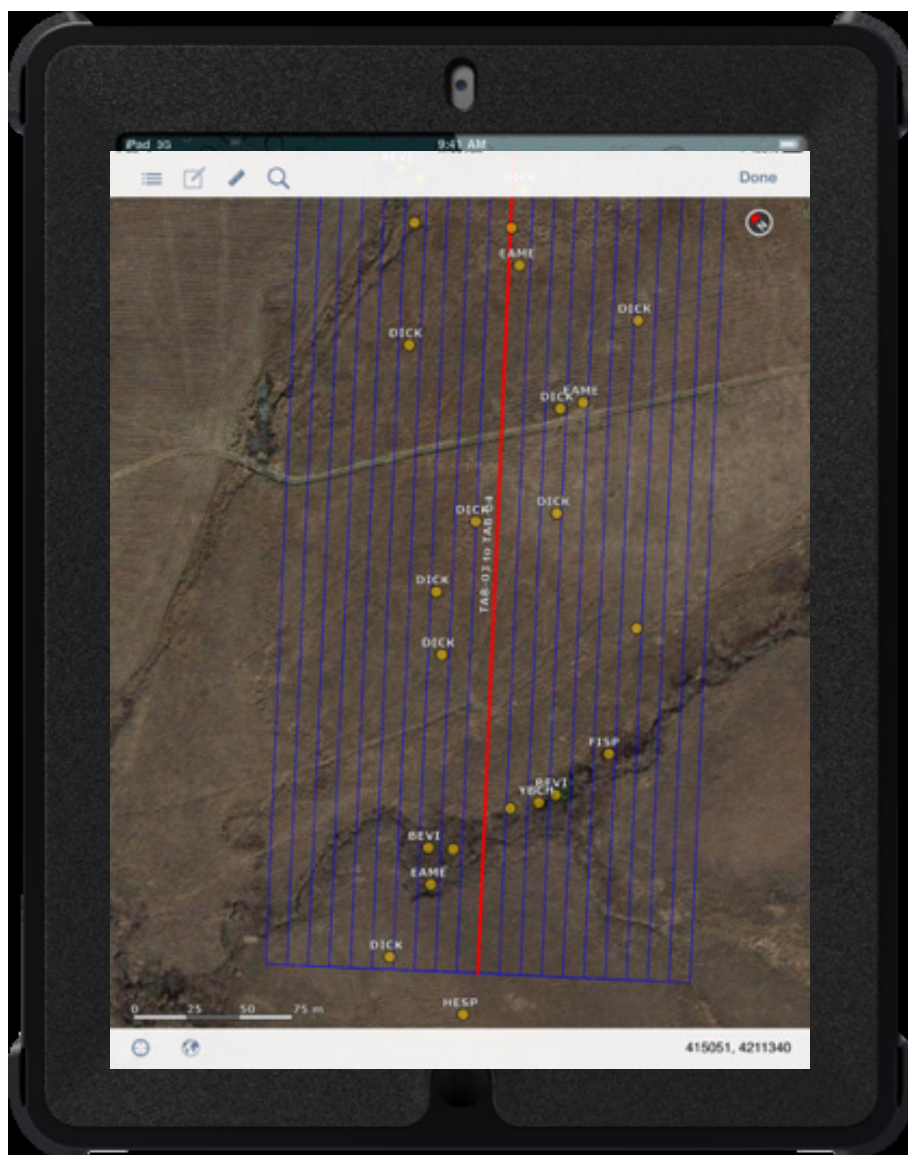
METHODS

Following protocol developed by MRBO, MDC and the National Audubon Society (Ripper et al. 2013), transect surveys were implemented in combination with territory mapping to document all bird species on each study site. In 2014 and 2015, all transects were examined and redesigned as necessary to maximize coverage. Transects varied in length on smaller properties but were at least 250 meters, with the majority being a standard 400 m on most properties. Each transect was surveyed once during the breeding season window of 15 May – 30 June, with the exception of two surveys each at MDC’s Resource Science Division (RSD) grazing study sites* (Kickapoo, Providence, Taberville, Wah’Kon-Tah, and Hi-Lonesome Prairie CAs). More southerly survey areas were visited earlier in the season; northern Missouri sites were surveyed later.

Surveys began at sunrise and continued for a maximum of 3.5 hours to include only the period of highest bird activity. Observers walked each transect at approximately one mile/hour, and recorded all birds seen and heard on an iPad using the application iGIS (Geometry 2013) with modifications. Bird location data from iPads were uploaded daily and were accessible through ESRI Geographic Information System (GIS) ArcMap 10.3 (ESRI 2015), which allowed spatial mapping of all bird locations as well as automated calculations of distance from transect line for further analyses.

All birds seen and heard on surveys were documented, but only target species observations were used for density and abundance analysis. Target species are: Greater Prairie-Chicken, Northern Bobwhite, Upland Sandpiper, Bell’s Vireo, Loggerhead Shrike, Common Nighthawk, Sedge Wren, Eastern and Western Meadowlark, Dickcissel, Bobolink, and Henslow’s, Grasshopper, and Field Sparrows. These species may be considered by MDC staff for additional analyses based on their relative conservation ranking in Missouri (Appendix A).

We used the statistical program Distance 6.2 (Buckland et al. 2001) to generate density estimates for target species as a guild and for each species where we documented more than 15 observations within a property. Following analyses developed through the PBI (Ripper and Duke 2014), we also calculated a “bird-friendliness” score for each CA based on the conservation ranks of each of the 14 target species in conjunction with a Shannon-Wiener Diversity Index. The resulting score provides one measure of the contribution of each CA to grassland bird populations in Missouri.



Line transect design and iPad screenshot with observer view of device. Teams of observers collect field data with an aerial imagery basemap stored on devices. Even offline, observer location is visible on the device. Data is submitted within seconds upon wifi access. In 2016, all observer data will feed into realtime, mapped results that can be viewed on webmaps via the internet.



RESULTS - OBJECTIVE 1 - ABUNDANCE AND TRENDS

Trends from this study are assessed at the site level in terms of density and abundance and combined from all properties to explore trends in density for all grasslands. By examining yearly density results at the property level of multiple properties within priority geographies throughout the state, we are able to gauge year-to-year changes spanning 2013 through 2015. Since there is currently no way to examine grassland habitat specifics at the landscape scale in Missouri, it would be unwise to estimate abundance from beyond the local scale.

In 2014, the density of all target species increased with the exception of Sedge Wren (a decrease of .002 birds per acre). **In 2015** densities of over half of the target species decreased from 2013. Eastern Meadowlark, Northern Bobwhite Quail, and Yellow-breasted Chat densities increased slightly in of the last two years.

Dickcissel declines in 2015 were by far the most significant as they showed a .167 bird per acre decline. To put this number in perspective, an average-size property in 2015 (854-acres) would have seen a decline of approximately 143 Dickcissels. Dickcissel densities showed this level of decline on all 27 properties that were surveyed in both 2014 and 2015 with the exception of two properties in the Upper Osage Grasslands, Stony Point Prairie CA and a private ranch.

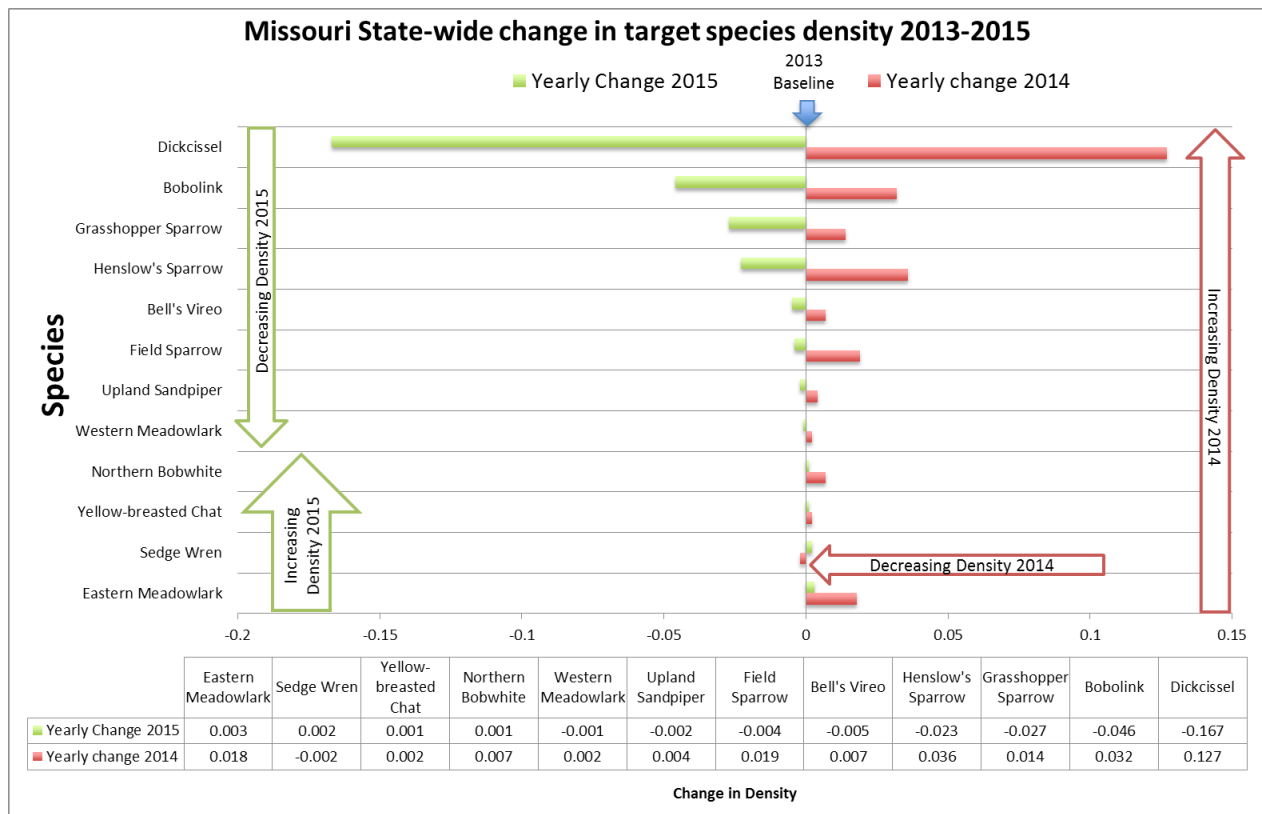
Like the Dickcissel, Bobolinks and Eastern Meadowlarks are habitat generalists within the guild of grassland obligate birds. Bobolinks showed marked declines like that of the Dickcissel, but Meadowlark densities across sampled sites showed a slight increase.



A Dickcissel perches amidst Ohio Spiderwort and coreopsis at Wah'Kon-Tah Prairie. Of all species declines documented in 2015, Dickcissels exhibited the steepest (see chart below).
Photo by Nic Salick.

Henslow's and Grasshopper Sparrows declined from 2014 to 2015 as well, as did shrub-dwelling species, Bell's Vireo and Field Sparrow.

Isolating the causes of density fluctuations at the property level is part of our second objective "Management Effects on Density." Other factors influencing breeding season numbers, such as the fate of birds on their wintering habitat that falls outside of Missouri should be considered.



above: This chart shows the change in species' densities across all properties from 2013 to 2015. To the right of the 2013 baseline, all species increased in density in 2014 (red) with exception of Sedge Wren. To the left of the 2013 baseline, all many species decreased in density in 2015 (green). The most notable and extreme year-to-year changes occurred in Dickcissel densities.



RESULTS - OBJECTIVE 2 - MANGEMENT EFFECTS ON DENSITIES

A primary goal of 2014 monitoring was to generate density and abundance estimates which accounted for recent management history. We determined that densities of grassland obligates were greatest on areas that had undergone a rotation of patch-burn graze, hay, and idle sections (Ripper and Duke 2014). Analysis of habitat found that warm-season grasses with a forb component supported the greatest densities of grassland obligates as a whole. These results merely confirmed what was already known, that grassland birds need heterogeneous structure (Jacobs et. al. 2012). More significantly, we found strong correlations and spatially visible shifts in birds' use of habitats undergoing different combinations of management.

Patch-burn Grazing

Patch-burn grazing (PBG) as implemented by MDC managers, resulted in higher bird-friendliness scores than properties ungrazed. This was observed within all priority geographies surveyed.

Ongoing Studies

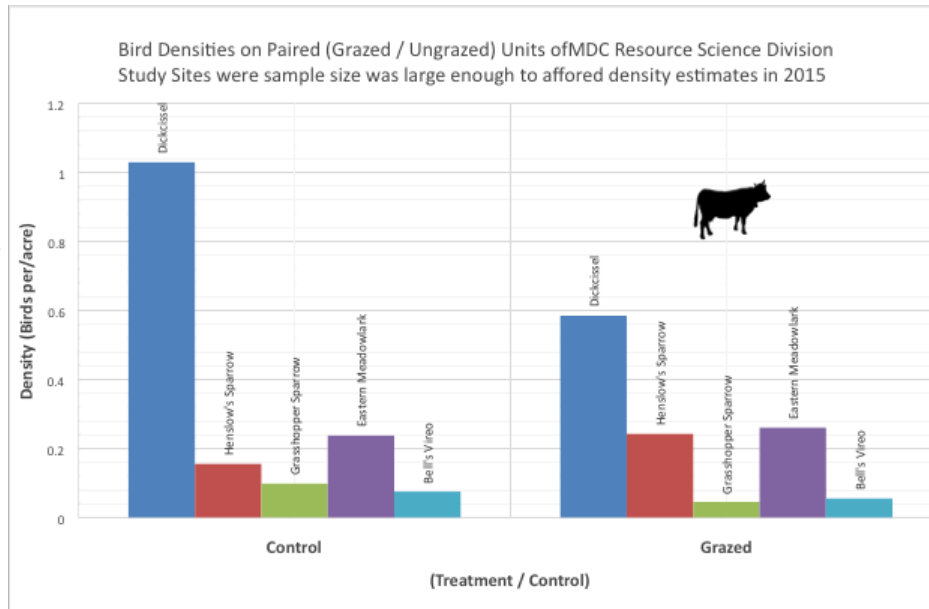
In 2015, MRBO began working in concert with MDC Resource Science Division's (RSD) fifteen-year PBG study. Grazing unit and control unit size are smaller than the average breeding season study sites. In order to increase sample sizes on PBG study sites, MRBO surveyed each of the study sites twice in 2015. Even with this effort, sample sizes were not adequate to achieve density estimates on all prairie obligate bird species on all PBG sites. Where sample sizes were adequate we combined the results patch-burn graze or control units on the study sites (Kickapoo Prairie, Providence Prairie, Hi-Lonesome Prairie, Taberville Prairie, Wah-Kon-Tah Prairie, and Diamond Grove Prairie CAs). Other than Dickcissels being more prominent in ungrazed units, there was little significant difference across all sites in the first year of this study (see graph at right).

Other Management Considerations

A variety of management techniques are employed in any given year on any given area. Furthermore, vegetation response to management is highly variable due to factors such as weather and soil type. As a result, no single, best approach may be molded as a broad-spectrum prescription throughout the state.

Management in Context

MDC biologists employ many different techniques to deal with challenges such as woody encroachment, invasive species, and lack of historical drivers such as wildfires and large herbivores. Each CA has its own set of unique challenges which are often dealt with in patches as they occur. Although density and abundance estimates have an informative function, we developed a new way of sharing grassland bird localized occupancy that services as a consistent gauge of management results (see next Section: Sharing Data Where it Matters).



above: Densities of prairie-obligate birds on MDC's Resource Science patch-burn grazing study sites in 2015.

2015 view: "Excessive rainfall events in early summer have resulted in excessive vegetation growth on most prairies. Even recent burn units have thicker vegetation than desired for a variety of grassland birds. Prescribed grazing has been extremely beneficial given all the rain, and the grazed units are far superior in habitat structure than other non-grazed prairie units.."

Kyle Hedges ~ MDC Wildlife Biologist & Area Manger



RESULTS - OBJECTIVE 3 - SHARING DATA WHERE IT MATTERS

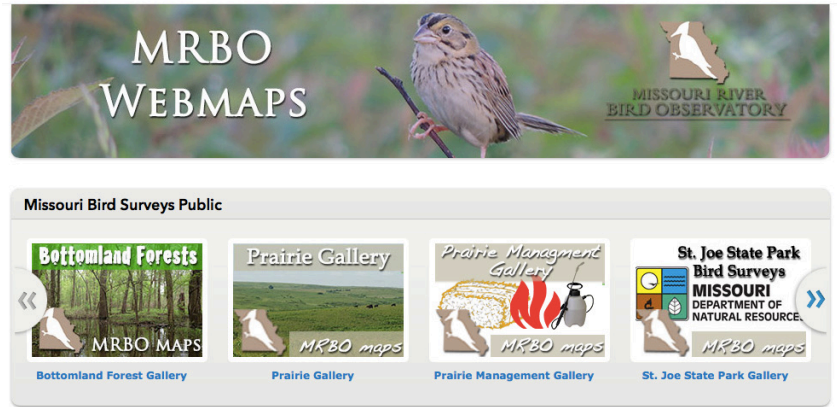
Traditional density analysis results are provided and are used as part of “Bird-friendliness” scores for each property. Bird-friendliness scores are produced as a property level tool to express the value of provided habitat to birds, and are useful in communicating results to the other stakeholders and the public.

Sharing usable data with MDC Area Managers that displays the response of birds to recent management actions is a fundamental objective of this project. Recent advances in technology support the well-known idea of adaptive (and informed) management. This is accomplished through displaying obvious patterns of occurrence locations of species with aerial imagery overlay. This format leads to greater resolution of within property level results. For example, through statistics, we can safely say that Paintbrush Prairie CA had the second highest density of Field Sparrows in 2015. Historically, this could have led to the assumption that the entire property had a strong scrub-shrub component. However, with review of actual bird locations, it becomes apparent that the high densities of Field Sparrow were concentrated on only a portion of the property (see example at right).

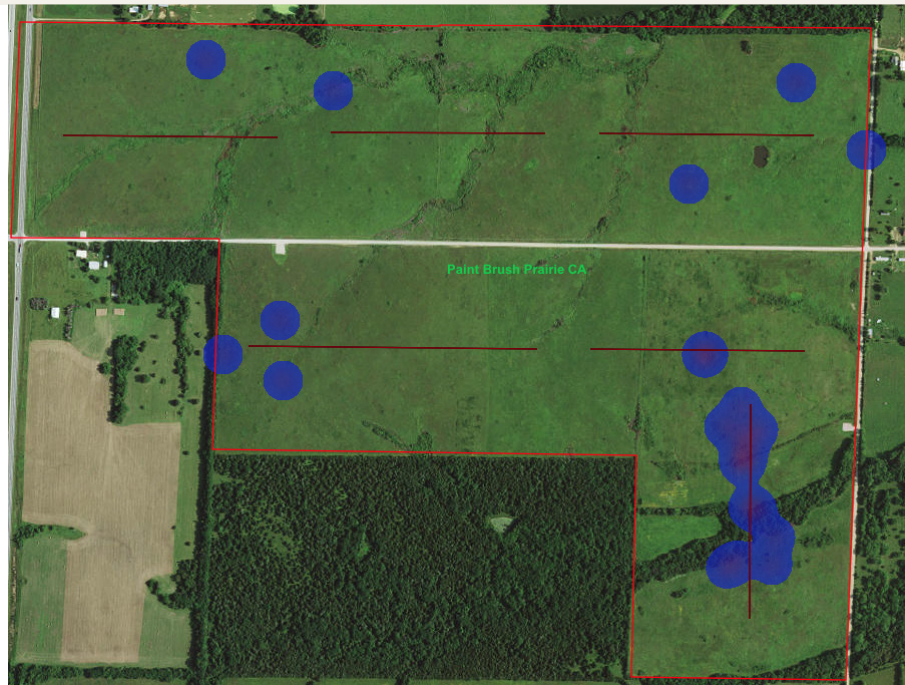
MRBO continually develops online web tools to enable land managers to search, query, and filter data via an online map platform. Currently some maps displaying public land data can be accessed at <https://mrbo.maps.arcgis.com>. Response from area managers and personnel who tested the platform has been positive. We also developed this platform to be used for collecting and or viewing field data on management activities using iPads, an internet browser, or Desktop versions of ArcGIS. Data can now be accessed on MRBO’s ArcGIS Online webpage at <https://mrbo.maps.arcgis.com>. Data are generally presented in a variety of formats that allow year-to-year comparisons of localized occupancy. Webmaps are predefined by spatial and data extent for specific areas of interest and are currently available. Webapps are more complex, but offer queries, filters, and other tools for use with webmaps. Most maps are simple and intuitive. If any further instructions are needed, individuals may contact Ethan Duke, [ethan.duke\(@\)mrbo.org](mailto:ethan.duke(@)mrbo.org).

Data collection is now available for area managers to note habitat and management in the field via iPads, online, or on Desktop ArcGIS. As managers enter data, they can also use a time-slider to view management activity on any area over time. Also, applications have been created and are under continued development that includes summary views of numerical density estimates by property.

Developer’s Note: The data-sharing and collaborative synergy can easily be applied to various studies within prairies and other habitats. Data gathered from other studies can be harnessed to further understanding of management effects on diversity. All data could be collected easily and made available as spatial layers to visualize localized occupancy of all flora and fauna.



above: A screenshot of what managers and landowners will see online. This image shows some of MRBO’s featured content.



above: An example of Field Sparrow hotspots on Paint Brush Prairie CA. Historically, density information alone could have led to the assumption that the entire property had a strong scrub-shrub component. However, with review of actual bird locations overlaid with aerial imagery, it becomes apparent that the high densities of Field Sparrow were concentrated on only a portion of the property

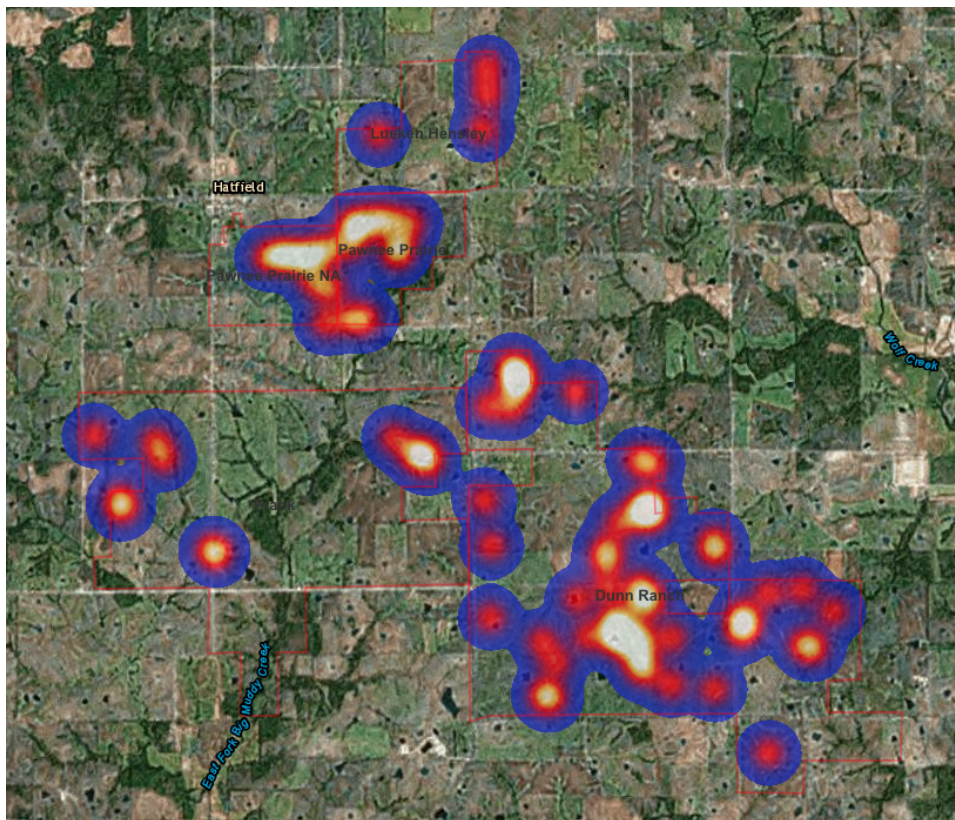
RESULTS - OBJECTIVE 4 - LONG-TERM LANDSCAPE LEVEL VIEWS

Surveys have resulted in bird densities and abundance estimates at the property level. Extrapolating abundances at this level can be done with a measurable level of confidence. However, estimated abundance further than the bounds of a property is currently not possible in our study in Missouri. Assumptions cannot be made of bird abundances on areas where aspects of habitat and land use affecting densities have not been quantified. In Missouri, delineation of grassland structure and composition throughout an entire landscape is made difficult by the heterogeneity of the remaining grassland habitat.

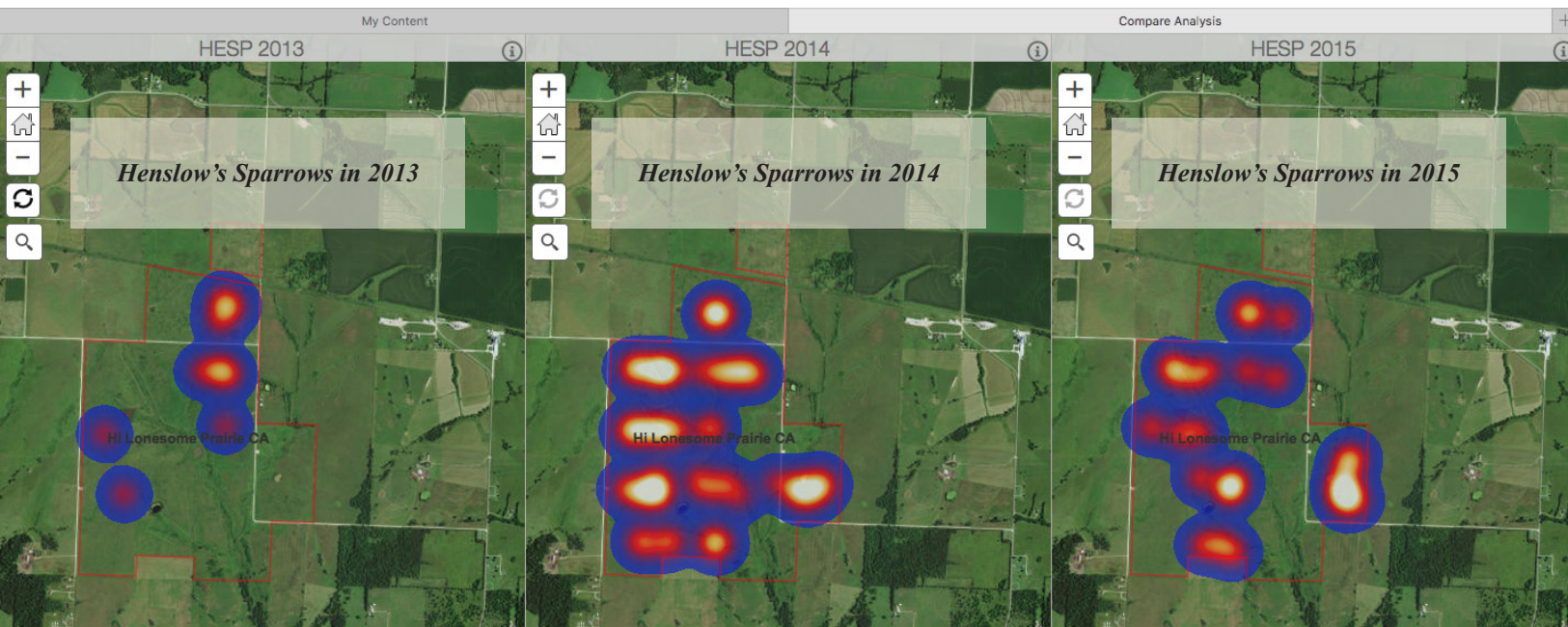
Current land cover data is becoming more accurate, allowing us to parse potentially suitable from unsuitable bird habitat with greater precision. More accurate estimates of abundance at the landscape level will require remote sensing techniques that identify native vegetation structure and composition.

Spatial data available today applies broad categories for land use types, such as crop production, development, pasture/hay, forest, shrub, and wetland. These categories are too broad for estimating bird abundances, however, they do indicate areas not suitable for grassland obligate birds as well as areas of conservation opportunity.

Based on the bird data that we have collected on proximal properties within priority geographies, distributional patterns can be observed at a larger scale and general questions how certain species are distributed throughout the landscape can be answered.



above: A view of Northern Bobwhite Quail across a landscape of public and private properties in the Grand River Grasslands CCS in 2014. Views such as this help underscore the supportive habitat contributions of properties within a landscape.



10 above: An example of year-to-year distribution shifts of Henslow's Sparrows across a Hi-Lonesome Prairie from 2013 to 2015. These shifts are due to structural changes to the vegetation produced by active management.

Surveys and Results

Prairie bird surveys conducted by MRBO have continually evolved to generate results on a range of scales, providing short-term and long-term information to those managing grassland habitats. The interpretation of results in 2015 has been an important step in this process for the overarching objective landscape level monitoring. Estimating populations of grassland birds at a landscape scale requires understanding of available habitat, temporal population dynamics, and management effects.

Survey efforts during the years of 2013-2015 covered roughly 140,000 acres of prairie with an average of 46,000 acres surveyed in a given year. Combined density results derived from findings on 82 Missouri properties provides us with an indicator of year-to-year trends in populations of our grassland birds. In 2015, we documented a decline in most grassland bird species' populations from 2014. Densities in 2015 were, however, more on par with 2013 numbers. Species' densities at the property level were compared temporally and within landscapes.

The statewide trends generate further questions. All though several species' abundances declined in 2015, Dickcissel was the most significant, with a .167 bird per acre decline. To put this number in perspective, an average-size property in 2015 (854-acres) would have seen a decline in approximately 143 Dickcissels. What caused such a boom year in 2014 for this and other grassland obligate species? Considered a generalist, prairie-obligate, does this species seem less likely to be affected by specific management activities on its breeding grounds and more likely influenced to factors on its more tropical wintering grounds? The declines in 2015 of Grasshopper and Henslow's Sparrows were slightly less significant, but still fit of the pattern. We regularly document management effects on these species and they winter in the United States.

Incorporating understandings of such temporal variations at different scales and teasing out effects of management from other environmental factors is becoming possible. Potential drivers for statewide population fluctuations may be examined on a local level with high resolution. These observations are statistically significant through density estimates and visible through mapped shifts in localized occupancy over time. Area managers can see changes in densities of species and can quickly see where and how specific actions affected localized occupancy.

Understanding The "bird-friendliness" index

The 'bird friendliness' equation derived from densities, conservation values, and diversity measures provides a comprehensive metric with which to gauge the state of Missouri's birds at the property level. In combination with spatially explicit localized occupancy maps, these results inform land managers of the effects of specific management techniques on grassland obligate birds.

Restorations and On-going Studies

We have documented bird response to prairie restoration efforts on Schell-Osage CA and Linscomb WA and have completed the first year of the bird survey component of the 15-year RSD examination of patch-burn grazing effects.

Data Collection and Sharing

All of the findings of this report have been shared in usable formats where compelling visual information via online webmaps, which are housed with the downloadable data upon which they are based. Interpreting and sharing data with land managers is an essential component to the adaptive management paradigm. Technology enables greater accuracy as well as efficiency and results in more time being afforded to actions on the ground and less time interpreting results.

Access to Results

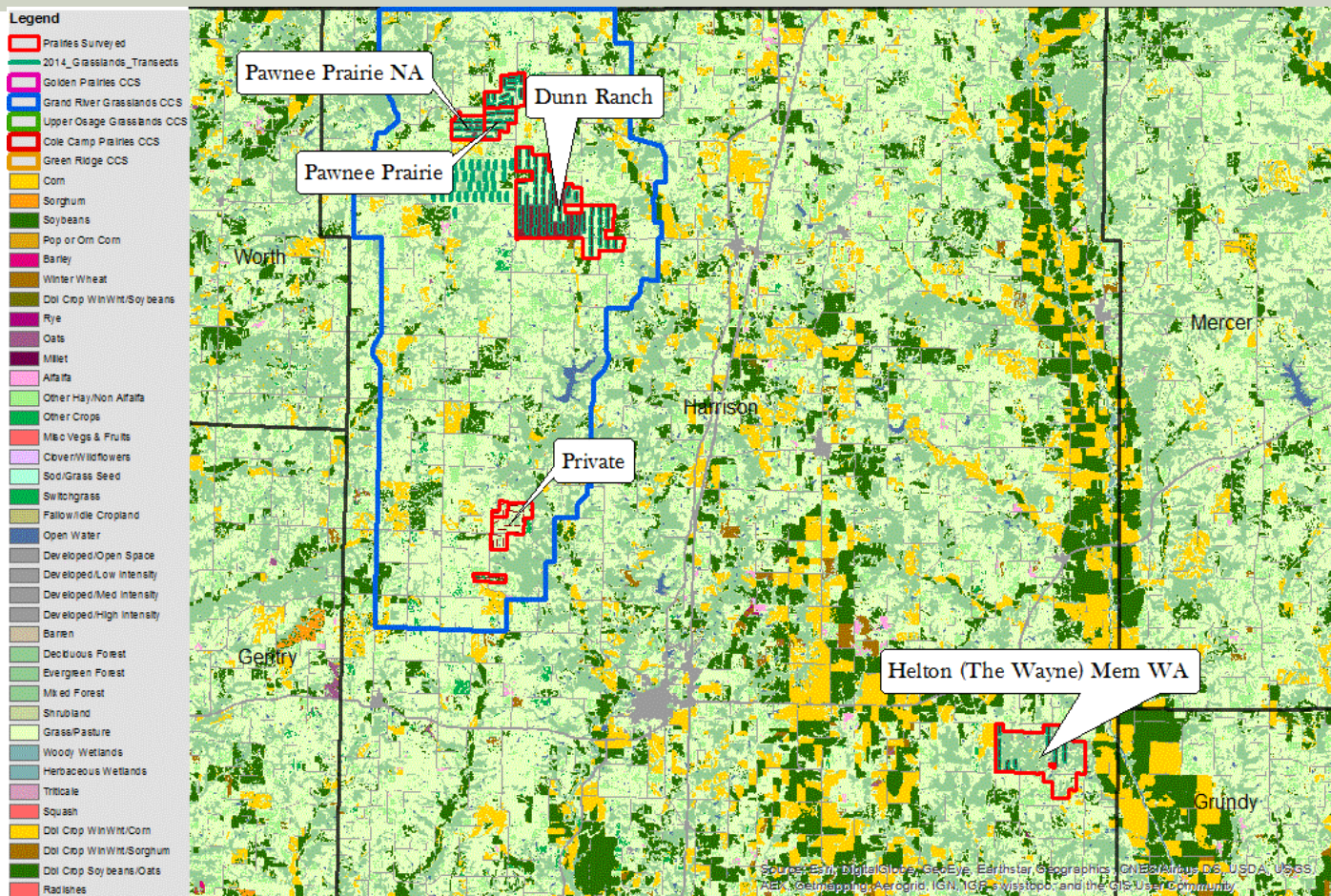
Innovation in data collection and sharing has brought us to a new age in conservation based on timely and significant findings, which make sense to those managing land at the property level in concert with those strategizing at the landscape habitat and bird population level. Data is now housed by MRBO in a singular location and cloud enabled. Data collection of birds, habitat, and management variable is stored in one location and can be served from there in map or tabular format. This is an extreme timesaving factor in terms of data collection and data sharing. The online map and data structure developed by MRBO houses habitat and management action data as well as bird data, which may be overlaid as layers in map form by collaborators in real-time as data is entered.



A Henslow's Sparrow at the Missouri Prairie Foundation's Coyne-Pennsylvania-Welch site.

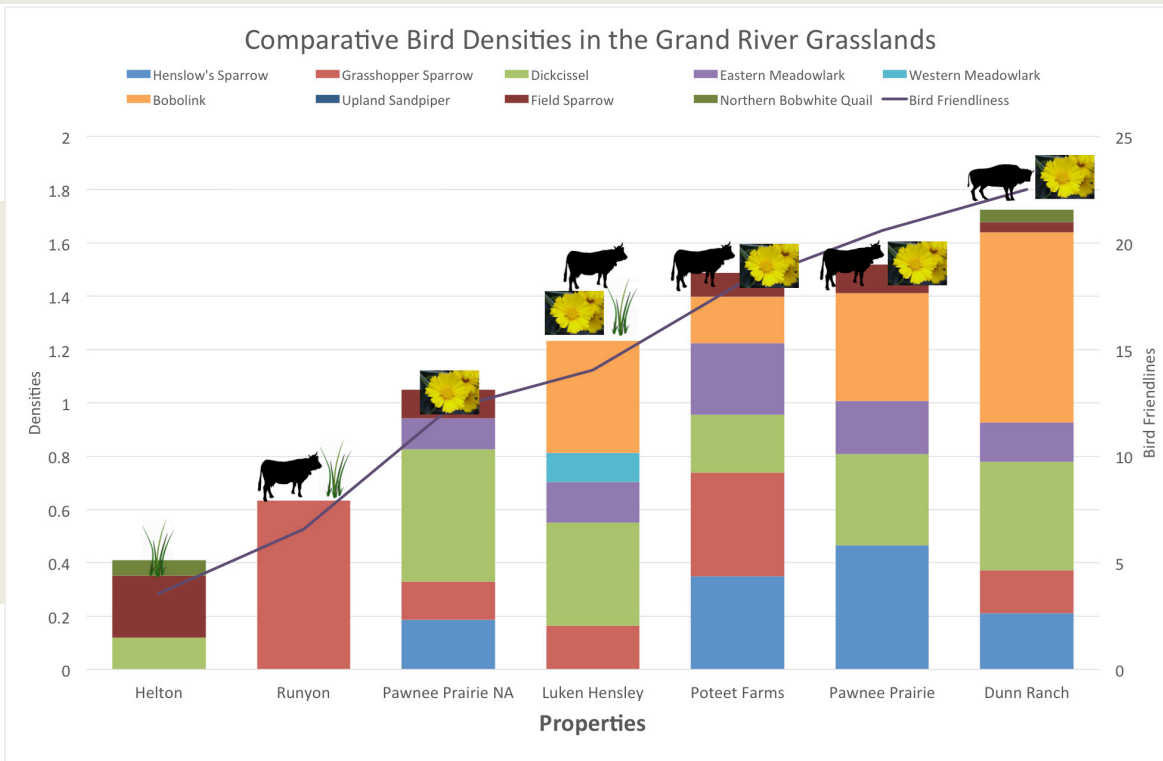
Photo by: Nic Salick

GRAND RIVER GRASSLANDS CCS



above: Property locations within the Grand River Grasslands CCS and land use overlay (USDA 2014). This geography has relatively little intensive crop production as compared to the surrounding landscape and that of other focus regions.

right: 2015 prairie bird densities (columns) and bird-friendliness score (line) calculated for each property in the Grand River Grasslands,



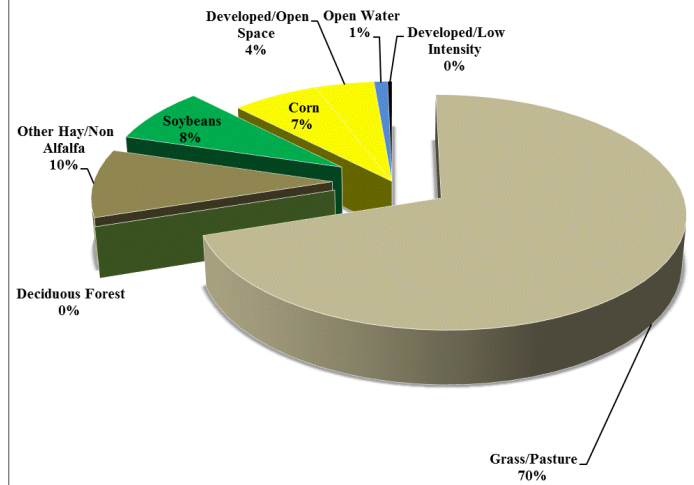
The Grand River Grasslands (GRG) is located in Harrison County on the western edge of the once vast Central Plains ecological region. It is defined by dry-mesic loess/glacial till prairies that once encompassed millions of acres across northern Missouri. This prairie type is characterized by wide ridges with moderate slopes and vegetation that ranges from 3-6 feet. (Nelson et.al. 2010).

Intensive agricultural practices combined with overgrazing and woody encroachment have severely compromised this habitat. The CCS now comprises roughly 87,000 acres of northern Missouri's critical habitat for prairie birds. Fortunately, many of the landowners in this area value conservation. The vision to restore and maintain the integrity of this landscape is possible. Seventy percent (approximately 48,000 acres) of the CCS is comprised of pasture and grassland of varying quality and 15 percent is in some form of crop production. Anchored by The Nature Conservancy's (TNC) nearly 4,000 acre **Dunn Ranch**, the GRG is made up of several thousand acres with which the MDC assists private landowners. Additionally, the MDC manages 1,000 acres of public prairie. Iowa conservationists also have recognized the importance of this landscape, adding to its scope beyond state political boundaries.

Since 2012, MRBO has surveyed 9,829 acres of the GRG. This geography is of particular importance to species of prairie-obligate birds such as Greater-prairie Chicken, Northern Bobwhite Quail, Henslow's Sparrow, and Bobolink. Greater-Prairie Chickens populations are decimated and by default any region they occupy warrants a high degree of attention.

Current consensus, based on Breeding Bird Surveys since 1967 (Sauer et.al. 2014) and other regional records indicate that Missouri's core breeding range and source population of the Henslow's Sparrow is located in north-central part of the state. Other pockets exist through western Missouri, but not to

Grand River Grasslands Landuse Acres (thousands)



above: Land use in the Grand River Grasslands (USDA 2014). Approximately Seventy percent of the land is some form of grassland. Even though this includes fescue or other non-native grasses this chart underscores the potential for improved habitat for grassland obligate species,

Bobolink density was 0.714/acre and translated into an estimated abundance of 2,637 individuals.

Examining density standardizes for size when comparing large and small properties; while this site demonstrated highest density for some target species it was among the top 25% for nearly all. Additionally, when calculating densities of the combined grassland obligate species Dunn Ranch was fourth highest among all sites (density=1.64 grassland obligates/acre).

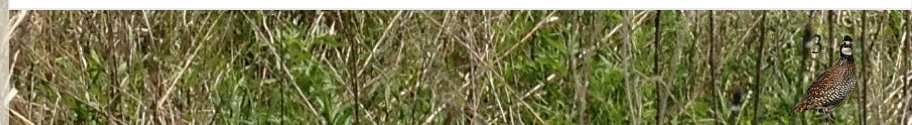
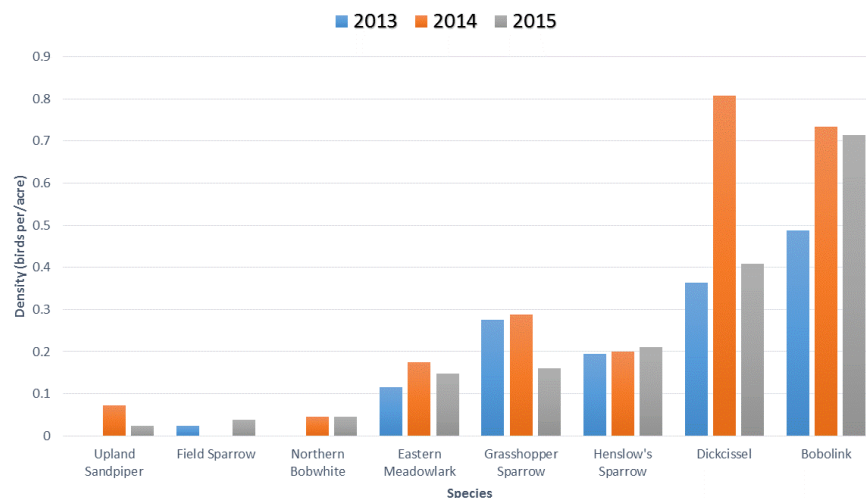
The adjacent **Pawnee Prairie CA**, with portions owned by the



right: Densities (birds per/acre) of grassland obligate species at Dunn Ranch from 2013 to 2015. Grassland obligate species across the state experienced a boom year in 2014. Note that 2015 densities are on par with or slightly increased from 2013.

Photo: Bison on Dunn Ranch

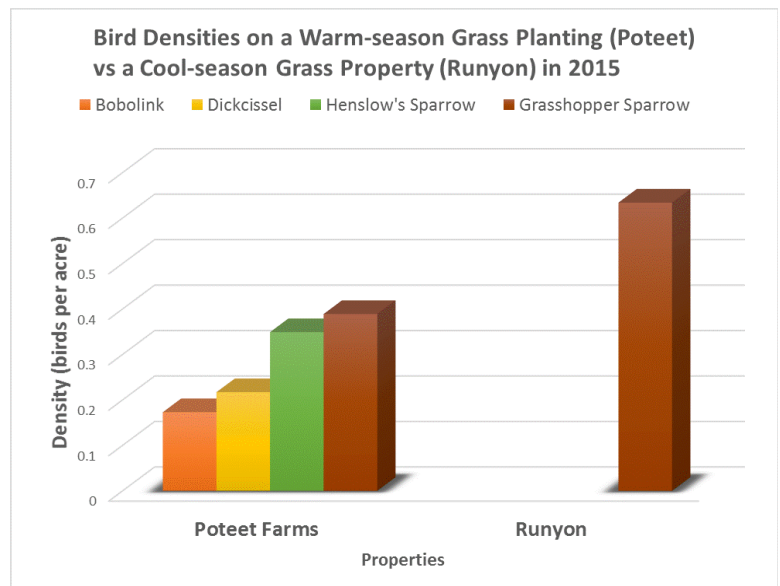
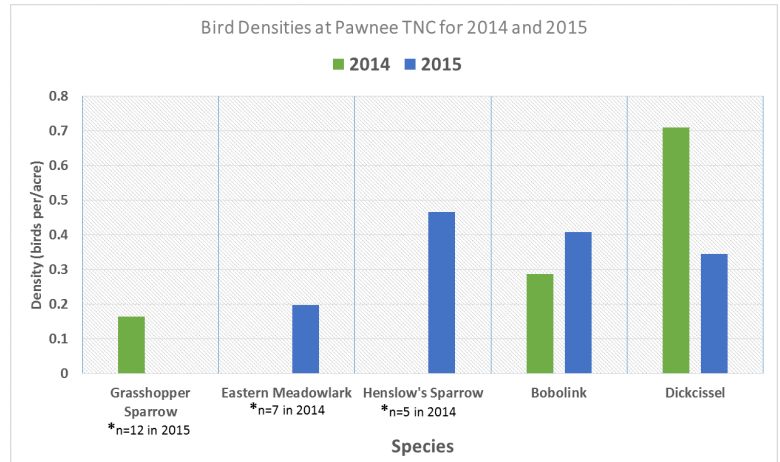
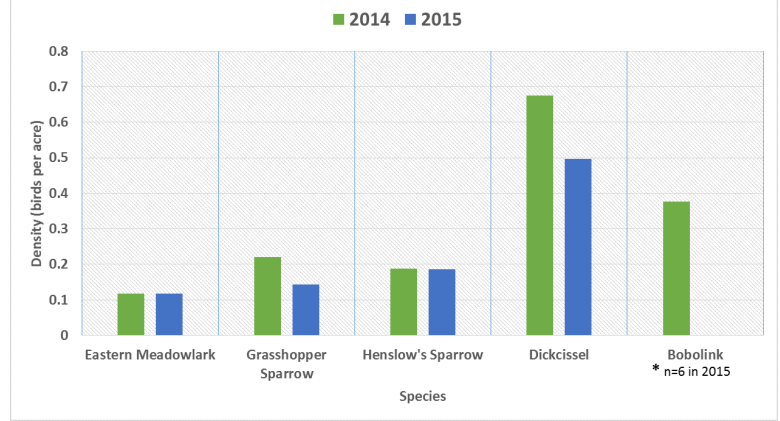
Bird Densities at Dunn Ranch 2013-2015



Nature Conservancy and the MDC, scored similarly to Dunn Ranch in terms of bird-friendliness (see chart), followed closely by a few private properties. **Pawnee Prairie** is dominated by forbs and native grasses, Grassland obligate density on this property ranked among our top ten sites (1.55 grassland obligates/acre). Additionally, during subsequent surveys 14 Greater Prairie-chickens were detected during a post breeding season visit. Dickcissels and Eastern Meadowlarks occurred in similar numbers on both MDC and TNC sections. Henslow's Sparrows were found in greater numbers on the MDC owned section, while Bobolinks on the TNC section outnumbered those on the MDC portion. Sedge Wrens, only detected within the Grand River Grasslands, were present on this property.

Although not within the GRG boundary, **Helton Prairie CA** shares geographic and ecological characteristics that warrant it suitable for comparison purposes. Old fields and woodlots with a minor component of grasslands and cropland dominate this CA. The northwest corner of the property is a native untillied prairie; native grasses and forbs were plentiful and tall in that area. Currently undergoing intensive restorations, grasslands will be more abundant in years to come. Much of **Helton CA** had components of woody vegetation ranging from scattered and dense shrubs to forested stands. Northern Bobwhite Quail and Field Sparrows that rely on a shrub component were abundant on this site. Additional shrub species; Bell's Vireo and Yellow-breasted Chat, also occurred.

Two private tracts in the GRG were part of this year's surveys, Poteet Farms and Runyon. Poteet Farms is a 670-acre property upon which Private Lands Conservationist Kendall Coleman oversaw a warm-season grass planting. The area of native planting helped support a diverse suite of grassland obligates in high densities. Overall, the property had one of the highest densities of grassland obligate birds of all private properties surveyed, with 1.464 birds per acre. It also had the second highest amount of Grasshopper Sparrows recorded on any property. The Runyon property, comprised mainly of cool-season grasses, was surveyed as a comparison. This 109-acre piece supported generalist species in low densities and Henslow's Sparrows were absent.



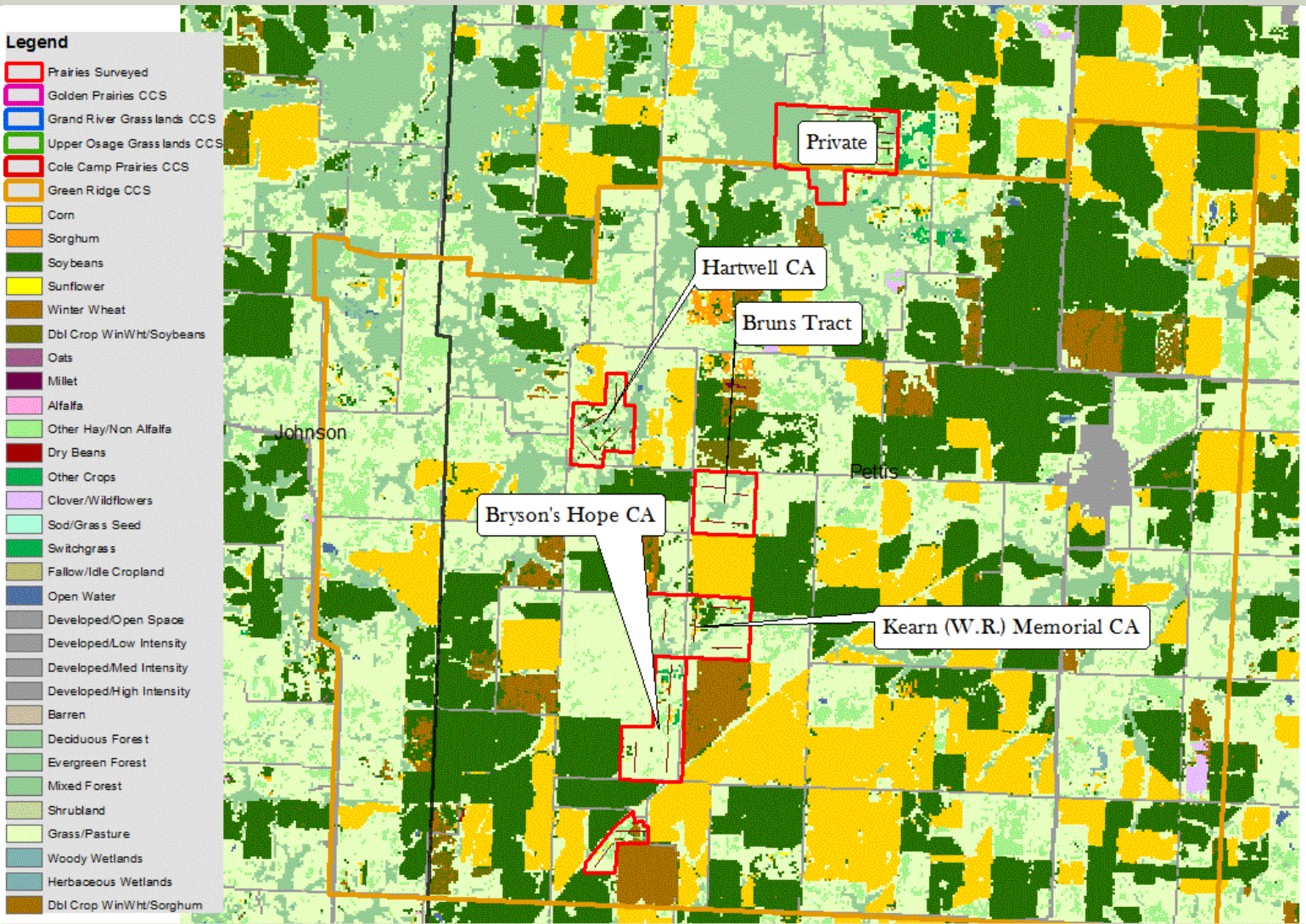
top: Densities (birds per/acre) of grassland obligate species at Pawnee Natural Area (NA) in 2014 and 2015.

middle: Densities (birds per/acre) of grassland obligate species at Pawnee (TNC) in 2014 and 2015.

***For some species sample sizes were to low for density estimates**

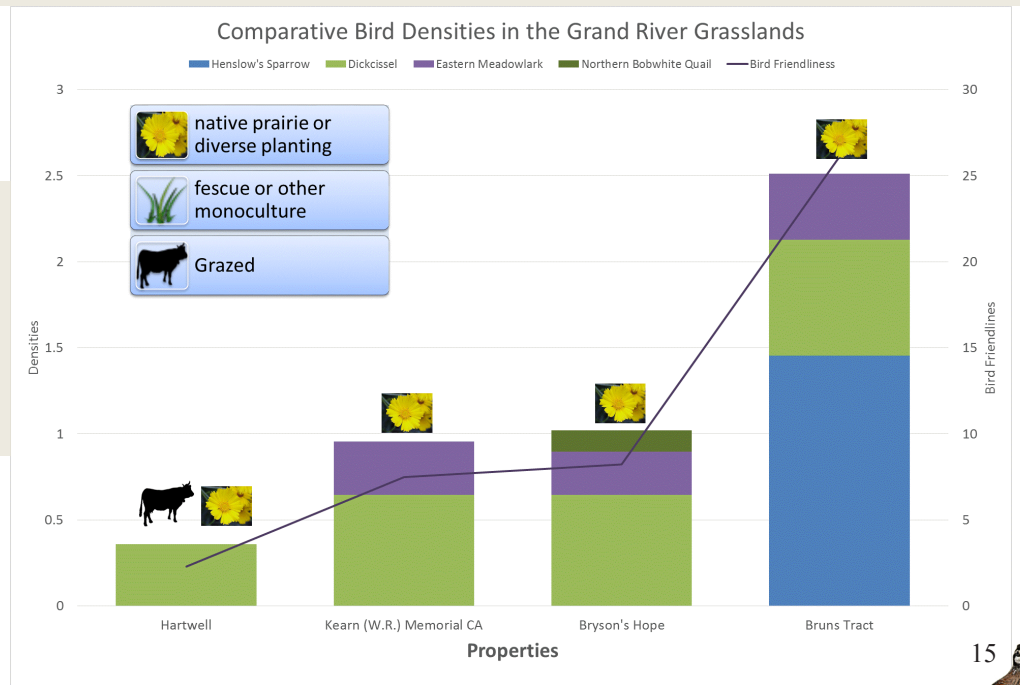
bottom: Densities (birds per/acre) of grassland obligate species on private lands with a warm-season planting (Poteet Farms) and a cool-seasons grasses (Runyon).

GREENRIDGE FOCUS AREA



above: Property locations within the Green Ridge Prairies Focus Area and land use overlay (USDA 2014). A large portion of this area boundary was derived from Quail by Quail emphasis teams.

right: 2015 prairie bird densities (columns) and bird-friendliness score (line) calculated for each property in the Green Ridge Prairies.

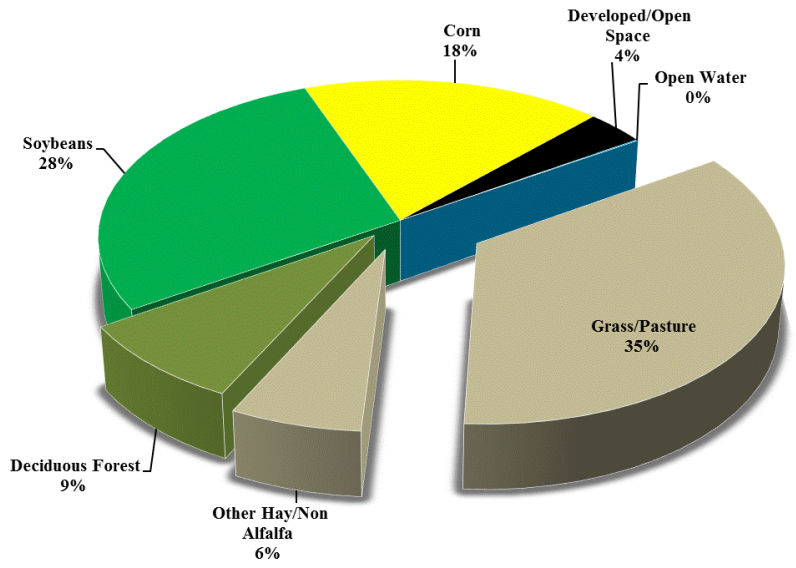


Quail emphasis teams recently developed the Green Ridge Prairies boundaries as no boundaries existed previously. The focus area comprises roughly 126,000 acres of land, within which the Missouri Prairie Foundation (MPF) acquisitions in concert with MDC management has resulted in some successes on private and public lands. These areas, mainly comprised of dry-mesic chert prairies, now hold critical habitat for prairie obligate birds in the region. Of this 27,000-acre geography, roughly 10,000 acres of potential grassland habitat remains. Over fifty percent of the area is either cropped or is forested.

As part of this 2015 monitoring effort, we surveyed the *Bruns Tract CA*, *Bryson's Hope CA*, *Kearn (W.R.) Memorial CA*, and *Hartwell CA*. One of the most important areas for grassland birds, *The Bruns Tract*, is 160-acre prairie owned by MPF. It is a converted crop field enrolled in the Conservation Reserve Program's (CRP) Practice 25— Restoration and Management of a Declining Habitat (moprairie.org). It is now comprised mostly of warm season grasses. A prescribed burn was conducted and successfully thinned much of the understory vegetation. However, the extremely wet spring of 2015 afforded a quick rebound of thickness and structure. Henslow's Sparrows were found on this property in the highest density of any site surveyed in 2015 (1.45 birds per acre). Despite being one of the ten smallest properties, it had the sixth most detections of this species of all properties surveyed. This large occupancy of a bird with a high conservation value contributed its high density of grassland obligate birds in 2015 with 2.866 birds per acre.

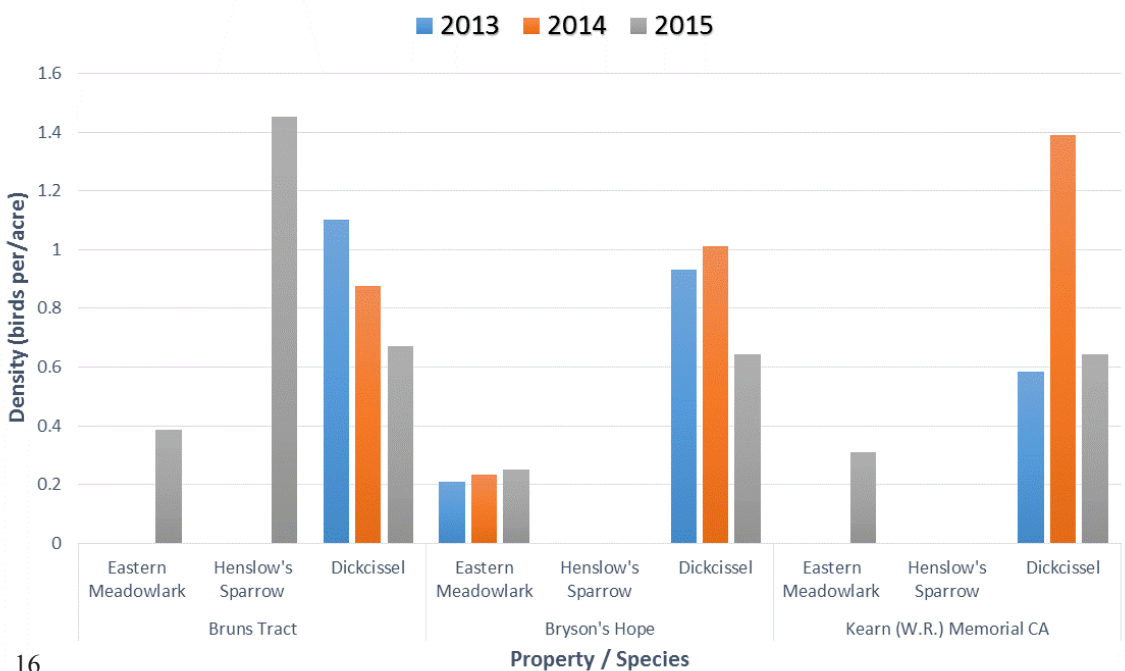
Bryson's Hope CA is a 295-acre converted grassland. Henslow's Sparrow, and Bell's Vireo were detected during the surveys, while Grasshopper Sparrow and Upland Sandpiper were observed outside of the survey window. Most notably, a pair of Short-eared Owls with young were observed on the property. This species is normally only seen in Missouri during the fall and winter. The presence of these owls during the breeding season is one of very few ever in this state and the first confirmed successful breeding. *Hartwell CA* is a 163-acre, warm and cool-season grass dominated site with cattle.

Green Ridge Prairies Landuse



above: Land use in the Green Ridge Prairies CCS (USDA 2014). Approximately forty percent of the land is some form of grassland. This includes fescue or other non-native grasses that do not support viable populations of grassland obligate species.

Bird Densities on Green Ridge CCS for 2014 and 2015



left: Comparative bird densities by species across years (2013-2015) where sample sizes afforded estimates. The general decrease in densities from 2014 was a state-wide trend.

Five target species were detected; Dickcissel, Henslow’s Sparrow, Eastern Meadowlark, Northern Bobwhite Quail, and a lone Bell’s Vireo. Among the three years this site has been surveyed as part of this project, Henslow’s Sparrow and Dickcissel have been the most commonly observed of those species. The scattered bushes and trees and primary woody draw on the property create cover for both Northern Bobwhites and Bell’s Vireo.

Adjacent to Bryon’s Hope CA, the 283-acre *W.R. Karn Memorial CA* supported nearly all target species in low densities with the exception of an abundance of Eastern Meadowlarks.

- More Meadowlarks (n=19) were recorded in 2015 than in any of the previous two years of surveys at the site.
- Additionally, a Northern Harrier and a Bobolink were detected. Northern Harriers are of conservation concern as they are an increasingly rare find on Missouri’s grasslands during the breeding season.
- The Bobolink was the only individual detected outside of the Grand River Grasslands during breeding season.



above: 2013-2015 distributions of Henslow’s Sparrows on Hartwell CA. Although this tract is too small to generate density estimates, area managers can note the location of occurrences of birds in response to management, such as grazing in the example here.



Short-eared Owls, were documented on Bryon’s Hope CA during breeding season. Two adults and a juvenile were seen. Although anecdotal reports exist of this species occurring during breeding season, no records exist confirming this species breeding in Missouri until now.

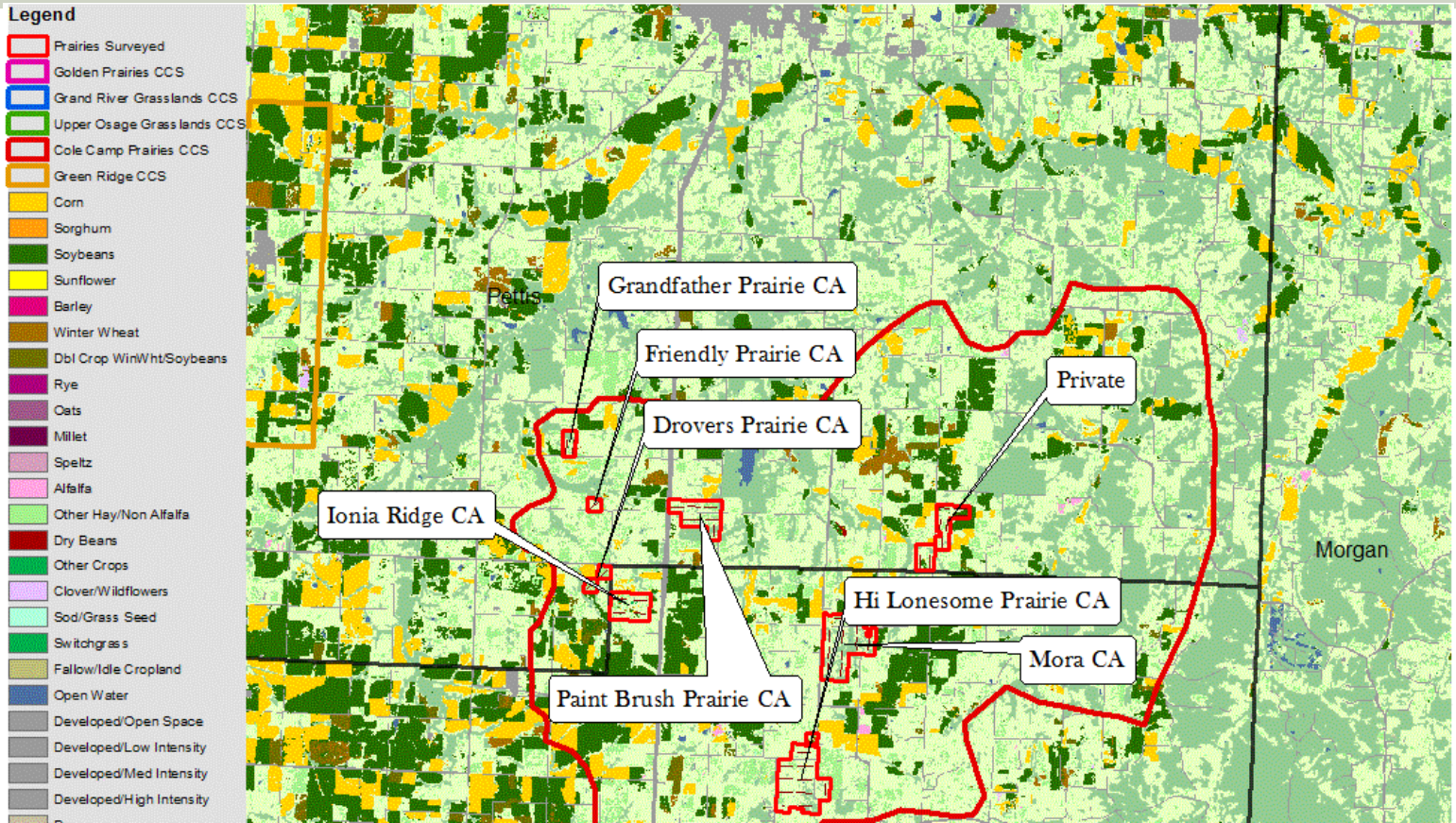
photo by: Dana Ripper

A Henslow’s Sparrow perches to broadcast its faint song of a prairie in Missouri. The Bruns Tract in the Green Ridge Prairies hosted more of this species and at greater densities than any other other site in the state.

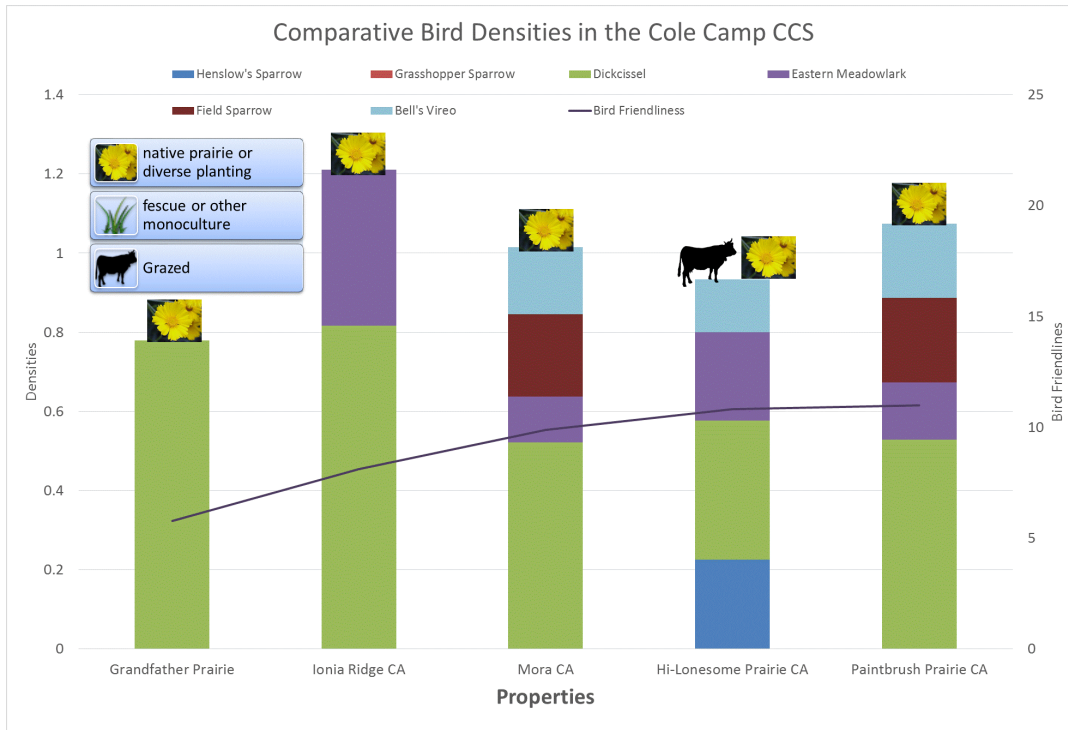
photo by: Nic Salick



COLE CAMP PRAIRIES FOCUS AREA



above: land use in the Cole Camp Prairies CCS and land use overlay (USDA 2014). A large portion of this CCS has become wooded.



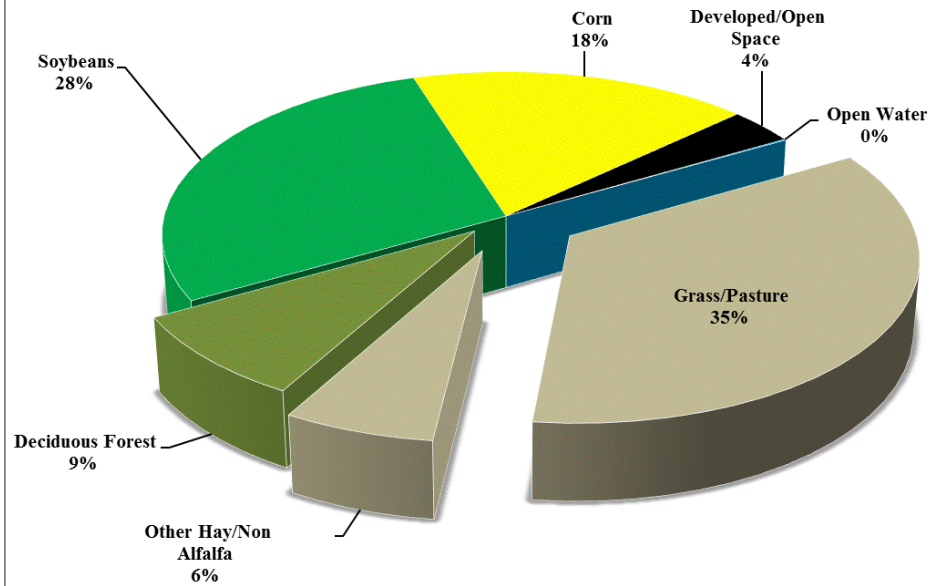
left: 2015 2015 prairie bird densities (columns) and bird-friendliness score (line) calculated for each property in the Cole Camp Prairies CCS.

The Cole Camp Prairie COAs located in southern Pettis and northern Benton Counties on the eastern edge of the Osage Plains. Nearly all of this geography is comprised of dry-mesic chert prairie (Nelson et. al. 2010). In recent history, Greater-Prairie Chicken lek sites have been abandoned here as they have elsewhere across the state. This is primarily due to loss of suitable habitat and fragmentation within the entire landscape. The National Audubon Society has designated portions of this landscape as an Important Bird Area (IBA).

The geography comprises roughly 63,000 acres of land, of which more than 12,000 has been converted to corn and soybean crops while 30,000 acres remains in some form of pasture or grassland. Roughly six percent of the area is managed primarily for wildlife. A few publicly managed prairies anchor the remaining prairie landscape, including lands owned by the Missouri Prairie Foundation (*Drover's and Friendly Prairies*). Other key properties include *Paint Brush Prairie CA, Ionia Ridge CA, Mora CA, and Hi-Lonesome CA*.

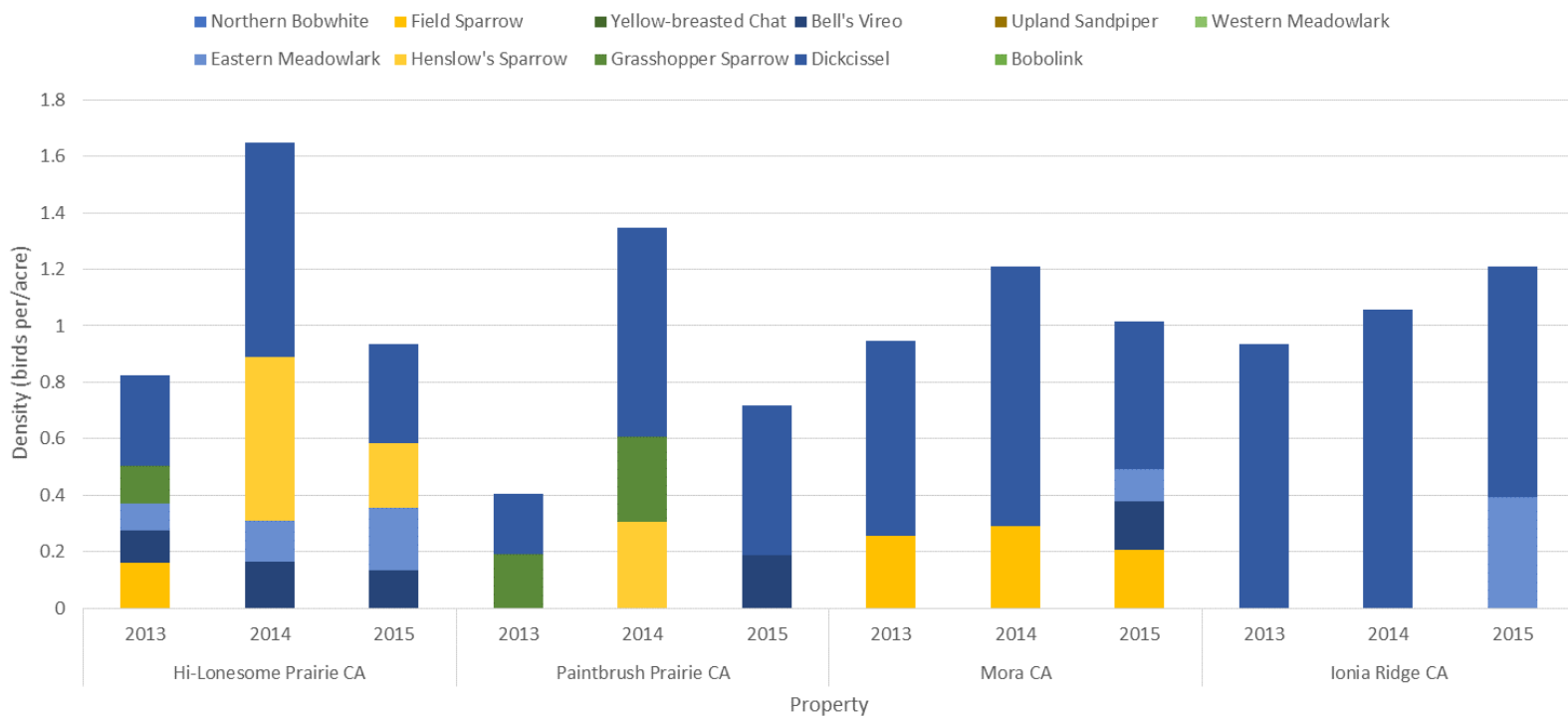
This region is of particular importance to species of prairie-obligate birds such as

Cole Camp Prairies Landuse



above: Land use in the Cole Camp Prairies CCS (USDA 2014). Approximately thirty-five percent of the land is some form of grassland. This includes fescue or other non-native grasses that do not support viable populations of grassland obligate species.

2015 Species Densities and Bird-friendliness Score by Property in the Cole Camp Prairies



above: Comparative bird densities by property across years (2013-2015) where sample sizes afforded estimates. The general decrease in densities from 2014 was a state-wide trend.

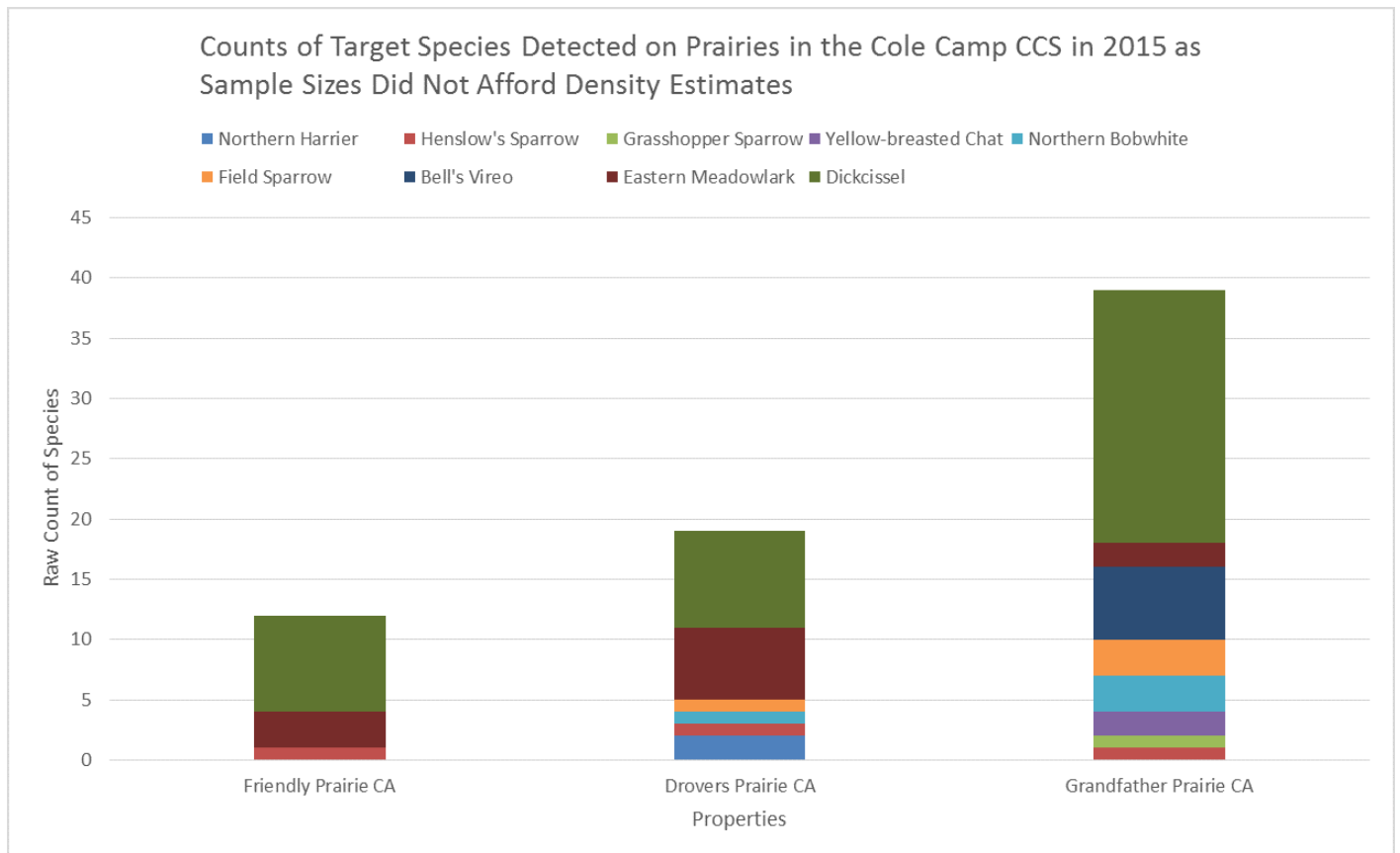
Northern Bobwhite Quail, Dickcissel, Grasshopper, and Henslow’s Sparrows.

Since 2012, MRBO has surveyed 2,300 acres of the Cole Camp area. *Hi-lonesome Prairie CA* is also one of the sites being examined in conjunction with RSD’s 15-year study on the effects of patch-burn grazing.

MRBO has conducted a variety of research and monitoring the Cole Camp focus area since 2010. These studies include fine-scale research in breeding season on the Monitoring Avian Productivity and Survivorship (MAPS) program as well as spring and fall migration monitoring. MAPS study sites have included *Ionia Ridge Prairie CA, Paintbrush Prairie CA, and Grandfather Prairie CA. Migration studies have focused on Mora CA and the Bruns Tract* of the Green Ridge.

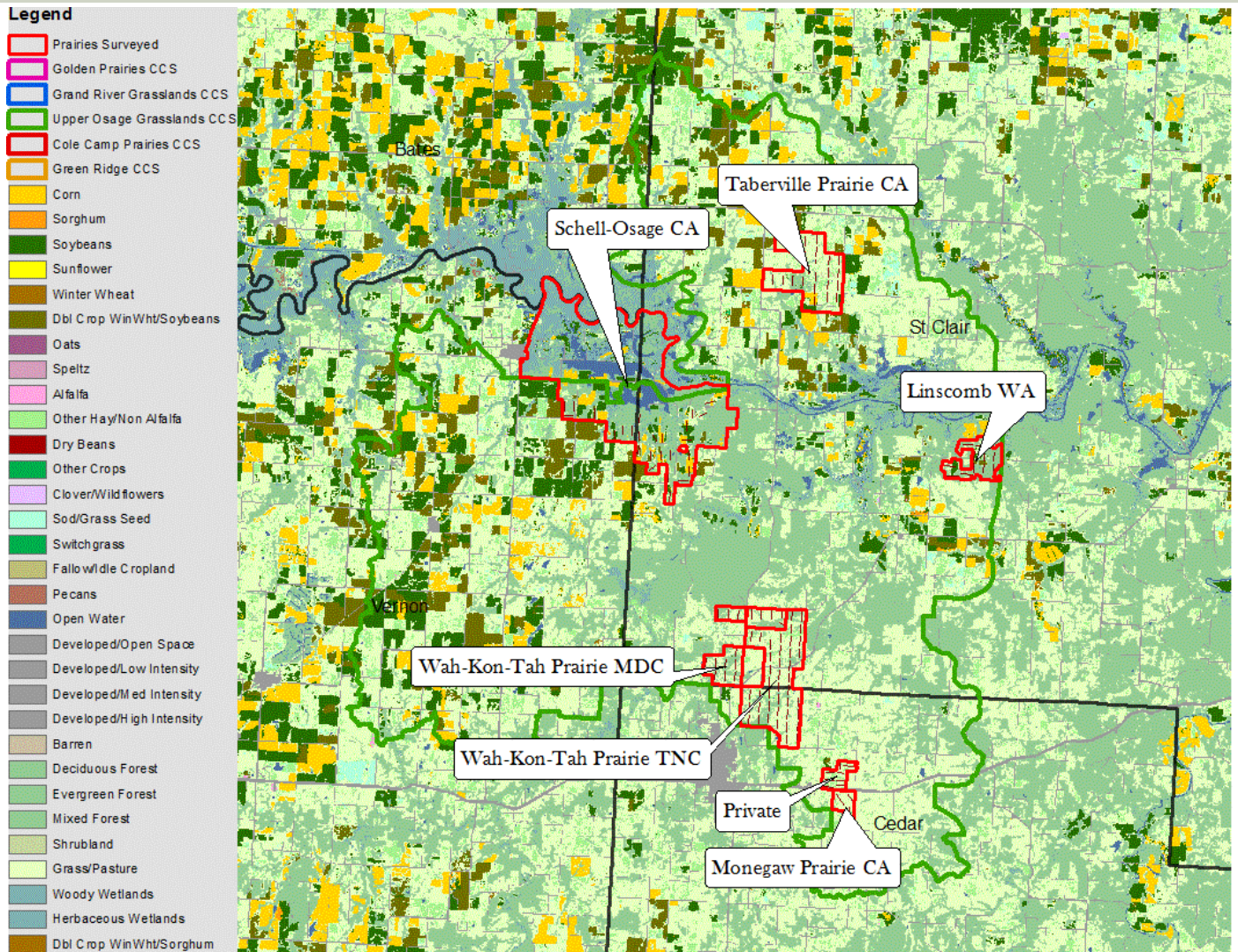
There was very little difference in bird-friendliness across the Cole Camp Prairies, as the range in scores being from **5.79** at the 80-acre *Grandfather Prairie CA* to **11** at *Paint Brush Prairie CA*. Bell’s Vireos and Field Sparrows contributed largely to the Paint Brush Prairie and *Mora CA (9.89)* scores. The traditional management of Paint Brush Prairie CA consisted of annual haying has changed considerably over the years, resulting in higher plant diversity, including the restoration of Mead’s Milkweed. The 649-acre *Hi-Lonesome Prairie CA*, which supported Greater-Prairie Chickens in the last decade, scored **10.89** in bird-friendliness. *Ionia Ridge CA* scored **8.11** and held the highest density of Eastern Meadowlarks of all the grassland properties surveyed in 2015 (.348 Meadowlarks per acre). A high density of Dickcissel also contributed greatly to its score (see chart on page 17).

Smaller, proximate properties contributed to the Cole Camp Prairies landscape as well, but were not large enough to provide sample sizes that yield density estimates. Raw counts of birds can be seen in the chart below. These properties include *Friendly Prairie CA, Drover’s Prairie CA, and Grandfather Prairie CA. Friendly Prairie CA* is a 39-acre prairie owned by the Missouri Prairie Foundation (MPF). MDC and MPF jointly owned *Drover’s Prairie CA*, consists of 78 acres: two diagonally connected 40-acre plots. The 81-acre *Grandfather Prairie CA* has been studied by MRBO as part of the Monitoring Avian Productivity and Survivorship (MAPS) program since 2012. Although different protocols are employed for that project, we have seen several changes take place in the bird community in recent years. In 2013, the Missouri Prairie foundation was contracted through a Wildlife Diversity Grant to conduct invasive species and woody removal. Grassland bird numbers increased at *Grandfather Prairie CA* shortly thereafter.



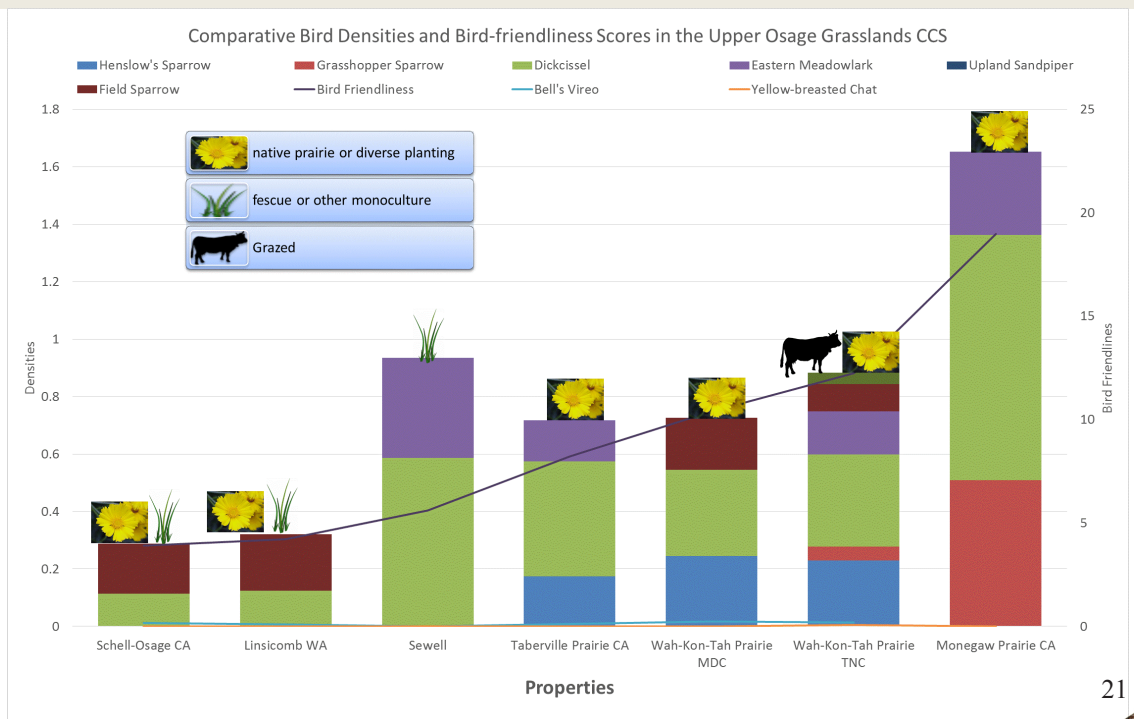
above: 2015 prairie bird counts in the Cole Camp Prairies on properties which were too small to afford sample sizes requisite for density estimates. Note: the counts above do not include all birds observed, only birds detected on transect.

UPPER OSAGE GRASSLANDS CCS



above: Property locations within the Upper Osage Grasslands CCS and land use overlay (USDA 2014).

left: 2015 prairie bird densities (columns) and bird-friendliness score (line) calculated for each property in the Upper Osage Grasslands CCS.



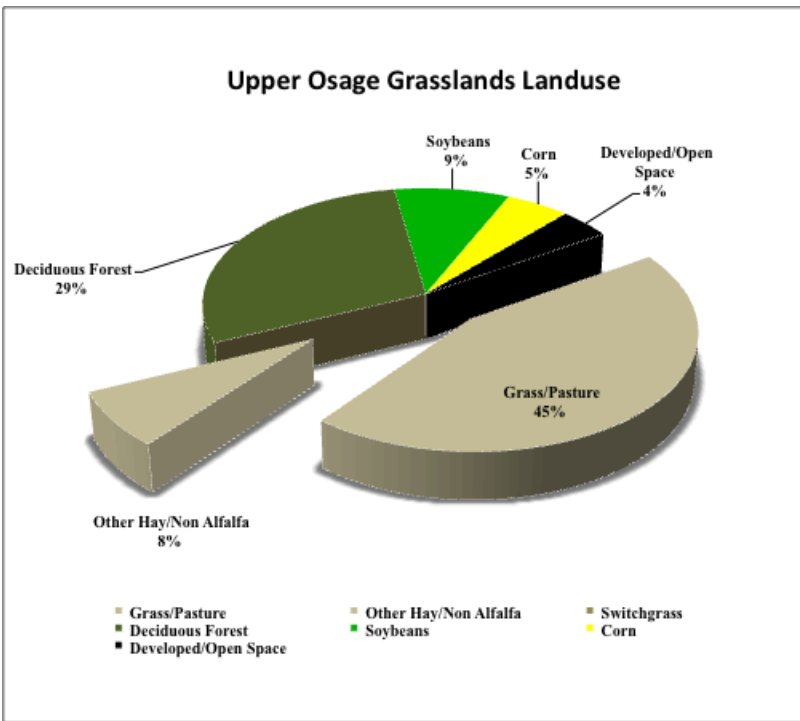
The Upper Osage Grasslands (UOG) CCS is a 126,000-acre region located in Cedar, St. Clair, and Vernon Counties on the edge of the Osage Plains and Ozark Highlands ecological boundary. Main prairie types are dry-mesic sandstone/shale on properties like *Schell-Osage CA*, and dry-mesic chert (Nelson et. al. 2010). Anchored by large tracts of public lands with high-quality prairie — *Wah-Kon-Tah CA* and *Taberville Prairie CA* — over fifty percent of this CCS is made up of grassland of varying value to birds. The greatest threat to prairie bird habitat in this region is woody encroachment and reforestation. This region is of particular importance to species of prairie-obligate birds such as Greater-prairie Chicken, Northern Bobwhite Quail, and Grasshopper and Henslow’s Sparrows. Greater-Prairie Chicken populations are low throughout Missouri and thus conservation of this landscape is paramount to the survival of the Greater-prairie Chicken in Missouri.

Since 2012, MRBO has surveyed 16,625 acres of the UOG region. Currently, two of the five sites in this region, *Wah-Kon-Tah Prairie CA* and *Taberville Prairie CA*, are part of RSD’s 15-year study on the effects of patch-burn grazing at two of the five sites in this study region, *Taberville and Wah-Kon-Tah Prairie CAs* (see page 8).

Restorations

MRBO is monitoring bird response to intensive prairie restoration work at *Schell-Osage CA* and *Linscomb WA*. Remnant high-quality prairie ecotypes are found throughout *Linscomb WA*. Current restoration that is underway includes tree removal and native grass planting. This area also contains woodlands, which are maintained as mature timber stands. Woodland birds detected included various Flycatchers, Woodpeckers, Wood Warblers, and Wood Thrush. Late-successional habitat at Linscomb WA hosts Blue-winged Warblers.

Crop are planted throughout the southern areas of the area. Only one bird detection was made in these cornfields. On the restored portions, densities for Bell’s Vireos and Dickcissels increased.



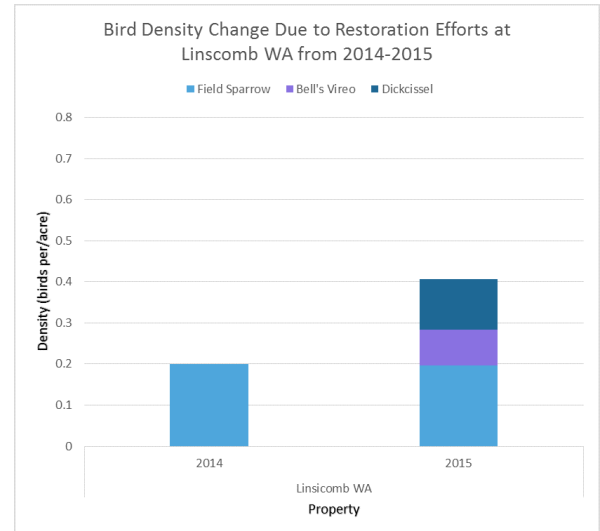
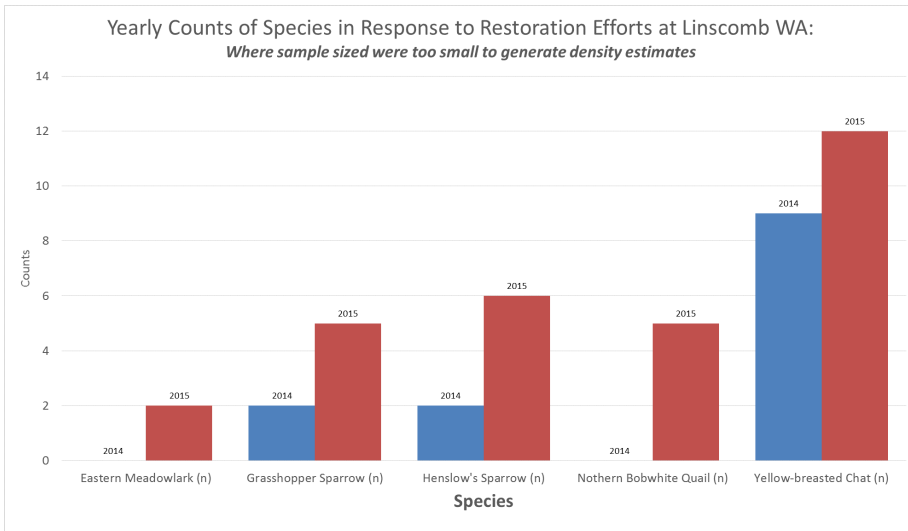
above: Land use in the Upper Osage Grasslands CCS (USDA 2014). Approximately fifty percent of the land is some form of grassland. This includes fescue or other non-native grasses that do not support viable populations of grassland obligate species. Woody encroachment and forestation is the greatest contributor to habitat loss.

Similarly, counts of Henslow’s Sparrow and Northern Bobwhite increased (see charts).

Five different areas throughout *Schell-Osage CA* are actively undergoing major prairie restoration efforts to set woodland succession back and promote the prairie community that historically



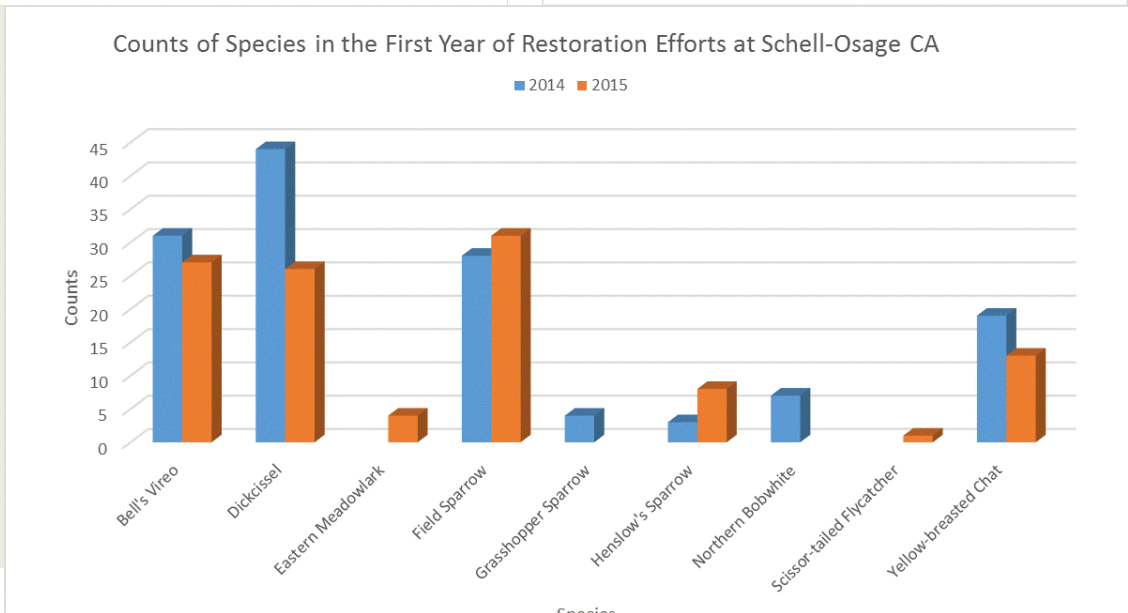
Restorations: Two properties within the Upper Osage CCS (above) are being monitored in order to document bird response to prairie restoration efforts. Linscomb WA has recently undergone native plantings as well as woody removal. Schell-Osage has undergone intensive woody removal as well as planting. Grassland obligate birds have responded positively to management at both sites, albeit the benefits of prairie habitat regeneration will increase significance time.



above left: Yearly species counts during restorations at Linscomb WA, where sample sizes were too small to generate density estimates.

above right: Yearly species density estimates during restorations at Linscomb WA.

right: Counts of birds within Schell-Osage CA units, indicating early response to prairie efforts.



occurred there. Preliminary findings show Dickcissels and Eastern Meadowlarks already taking advantage of this new habitat (**above right**). A comparison map for Dickcissels is available at <https://mrbo.maps.arcgis.com>.

Monegaw Prairie CA, a small, early MDC acquisition, was surveyed for the first time in 2015. A wildfire ran through the property in 2014 and the native prairie response resulted a bird-friendliness score of **18.98**, the highest for the region. The neighboring private property, **Sewell**, had a bird-friendliness score of **5.6**. The **Sewell** property has been noted to host Greater-prairie Chickens in its small section with native vegetation. The majority of the property consists of planted fescue with minor components of clover. While the overall fescue landscape had little structural diversity, the property held high densities of Dickcissel, and Eastern Meadowlark. A few Grasshopper and Henslow's Sparrows were detected.

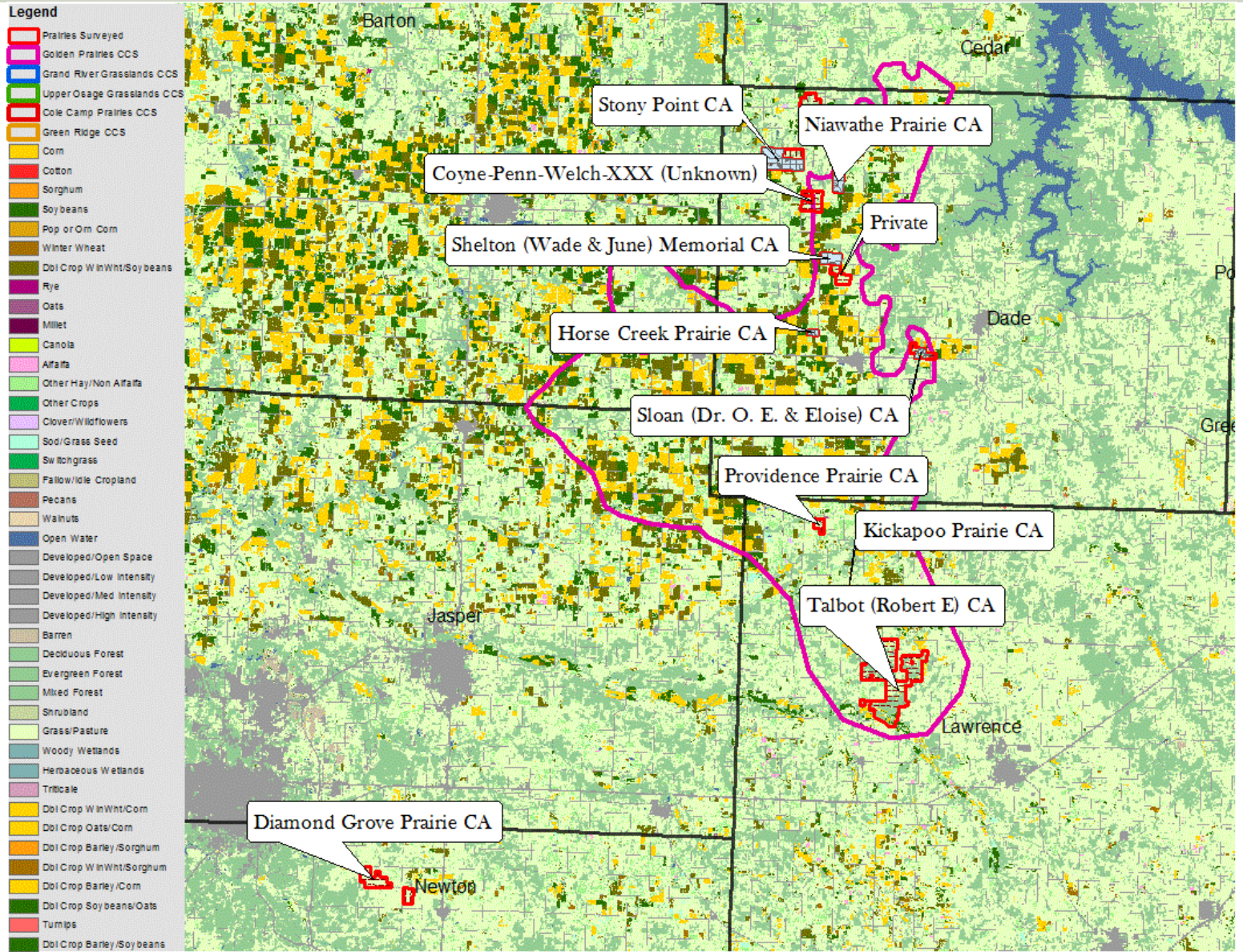
Owned and managed by both the MDC and The Nature Conservancy (TNC), **Wah-Kon-Tah Prairie CA** and **Wah-Kon-Tah Prairie TNC** scored similarly in bird-friendliness (**12.23** and **10.39**, respectively) and are collectively one of the largest public grasslands in Missouri with over 2,700 acres. TNC's

Wah-Kon-Tah Prairie CA supported high densities of Henslow's Sparrows, but comparatively fewer Grasshopper Sparrows. Bell's Vireo, a shrub-dwelling grassland obligate, were seen in their greatest numbers here. **Wah-Kon-Tah Prairie CA** detections of Henslow's Sparrows (n=132) were second only to that of the larger Dunn Ranch (n=133, .229 per acre). While Henslow's Sparrows were abundant, Grasshopper Sparrows (0.049 per acre) were less common. Also of note, seven Greater Prairie-chickens were detected. Nearby **Taberville Prairie CA** ranked a close third to the **Wah-Kon-Tah Prairie CA** tracts with a score of **8.21**.

“As a prairie manager my goal to provide a variety of vegetation structure and diversity in a mosaic across the prairie so that as many plant and animals species as possible can find a place to thrive. Monitoring certain suites of species is a way we can evaluate past management and adjust management in the future.”

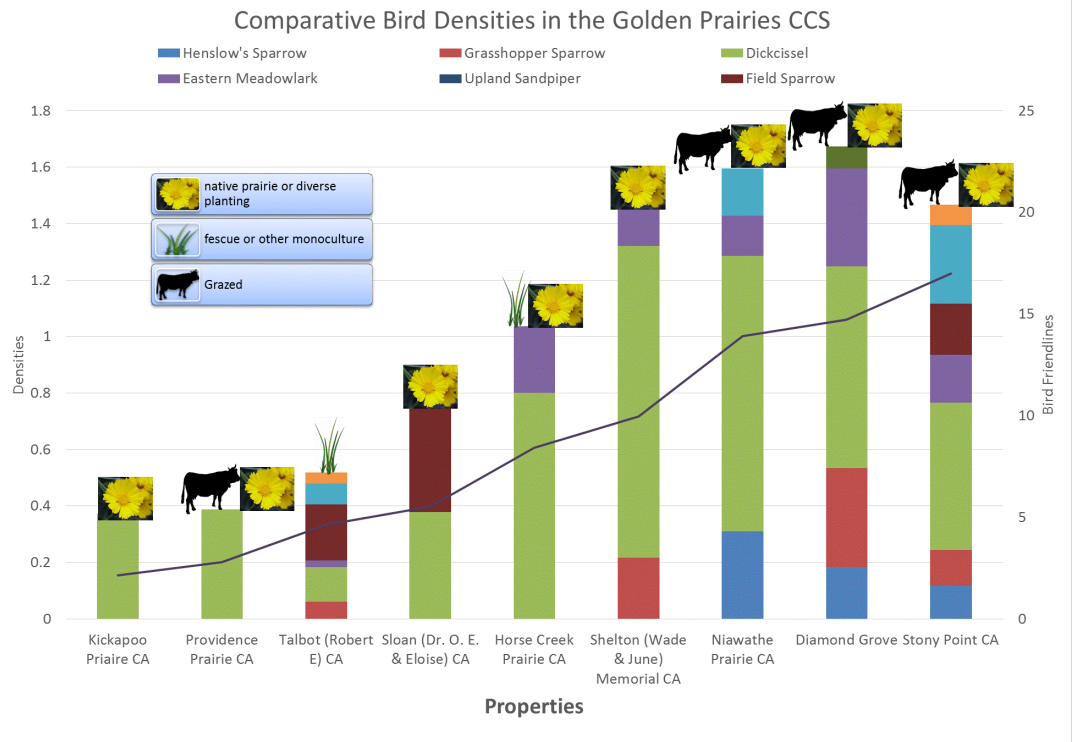
~Matt Hill

GOLDEN PRAIRIE FOCUS AREA



above: Property locations within the Golden Prairies Focus Area and land use overlay (USDA 2014).

right: 2015 prairie bird densities (columns) and bird-friendliness score (line) calculated for each property in Golden Prairies Focus Area.



The Golden Prairies (GP) CCS is 188,000-acre region located in Jasper, Dade, Lawrence, and Barton Counties on the western edge of the Ozark Highlands ecological boundary. Stony Point CA and the Missouri Prairie Foundation's (MPF) "Coyne-Pennsylvania-Welch" tracts fall just inside of the Osage Plains. A mosaic of varying prairie types ranging from prairie swale to dry-mesic sandstone/shale, dry-mesic chert, and even hardpan prairies defines it (Nelson et. al. 2010). Near GP and within the same landscape, the 861-acre Diamond Grove Prairie CA of Newton County is technically within the Ozark Prairie CCS (otherwise not surveyed by MRBO in 2015). In comparison to the Golden Prairies, Ozark Prairie had a larger savanna component. Historically, this region contained small stands of post, black, and blackjack oaks. We surveyed nine public properties and one private property in GP in 2015.

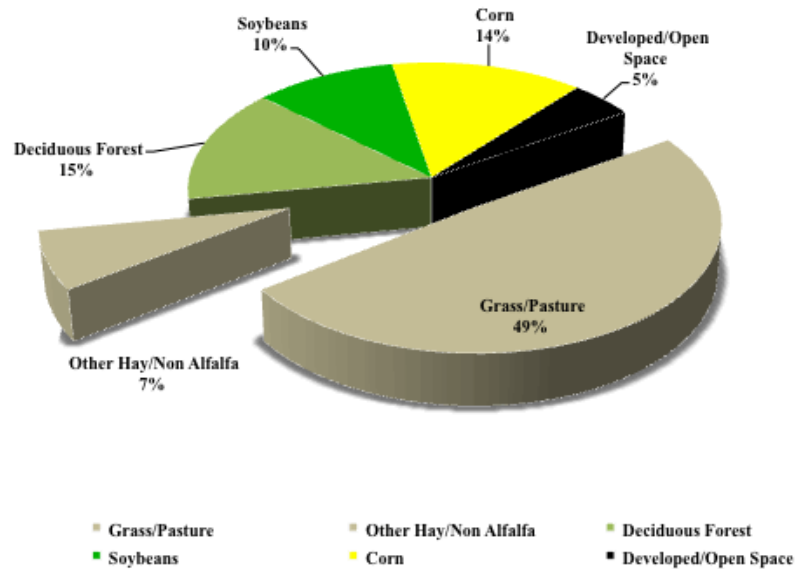
Stony Point CA scored the highest bird-friendliness score in the region, **16.98**. This was just above **Diamond Grove Prairie CA's** score of **14.72** and **Niawathe Prairie CA's** **13.91**. **Stony Point CA's** score was bolstered by it being the only site in GP with high sample sizes to generate density estimates for Northern Bobwhite Quail.

At **Diamond Grove Prairie CA**, there are two separate tracts. The eastern tract contained cattle that are part of RSD's patch-burn grazing study (see page 8). Grasshopper Sparrow densities increased slightly from 2014, which was counter the statewide decline. More inline with the regional declines, Henslow's Sparrow and Dickcissel densities decreased in 2015, but exceeded those of 2013.

Prairie birds responded well in two prescribed burn sections at **Niawathe Prairie CA**. Fire reached two sections on the western side of the property. This impacted Grasshopper and Henslow's Sparrows localized occupancy, as is typical of first year post-burn response, they were found outside of the burn units. Grassland habitat generalists such as Dickcissel and Meadowlarks were widely dispersed throughout the property. As a whole, grassland obligates at Niawathe had the third highest density of the 2015 sites (1.847 per acre).

The use of fire to encourage forb growth, coupled with grazing, appeared to help support prairie obligates at **Shelton (Wade & June) Memorial CA**, as well. High densities of Dickcissel, Eastern Meadowlark, and Grasshopper Sparrows contributed to Shelton CA's score of **9.96**. With a bird-friendliness score of **8.43**, **Horse Creek CA** is plagued by concentrations of fescue and *sericea lespidiza*. Sections of warm and cool season grasses helped support measurable densities of Eastern Meadowlark and

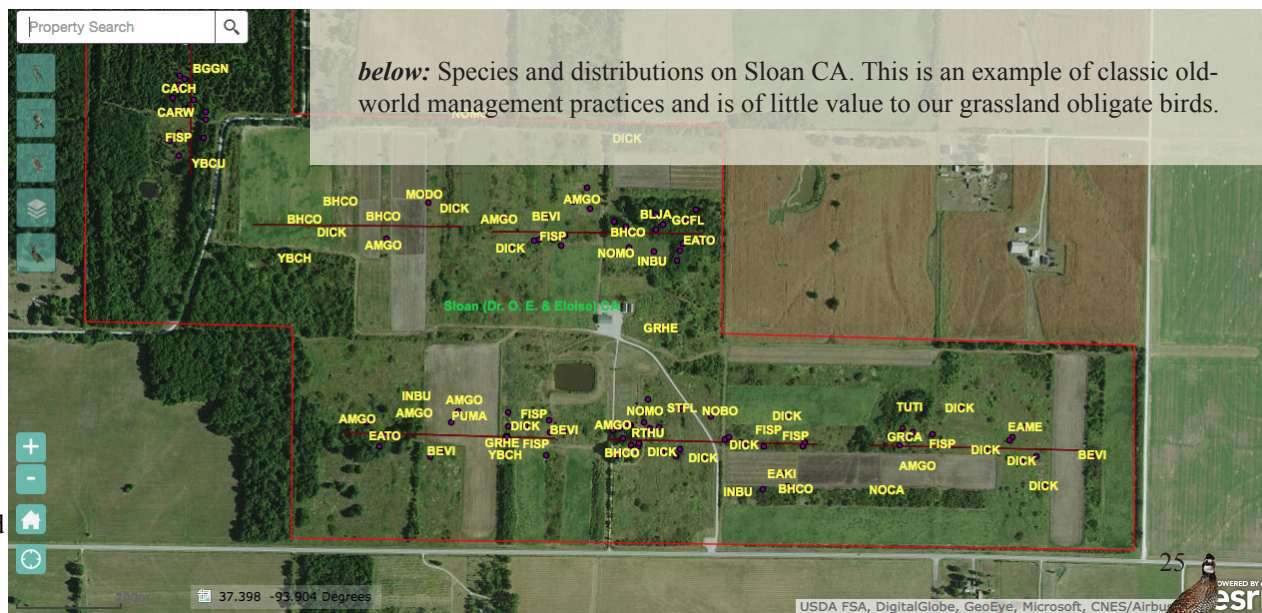
Golden Prairies CCS Landuse



above: Land use in the Golden Prairies CCS (USDA 2014). Approximately sixty percent of the land is some form of grassland. This includes fescue or other non-native grasses that do not support viable populations of grassland obligate species.

Dickcissel. **Talbot (Robert E.) CA** is 300-acre property has been historically managed using traditional techniques of planted crops in strips and edge feathering. A bird-friendliness score of **4.62** contrasts other sites in the CSS with management histories that have provided more heterogeneity and native habitat. Shrubs and agricultural fields, both fallow and seeded this year, dominated the landscape, with areas of native grass and forbs being only in small blocks and strips.

Native prairie plants dominate the small **Providence Prairie CA**. Surveyors noted extensive, recent woody removal, but signs of vehicle traffic through prime prairie habitat. A low score in bird-friendliness of **2.84** may be attributed to this



disturbance. Providence serves as a cattle-grazing treatment, as nearby *Kickapoo Prairie CA* with a similarly low score (2.14) is the control site for the MDC's patch-burn grazing study (see page 8). As in 2014, only a single Grasshopper Sparrow was found in 2015 at *Providence Prairie CA*. Henslow's Sparrow counts decreased from last year (2014; n=31 vs. 2015; n=11). Conspicuous, localized occupancy decreases were found in the

western and northern portions of the property. Northern Bobwhite Quail numbers increased substantially from two detected in 2014 to ten in 2015. Henslow's Sparrows on Kickapoo Prairie CA shifted localized occupancy from 2014 to the south portion of the site. Grasshopper Sparrows were found on the western portion only in 2015.

APPENDIX A: TARGET SPECIES CONSERVATION RANKING

	MRBO rank	Justification	ABC rank	Jacobs rank	BBS trend MO 1966-2012	BBS trend MO 2002-2012	BBS trend ETGP
Greater Prairie-Chicken	10	<100 remaining in Missouri	16	1	not given	not given	-5
Loggerhead Shrike	9	extreme declines in region & state; declines obvious to MO observers	13	3	-6.99	-8.5	-5.71
Henslow's Sparrow	8	high ABC rank, MO is range core; but, marked increases in region & state	16	2	8.44	9.82	3.64
Bell's Vireo	8	high ABC rank, neg trend in MO, MO is range core; but, shrub habitat not rare.	16	5	-1.73	-0.32	-0.6
Common Nighthawk	8	rare in natural habitat (common only in MO towns), high ABC rank, rangewide declines	15	not rated	1.01	1.31	-1.12
Bobolink	7	relatively high ABC rank, regional declines but increasing in MO; stable in north part of range	13	10	4.57	2.09	-3.55
Western Meadowlark	7	rangewide & MO declines	13	9	-3.51	-3.85	-5.52
Grasshopper Sparrow	7	mod. ABC rank, but strong declines in state, region, and adjacent regions	12	6	-2.12	-2.36	-4.06
Eastern Meadowlark	7	rangewide & MO declines	12	9	-2.32	-2.69	-2.57
Northern Bobwhite	7	continued declines despite habitat restoration	11	4	-3.01	-3.54	-3.21
Field Sparrow	6	mod. ABC rank, declines in MO, but habitat not lacking, also wide range	12	7	-1.79	-0.92	-1.75
Upland Sandpiper	5	increasing in some parts of range, including MO	12	11	0.72	0.76	-1.71
Dickcissel	5	relatively low ABC rank, high overall population, but neg. trends in MO	10	8	-1.35	-0.87	-1.04
Sedge Wren	4	low ABC rank, but declining in MO (small sample size); indicative of quality wet prairie habitat	8	not rated	-3.77	-4.44	1.05

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A Grasshopper Sparrow nest at Horse Creek Prairie CA.
Photo by: Nic Salick



