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Grassland Bird Conservation Design in the Chicago Region:

Mapping Abundance and Ecosystem Service Value to Identify Conservation Opportunity

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Executive Summary

With the ultimate goal of conserving and restoring threatened native grassland prairies and the wildlife that depend on them, the National Audubon Society (Audubon) is facilitating a landscape conservation design for the grassland birds in the greater Chicago region. As a first step in this process standardized avian point count surveys conducted primarily by citizen volunteers were combined with landcover composition and configuration, soils, and vegetation productivity data to model abundance of five grassland bird species. Models were updated with additional data and expert review in 2015 and now provide map outputs of existing grassland bird habitat and population estimates for species of conservation concern in the region. Supporting approximately 62,700 Bobolink; 4,700 Henslow's Sparrow; 3,200 Grasshopper Sparrow; 4,000 Sedge Wren; and 33,500 Eastern Meadowlark, an approximate total of 140,000 acres of grassland bird habitat has been identified in the Chicago Metropolitan Region (Cook, DuPage, Kane, Kendall, Lake, McHenry, Will counties). Approximately one-third of which (46,000 acres) is under current legal protection.

In the summer of 2015 modeled grassland bird habitat and abundances were summarized with data on water filtration, flood control, groundwater recharge, and carbon storage from the Chicago Wilderness Green Infrastructure Vision (GIV) which aims to identify opportunities for conservation and restoration based on these ecosystem services. Quantifying the value of these ecosystem services along with grassland bird habitat will inform conservation decision-making beyond acres of habitat and number of species or individuals. Grassland bird habitat within seven Chicago Metropolitan Region counties provides over 900 million dollars in ecosystem services annually, with approximately half of that value on unprotected lands.

Through the collaborative process of the Chicago Wilderness Grassland Bird Committee future work will focus on building bottom-up habitat and population objectives for the region. Working with major land owners, the committee will develop county-level grassland plans that are realistic and cost-benefit based. Combined, these county objectives will inform regional targets that can be tracked over time. The committee will continue to work toward increased and improved grassland bird monitoring, which could allow for the further refinement and geographical expansion of modelling.

Introduction

As the result of urban development and vast agricultural expansion, the United States has lost 98% of its original tallgrass prairie (NABCI 2009). Due to disappearance of grassland communities, grassland bird populations have been among the fastest and most consistently declining suite of species in North America over the past 40 years. Of the 46 North American grassland-breeding birds 55% have shown significant declines and 48% are of conservation concern including four which are federally endangered (NABCI 2009). Between 1967 and 1989 in Illinois, Bobolink populations fell by 90%, Eastern Meadowlarks by 67%, and Grasshopper Sparrows by 56% (Walk and Warner 2000), and an indicator for grassland birds based on 24 grassland-obligate species dropped 40% from the baseline value set in 1968 (NABCI 2009). In recent years this indicator has stabilized, albeit at historically low levels (NABCI 2014), but recent increases in grassland conversion to row crops (1-5% annually; Wright and Wimberley 2013) may jeopardize the status quo. Therefore, continued effort to identify key areas for grassland conservation are needed (e.g. Johnson et al 2010).

Numerous studies and regional conservation plans point to the critical need of restoring and protecting large areas of native grasslands for breeding birds in order to save these threatened species. However, with limited resources and competing conservation priorities, many of which receive greater public attention, restoring large-scale grasslands remains a significant and urgent challenge.

Goals formulated on maximizing biodiversity at a site by site basis can be counterproductive to population-level conservation and often more costly (Vickery et. al 2000). Regional level, holistic conservation planning, or "landscape conservation design", is especially important for grassland birds that depend on large and diverse grassland habitats. Landscape conservation design is both a process and a conservation product that takes a collaborative approach to define, design and deliver conservation. To this end a Chicago Wilderness Grassland Bird Committee was formed in 2010 with the goal of building awareness and a cohesive strategy for conserving grassland birds at a regional scale. In 2013, with funding from the U.S. Fish and Wildlife Service and Upper Midwest and Great Lakes Landscape Conservation Cooperative, Audubon launched a project within this committee to facilitate the development of a landscape conservation design for grassland birds.

Mapping Abundance and Estimating Populations

Optimal conservation planning requires information on the distribution of species. Presence/absence data is useful and often the most widely available data type; however, estimates of abundance maximize the benefits of conservation planning exercises (Veloz et al 2015). In our conservation design, we make use of a multi-year systematic survey of avian abundance collected by citizen volunteers to build models of avian abundance for five grassland bird species covering a range of habitat requirements: Bobolink, Sedge Wren, Henslow's Sparrow, Eastern Meadowlark, and Grasshopper Sparrow. Models estimate abundance based on landcover composition and configuration, soils, and vegetation condition. We then map relative abundance and estimate regional population sizes in support of grassland conservation efforts in the Chicago Metropolitan Region.

Methods

The full project area is defined by the Chicago Wilderness boundary, a 16,000-square mile region which includes all or portions of 29 counties in four states. However, systematic avian abundance survey data (described below) were only available for the Chicago Metropolitan region. Therefore, the abundance modeling work focuses on the 5,643-square mile region including seven metropolitan counties (McHenry, Lake, Kane, DuPage, Cook, Kendall, and Will) surrounding Chicago, IL.

Observation Data

We built abundance models for five obligate grassland bird species: Bobolink, Eastern Meadowlark, Henslow's Sparrow, Grasshopper Sparrow, and Sedge Wren. Annual ten-minute, fixed-radius (75 meters) point counts conducted between 2007 and 2014 were used to estimate avian abundance. The majority of observations were collected by Bird Conservation Network (www.bcnbirds.org) volunteers. Point count data collected with a similar protocol by the Lake County Forest Preserves, the Illinois Department of Natural Resources (Will County, IL), and the Illinois Natural History Survey's Critical Trends Assessment

Program were also included but constituted a small proportion of available data. Surveys were repeated annually and often in points located in close proximity to one another. Therefore, to reduce sampling bias in the dataset that could lead to a biased abundance model (Boria et al 2014), we selected only one observation within each grid cell. The maximum abundance was used (selecting randomly between ties) to minimize the impact of imperfect detection by the volunteer surveyors. We then sampled annual environmental data for the year in which each filtered observation was made.

Environmental Data

Environmental datasets used to predict the abundance of the five focal species included landcover, soils, and vegetative condition. We extracted annual landcover from 2007-2014 for the study area from the National Agricultural Statistics Service (USDA) CropScape web service (Han et al 2012). The 30-meter resolution dataset classifies cropland on an annual basis and utilizes National Landcover Database (Homer et al 2015) classes for non-agricultural areas. We consolidated cropland and landcover classes into 12 classes. Landcover data was summarized in multiple metrics at each survey point, including the landcover class and patch size, proportion of each consolidated landcover class within one kilometer, and distance other landcover classes (Table 1). Also characterized at each point were annual vegetation condition (NDVI) in mid-June, extracted from the VegScape web service (Mueller et al 2013), and soil hydrologic group, based on the gridded SSURGO soils dataset (NRCS-USDA). The resulting environmental dataset included 33 predictor variables. Survey time and date were also included as predictors, resulting in a total of 35 variables.

Table 1. Environmental data used to predict avian abundance included consolidated landcover classes and derived variables, vegetative condition and soil data.

Landcover Classes	**Derived Landcover Variables**
Herbaceous grassland and hayland	Landcover in each cell
Herbaceous wetland	Patch size of landcover class at each point
Deciduous woodland	Proportional coverage within 1 km
Wooded wetland	Distance to class
Other shrub and woodlands	
Corn	**Vegetation Condition**
Soy	Normalized Difference Vegetation Index (NDVI)
Wheat	
Other crops	
Low density development	**Soil Data**
High density development	Hydrologic group
Water	Drainage class

Abundance Modeling

We generated abundance models for each species using Boosted Regression Trees (BRTs). BRTs are a machine learning algorithm with high predictive performance able to capture nonlinear relationships between environmental and response variables and interactions among predictor variables (Elith et al 2008). We built models based on techniques outlined in Elith et al. (2008). We used a Poisson model for count data and set tree complexity to five. Learning rate was adjusted (range: 0.005-0.01) such that at least 1,000 trees were included in each final model (Elith et al 2008). We used a stepwise variable removal procedure (Elith et al 2008) to reduce the 33 environmental variables to a smaller set for each species.

The stepwise procedure was run on the full dataset using ten-fold cross-validation to assess model performance. We eliminated all predictor variables for which removal had no adverse effect. The reduced variable set was used in subsequent analyses.

We modeled mean avian abundance as the performance-weighted average of 20 BRT models generated for each species (as in Barker et al 2014). We assessed the performance of each model by cross-validation using spatially stratified subsampling. Spatially stratified subsampling generates robust performance measures because model training and test data are spatially independent (Bahn & McGill 2013). We used semi-variograms to explore spatial autocorrelation in our environmental dataset and determined that on average correlative patterns leveled off at distances greater than five kilometers. We then created a novel procedure for building model training and test datasets in which a five-kilometer grid was overlaid on the study area and all sampling points within randomly selected grid cells were assigned to either the training or test dataset at a ratio of 5:1 training to test points. Assignments were regulated such that prevalence in training and test dataset had to match prevalence in the full dataset. The output included 20 unique pairs of training and testing data for use in model construction. We assessed model performance based on the Pearson's correlation between observed and predicted abundance.

Abundance Prediction

We predicted avian abundance to environmental data from 2014 calculated for a 30-m resolution grid encompassing the study area. Mean abundance was calculated as a performance-weighted average of the 20 prediction grids. We then estimated overall abundance across the study area by transforming model outputs into densities based on a 75-m point count radius and multiplying by the area of each grid cell.

Results

Our full dataset included 8,723 point counts completed from 2007-2014 and included multiple counts at the same location. Spatial thinning reduced that to a single record for each species at 1,434 locations. Training datasets generated via spatial stratification included 1,177 points on average, leaving 257 points for model testing.

The variable removal procedure reduced the 35 environmental variables to 9-16, depending on the species. 20 variables in total were used in model construction (Table 2). Proportions of land cover within one kilometer of points for grass and hay, high density development, and water were included in all species models. Also included in all models were hydrologic class of soils and time of day. Proportion of corn, soy, and wetlands; distance to grass/hay; and patch size were included in models for four species. Variable importance scores were used to rank the contribution of each predictor to overall model performance. Table 3 lists the five most important variables for each species.

TABLE 2. PREDICTOR VARIABLES RETAINED FOR MODEL CONSTRUCTION AND THE NUMBER OF SPECIES (#) FOR WHICH IT WAS RETAINED. PROPORTIONS WERE CALCULATED WITHIN ONE KILOMETER OF EACH SURVEY POINT.

Predictor	#	Predictor	#
Proportion of grass/hay	5	Proportion of low-density dev.	3
Proportion of high-density dev.	5	Date of survey	3
Proportion of water	5	Landcover in cell	3
Hydrologic class	5	Distance to soy	3
Time of day	5	NDVI	2

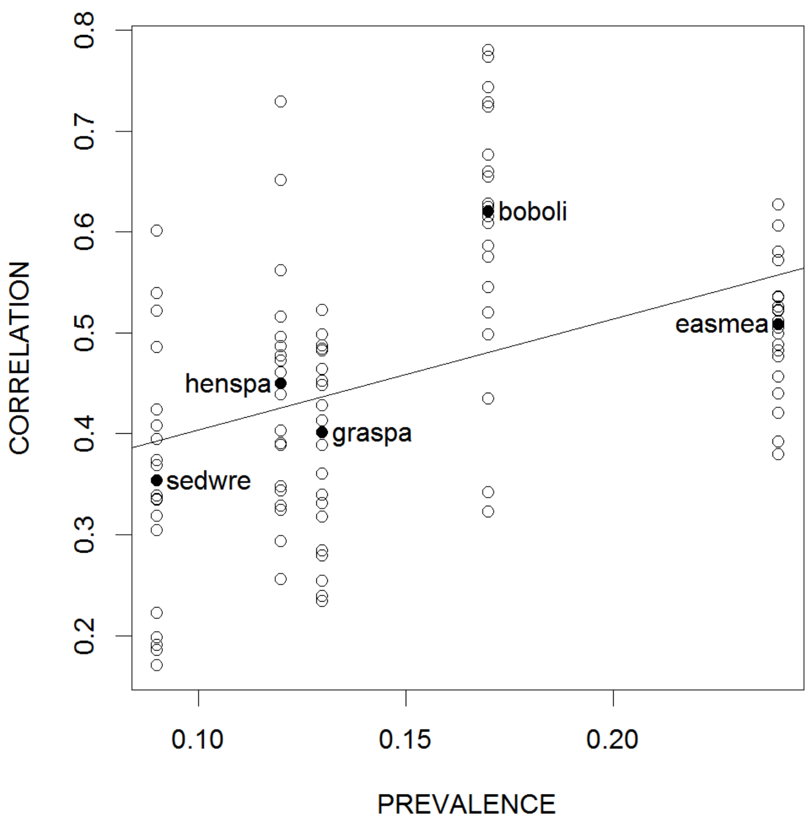
Proportion of corn	4	Distance to high-density dev.	1
Proportion of soy	4	Distance to low-density dev.	1
Proportion of wetland	4	Distance to corn	1
Distance to grass/hay	4	Distance to wetland	1
Patch size	4	Distance to water	1

TABLE 3. TOP FIVE PREDICTOR VARIABLES FOR EACH SPECIES.

Species	Predictor
Bobolink	
	Proportion of grass/hay
	Patch size
	Proportion of soy
	Proportion of water
	Proportion of high density development
Sedge Wren	
	Proportion of grass/hay
	Proportion of water
	Time of day
	Survey date
	Hydrological class
Henslow's Sparrow	
	Time of survey
	Proportion of grass/hay
	Proportion of soy
	Distance to grass/hay
	Hydrologic class
Eastern Meadowlark	
	Proportion of grass/hay
	Proportion of soy
	Distance to soy
	Proportion of low density development
	Landcover in cell
Grasshopper Sparrow	
	Proportion of grass/hay
	Proportion of soy
	Distance to soy
	Proportion of low density development
	Landcover in cell

Model performance varied among species (Figure 1). Bobolink had the highest performing model with a median correlation between observed and predicted abundance of 0.62 (range 0.32-0.78) followed by Eastern Meadowlark (0.508 [0.38-0.63]), Henslow's Sparrow (0.45 [0.26-0.73]), Grasshopper Sparrow (0.40 [0.23-0.52]), and Sedge Wren (0.35 [0.17-0.60]) by decreasing performance. Model performance was a function of the number of non-zero counts (e.g. prevalence) among the modeled species (Figure 1, F=20.11, p<0.0001).

FIGURE 1. RELATIONSHIP BETWEEN DATA PREVALENCE AND MODEL PERFORMANCE. OPEN CIRCLES CORRESPOND TO EACH OF 20 GENERATED ABUNDANCE MODELS. CLOSED CIRCLES MARK THE MEDIAN PERFORMANCE ACROSS MODELS.



Abundance estimates suggest that of the five study species, Bobolink and Eastern Meadowlark are the most abundant grassland birds in the Chicago Metropolitan Region with estimates based on the performance-weighted mean of 20 abundance models greater than 50,000 individuals (Table 4). Sedge Wren, Henslow's Sparrow, and Grasshopper Sparrow have estimated populations closer to 10,000 individuals. Uncertainty characterized by the performance-weighted coefficient of variation (CV) is greatest for the Grasshopper Sparrow (24%), Henslow's Sparrow (20%), and Sedge Wren (17%, Table 4).

Chicago Wilderness estimates are between 2.3 and 3.5 times greater than estimates for the metropolitan region (Table 5). The Chicago Wilderness is roughly 2.9 times larger suggesting that populations may be disproportionally located outside the Chicago metropolitan region for Sedge Wren, Eastern Meadowlark, and Grasshopper Sparrow. However, models with the greatest proportional increases, Sedge Wren and Grasshopper Sparrow, also have the greatest uncertainty in estimates. Furthermore, expert review of predicted abundance maps suggest that estimates for extrapolated areas, such as Wisconsin, are spurious (Christine Ribic, personal commentary). For this reason we have elected to focus on the Chicago Metropolitan Region in subsequent analyses.

Table 4. Abundance estimates for the Chicago Metropolitan Region.

Estimate	BOBO	SEWR	HESP	EAME	GRSP
weighted mean	81,919	9,615	11,979	51,536	10,186
low	63,469	6,147	8,271	43,181	6,728
high	98,738	12,081	16,765	65,057	14,483
cv	13%	17%	20%	11%	24%

Table 5. Abundance estimates for the Chicago Wilderness. These estimates are extrapolated from models build with abundance observations from the Chicago Metropolitan Region.

Estimate	BOBO	SEWR	HESP	EAME	GRSP
weighted mean	194,149	34,223	33,337	158,290	32,957
low	155,104	22,734	20,459	130,163	23,468
high	232,679	48,560	42,802	198,548	47,267
cv	12%	17%	20%	10%	22%

Abundance model outputs were converted to density estimates and mapped to classified non-forested, natural vegetation within the study area (Figures 2-6). The distribution of avian abundance is patchy and varies among species. However, Will and McHenry counties support relatively large populations of all species with Lake and DuPage important for Sedge Wren and Henslow's Sparrow, respectively. See Table 7 on page 18 for detailed summaries of county-level population totals for conservation.

FIGURE 2. ESTIMATED DENSITY OF BOBOLINK.

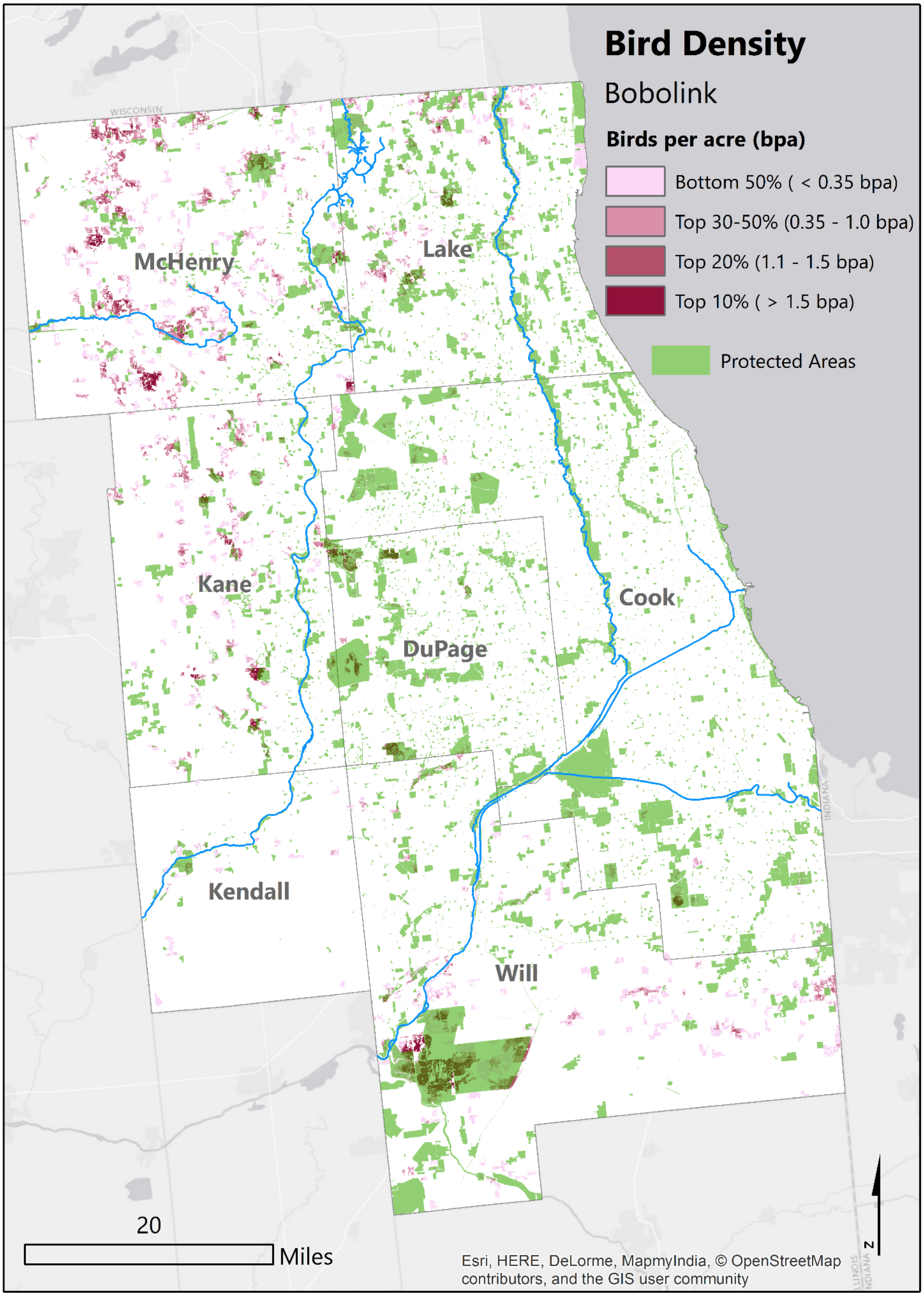


FIGURE 3. ESTIMATED DENSITY OF SEDGE WREN.

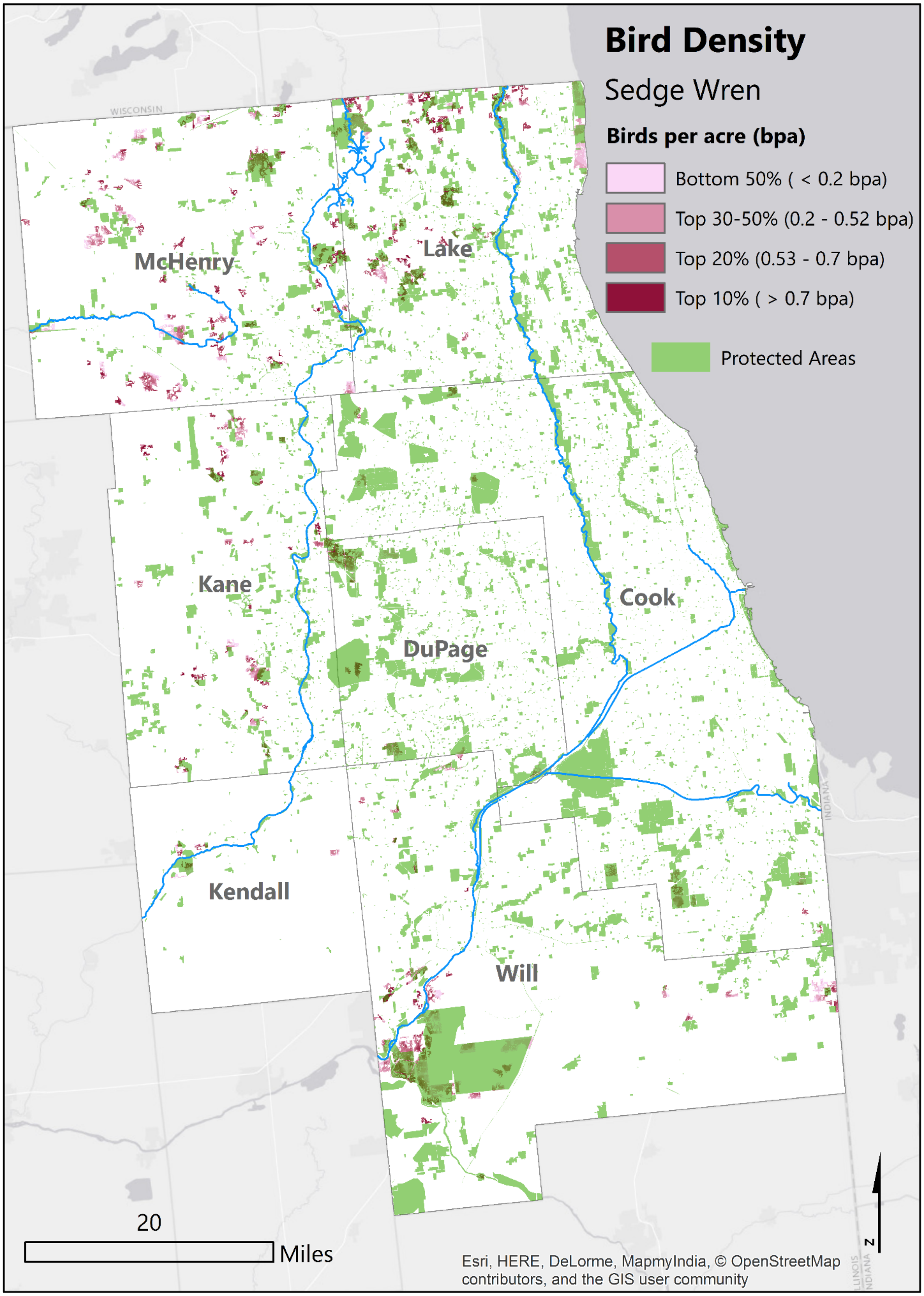


FIGURE 4. ESTIMATED DENSITY OF HENSLOW'S SPARROW.

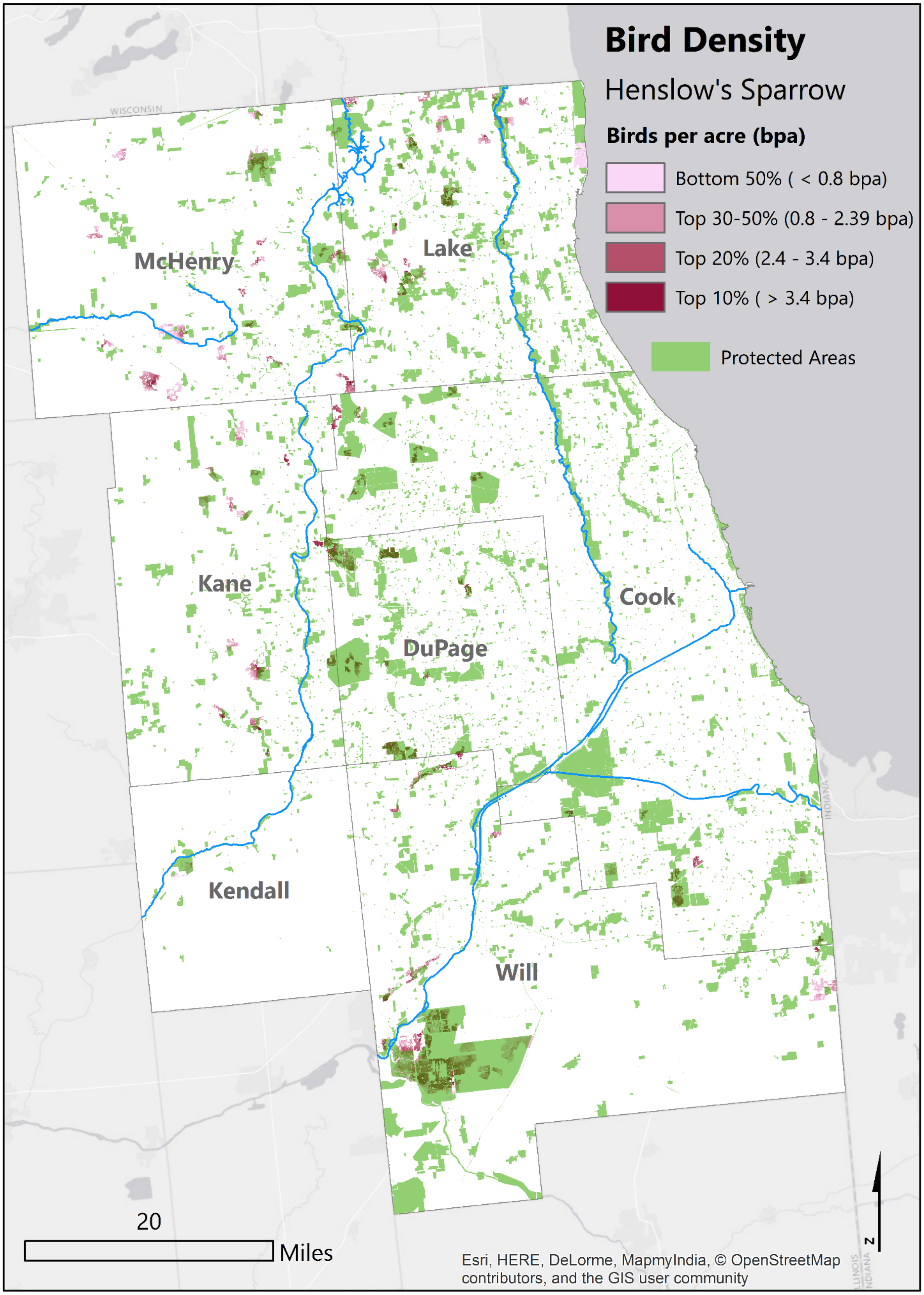


FIGURE 5. ESTIMATED DENSITY OF EASTERN MEADOWLARK.

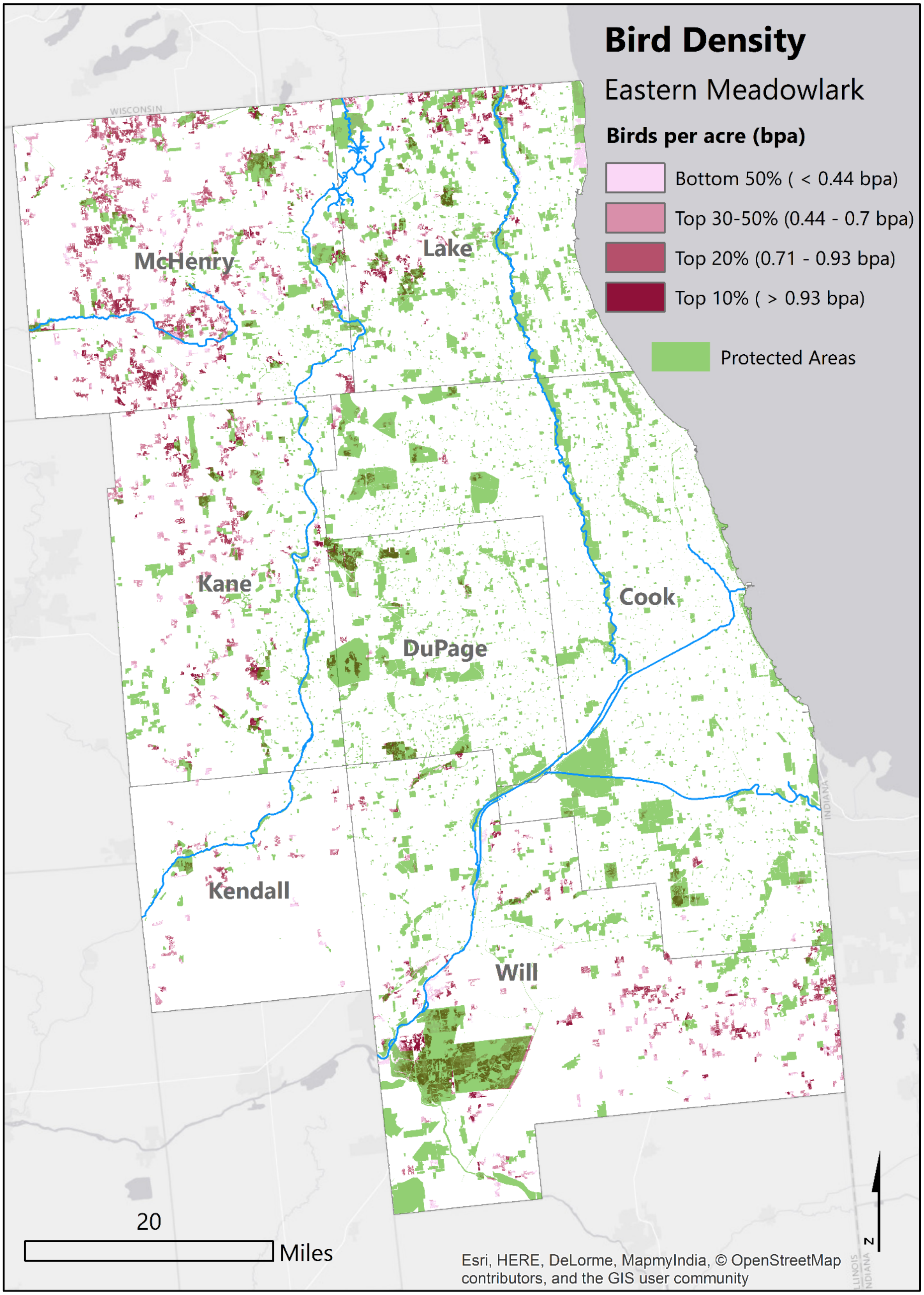
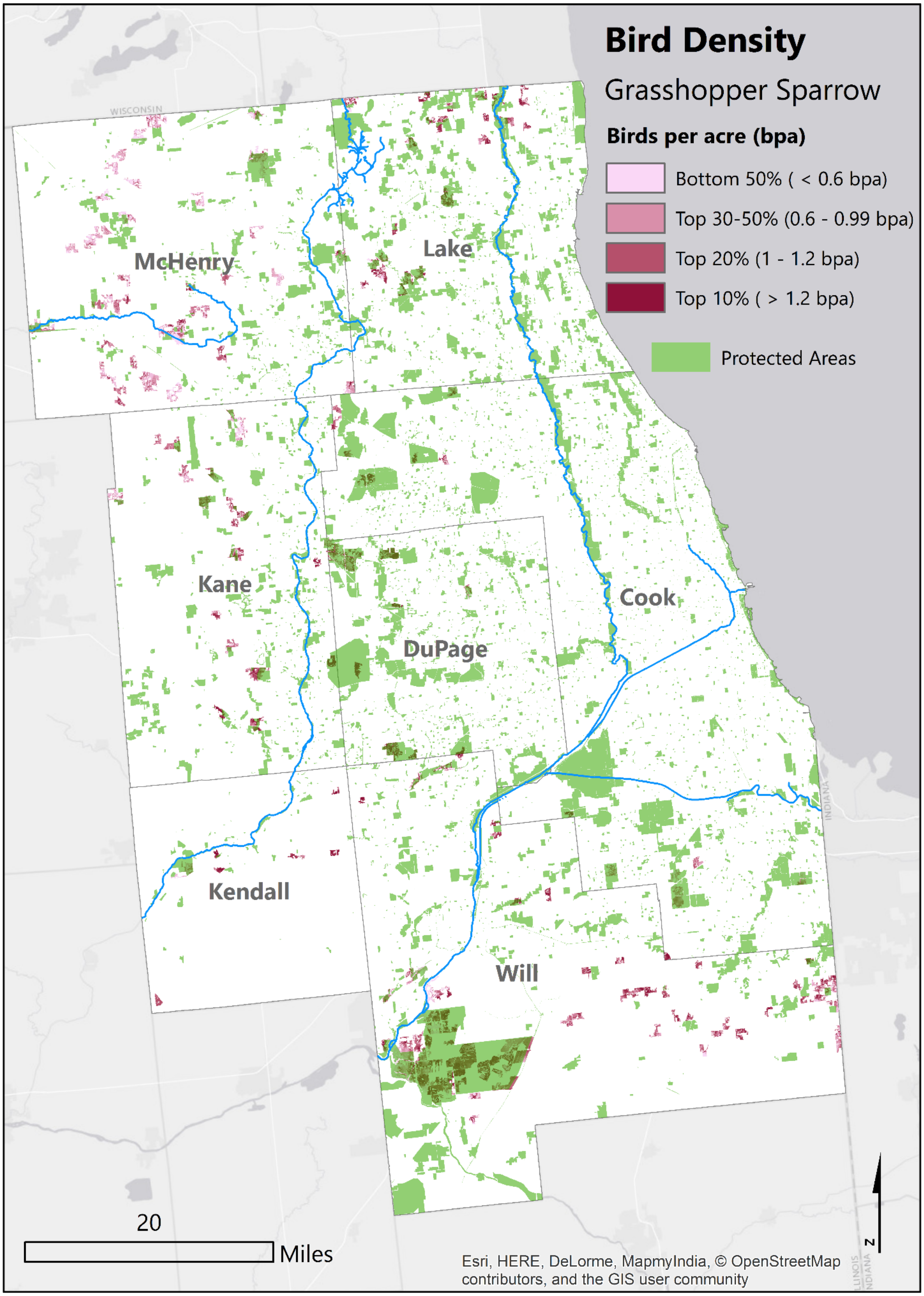


FIGURE 6. ESTIMATED DENSITY OF GRASSHOPPER SPARROW.



High Value Conservation Opportunity Areas

Ecosystem services, or the benefits provided to people by natural resources, enhance the quality of life for people worldwide (Birch et al. 2010; Bateman et al. 2013; Arkema et al. 2015; Ferraro et al. 2015). For example, forest restoration has been found to increase carbon storage and tourism in Latin America and Southeast Asia (Birch et al. 2010; Ferraro et al. 2015); coastal protection has increased fishery and recreational revenues while decreasing damages caused by storms in Latin America and the U.S. (Arkema et al. 2015; Reddy et al. 2015); and targeted land use planning has increased urban green space and bird species diversity in the United Kingdom (Bateman et al. 2013).

The spatially explicit quantification of ecosystem services is increasingly used as a method to demonstrate the economic value associated with the protection of natural areas (Polasky et al. 2011; Arkema et al. 2015; Hamel et al. 2015). Additional studies have illustrated the link between ecosystem services and biodiversity conservation (Nelson et al. 2009; Chaplin-Kramer et al. 2015; Reuchlin-Hugenholtz and McKenzie 2015). It is important for land managers to incorporate the benefits provided by ecosystem services when making decisions regarding land use (Polasky et al. 2011).

Here, we quantify the link between ecosystem services and grassland bird habitat using data from the Chicago Wilderness Green Infrastructure Vision (GIV). Green infrastructure refers to the network of natural areas that not only support native species but also provide ecosystem services. The GIV aims to identify opportunities for conservation and restoration of such landscapes, including wetlands, grasslands, and forests, which offer services such as water filtration, flood control, and carbon storage. This analysis aims to inform land managers' decision-making in the Chicago Metropolitan Region by identifying currently unprotected areas that are valuable for both grassland birds and ecosystem services.

Methods

We estimated bird abundance and ecosystem service value for patches of suitable grassland habitat for five threatened grassland bird species: Bobolink, Eastern Meadowlark, Grasshopper Sparrow, Henslow's Sparrow, and Sedge Wren. The study area is the 5,643-square mile region including seven metropolitan counties (McHenry, Lake, Kane, DuPage, Cook, Kendall, and Will) surrounding Chicago, IL.

TABLE 6. LIST OF ECOSYSTEM SERVICES INCLUDED IN VALUATION BY GIV 2.3 (ALLEN ET AL. 2014)

Ecosystem Service	Description
Flood Control	Maintain water flow stability and protect areas against flooding
Groundwater Recharge	Maintain natural rates of groundwater recharge and aquifer replenishment
Water Purification	Maintain water quality sufficient for human consumption, recreational use, and aquatic life
Carbon Storage	Sequester carbon in vegetation and soils, thereby reducing greenhouse gases in the atmosphere and regulating climate

Landscape Analysis

We identified patches of suitable grassland habitat appropriate for landscape-scale conservation from modeled abundances (described above) and landcover. We generated patches of suitable habitat from areas classified as herbaceous grasslands, wheat, other forest and shrub, herbaceous wetlands, and woody wetlands in the Cropland Data Layer (Han et al. 2014) by clumping adjacent grid cells into patches. We then used criteria for minimum patch size and modeled bird abundance to further refine the patch list.

Larger patches supporting a minimum number of birds are more likely to be of conservation interest. Many grassland birds are area-sensitive (Herkert 1994a-b; Winter and Faaborg 1999; Johnson 2001; Johnson and Igl 2001; Ribic et al. 2009; Polasky et al. 2011). The Grasshopper Sparrow, Henslow's Sparrow, and Bobolink have been found to prefer habitat patches that extend well beyond their territories (Johnson 2001). Bollinger and Gavin (1992) found that large fields have higher densities of Bobolink than small fields. Specifically, patches at least 74 acres in size are considered suitable for Bobolink (Bollinger and Gavin 1992) and Grasshopper Sparrow (Herkert 1994b). Herkert (1994a) found habitat area to be the most important factor influencing Henslow's Sparrows in Illinois and that they were rarely found in patches less than 247 acres. In contrast, Walk et al. (2010) demonstrated the importance of small grassland patches for nesting habitat of nesting grassland birds, such as the Eastern Meadowlark. We chose a conservative minimum patch size of 30 acres to avoid overlooking smaller sites that may still be of use to grassland birds. Furthermore, we removed those patches with modeled bird abundances failing to meet a minimum threshold specific to each species, based on estimated densities from distance sampling conducted previously at a subset of sites. We determined these thresholds by taking the estimated average density found by Buxton (2014) and converting it to the number of birds estimated to be within an area of 30 acres to be consistent with our minimum patch size criterion. For example, Buxton (2014) found an average density of about 0.38 Bobolink per acre, which translates to a threshold of 11.54 Bobolink across a 30-acre area. Our rationale assumed that small patches of below-average density were of lower conservation priority.

Compiling Ecosystem Services

We calculated ecosystem service values for each patch that met the habitat, minimum area, and minimum abundance criteria. We used a Geographic Information System (GIS) to overlay modeled abundance for each grassland bird species with an ecosystem service valuation dataset provided in the Chicago Wilderness GIV Version 2.3 (Allen et al. 2014). Dollar values were estimated for four ecosystem services: flood control, groundwater recharge, water purification, and carbon storage (Table 6), based on economic analyses and mapped to a grid matching GIS layers from the GIV. The valuation of these ecosystem services considered several factors, some of which included avoided cost (e.g., from property damages or public health problems that would have occurred in the absence of those services), replacement cost (i.e., the cost of man-made systems that would emulate those services), and factor income (e.g., improved water quality increases commercial fisheries, which increase fishermen incomes) (Farber et al. 2002).

Protected Areas Analysis

We determined how much of each patch is currently protected and unprotected by overlaying each set of patches with a layer representing protected lands (sourced from The Field Museum in Chicago) in the region. We calculated the proportion that is protected and unprotected for each patch and multiplied these rates by the patch acreage, bird count, and ecosystem service values. This enabled us to identify the largest patches of unprotected habitat and their corresponding values for bird abundance and ecosystem services.

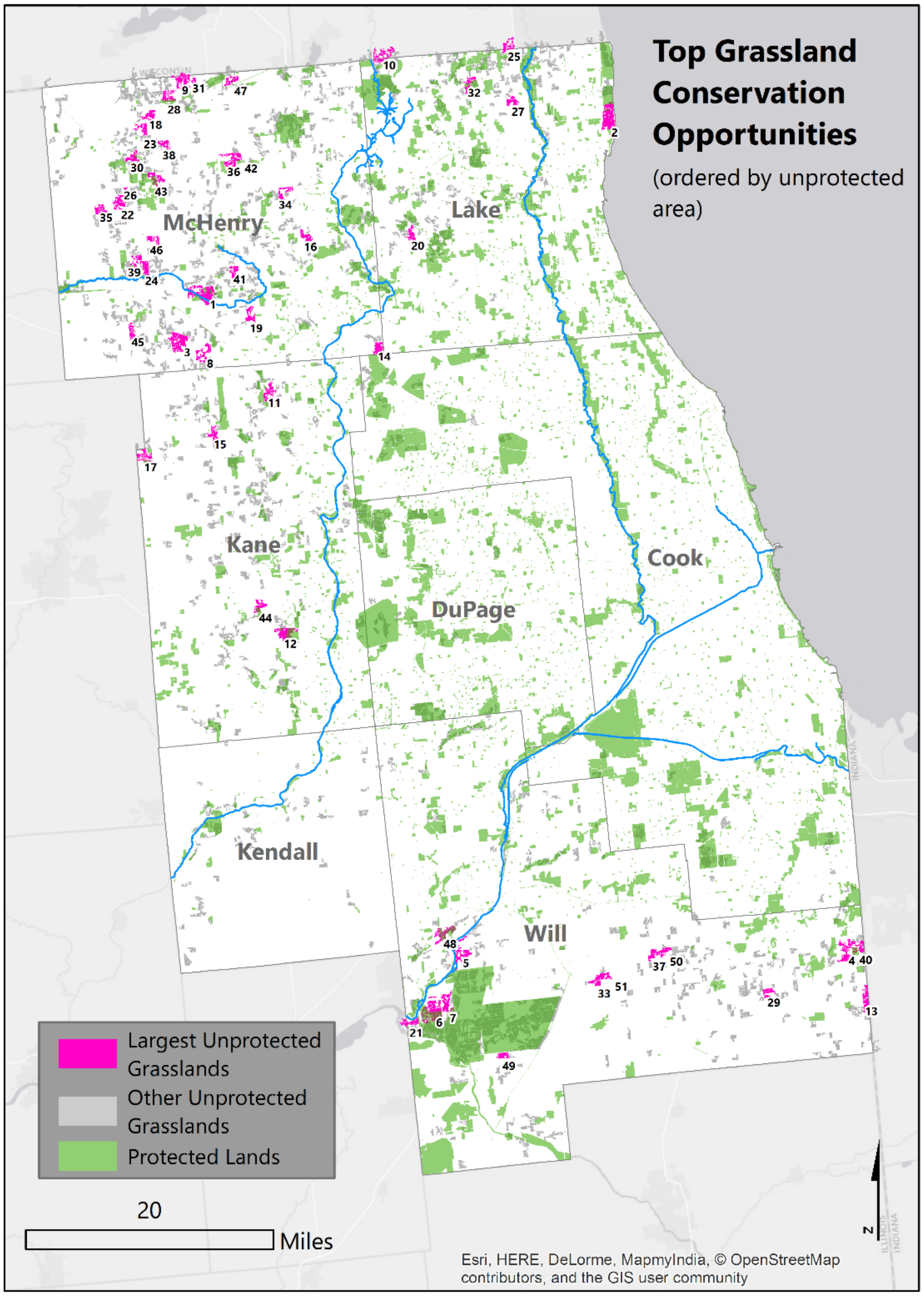
Moving Window Analysis

We used a moving window analysis with an 800 m search radius, comparable to that used in Johnson et al. (2010), to identify grassland bird conservation areas (GBCAs) across the CMAP region. First, we ran this analysis on patch grid cells located within protected areas to identify current GBCAs. Second, we ran the analysis on all patch grid cells (located within both protected and unprotected areas) to identify potential GBCAs if unprotected areas became protected.

Results

We identified grassland habitat patches containing the largest unprotected areas. In this report, we highlight the largest unprotected grassland habitat areas across the CMAP region that were also found to protect at least three of the five focal species in this analysis (*n* = 51; Figure 7).

FIGURE 7. TOP CONSERVATION OPPORTUNITY PATCHES ACROSS CMAP REGION BASED ON UNPROTECTED ACREAGE. Patches (n = 51) containing the largest amounts of unprotected grassland habitat were identified for Chicago Metropolitan Agency for Planning (CMAP) counties. Only patches protecting three or more grassland bird species are highlighted. These areas represent potential areas for protection.



McHenry, Will, Lake, and Kane counties all contained some of the largest conservation opportunity patches in the CMAP region. Appendix A includes a master table listing the patches with the largest unprotected areas of grassland. Of these areas, 26 patches (51%) were in McHenry County, suggesting that this county has the most opportunities for conservation. The largest patch is located in McHenry

County and contains 1,009 unprotected acres. This patch protects all five bird species and is valued at approximately $5.5 million for flood control, $2.3 million for groundwater recharge, over $700,000 for water purification, and over $42,000 for carbon storage (in $2014/ac/year) – a total ecosystem service value of over $8.5 million.

The 26 McHenry County patches cover 9,110 acres of unprotected habitat, and their total ecosystem service value amounts to over $45.5 million. Seven of these patches protect all five bird species. McHenry County also had the highest relative bird abundances (except Grasshopper Sparrow - Will County had the highest relative amount), with 28% of all Bobolink modeled for the CMAP region being located within the county's unprotected habitat patches, 27% of Eastern Meadowlark, 7% of Henslow's Sparrow, and 17% of Sedge Wren (Table 7).

TABLE 7. COUNTS AND RELATIVE AMOUNTS OF BIRDS PROTECTED (P) AND UNPROTECTED (U) IN EACH COUNTY AS COMPARED TO ENTIRE CMAP REGION.

		Bobolink		Eastern Meadowlark		Grasshopper Sparrow		Henslow's Sparrow		Sedge Wren	
County	**Status**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Cook	P	1,655	3%	975	3%	137	4%	468	10%	112	3%
	U	386	1%	289	1%	56	2%	95	2%	15	0%
Total		*2,041*	*3%*	*1,264*	*4%*	*193*	*6%*	*563*	*12%*	*127*	*3%*
DuPage	P	4,632	7%	1,898	6%	232	7%	760	16%	237	6%
	U	385	1%	181	1%	23	1%	70	2%	19	0%
Total		*5,017*	*8%*	*2,079*	*6%*	*255*	*8%*	*830*	*18%*	*256*	*6%*
Kane	P	2,462	4%	1,076	3%	133	4%	170	4%	148	4%
	U	6,166	10%	3,489	10%	205	6%	195	4%	331	8%
Total		*8,628*	*14%*	*4,565*	*14%*	*338*	*11%*	*365*	*8%*	*479*	*12%*
Kendall	P	215	0%	127	0%	15	0%	10	0%	30	1%
	U	469	1%	688	2%	71	2%	3	0%	31	1%
Total		*684*	*1%*	*815*	*2%*	*86*	*3%*	*13*	*0%*	*61*	*2%*
Lake	P	2,689	4%	1,486	4%	163	5%	400	9%	581	15%
	U	3,019	5%	2,706	8%	216	7%	233	5%	631	16%
Total		*5,708*	*9%*	*4,192*	*13%*	*379*	*12%*	*633*	*14%*	*1,212*	*31%*
McHenry	P	2,999	5%	1,339	4%	74	2%	199	4%	350	9%
	U	17,542	28%	8,880	27%	442	14%	343	7%	681	17%
Total		*20,541*	*33%*	*10,219*	*31%*	*516*	*16%*	*542*	*12%*	*1,031*	*26%*
Will	P	13,964	22%	5,282	16%	891	28%	1,428	31%	443	11%
	U	6,077	10%	4,996	15%	516	16%	292	6%	345	9%
Total		*20,041*	*32%*	*10,278*	*31%*	*1,407*	*44%*	*1,720*	*37%*	*788*	*20%*
CMAP	P	28,616	46%	12,183	36%	1,645	52%	3,435	74%	1,901	48%
	U	34,044	54%	21,229	64%	1,529	48%	1,231	26%	2,053	52%
Total		**62,660**		**33,412**		**3,174**		**4,666**		**3,954**	

Will County had 14 of the largest unprotected grasslands. Its largest unprotected patch contains 609 acres of unprotected habitat and was valued at approximately $660,000 for flood control, $260,000 for groundwater recharge, $125,000 for water purification, and $2,500 for carbon storage – a total annual value of over $1 million.

The 14 Will County patches cover a total of 4,973 acres of unprotected habitat. Five of these patches protect all five bird species and have a total ecosystem service value of over $24 million. Cook and DuPage counties did not have any patches in the list of the top grassland conservation opportunities because most (76% for Cook and 89% for DuPage) of the grassland areas in these counties are already protected.

When taking all patches into consideration (not just the top conservation opportunities), McHenry County had the largest acreage of bird habitat of all the counties. Of its 43,866 acres of bird habitat, 37,784 acres (86%) are unprotected and valued at over $184 million in ecosystem services annually. Will County came in second, with 23,165 of its total 41,154 acres (56%) of bird habitat being unprotected and valued at close to $80 million in ecosystem services annually (Table 8).

TABLE 8. COUNTY AND CMAP TOTALS FOR PROTECTED AND UNPROTECTED ACREAGE AND ECOSYSTEM SERVICES.

			Annual Ecosystem Service Value				
County	Status	Acres	Flood Protection	Groundwater Recharge	Water Purification	Carbon Storage	All Services
Cook	P	4,476	$30,729,124	$4,304,994	$3,199,141	$68,815	$38,302,086
	U	1,404	$4,554,411	$2,759,079	$770,727	$16,002	$8,100,217
Total		*5,880*	*$35,283,534*	*$7,064,073*	*$3,969,868*	*$84,817*	*$46,402,303*
DuPage	P	5,065	$15,638,025	$4,725,432	$3,089,444	$63,565	$23,516,467
	U	597	$2,024,589	$561,680	$419,876	$7,082	$3,013,227
Total		*5,662*	*$17,662,614*	*$5,287,112*	*$3,509,320*	*$70,647*	*$26,529,694*
Kane	P	3,840	$10,236,585	$4,443,811	$1,744,947	$53,559	$16,478,891
	U	15,004	$34,396,862	$13,882,952	$5,671,217	$139,170	$54,090,170
Total		*18,844*	*$44,633,447*	*$18,326,763*	*$7,416,164*	*$192,729*	*$70,569,061*
Kendall	P	658	$812,728	$330,072	$36,709	$4,964	$1,184,473
	U	3,828	$4,623,127	$2,701,678	$422,849	$21,166	$7,768,820
Total		*4,486*	*$5,435,855*	*$3,031,750*	*$459,558*	*$26,130*	*$8,953,293*
Lake	P	7,948	$117,265,855	$18,534,968	$16,005,961	$270,826	$152,077,663
	U	11,185	$76,725,784	$13,727,794	$11,728,834	$168,250	$102,350,682
Total		*19,133*	*$193,991,639*	*$32,262,763*	*$27,734,795*	*$439,076*	*$254,428,345*
McHenry	P	6,082	$43,126,921	$12,323,301	$6,526,173	$164,359	$62,140,748
	U	37,784	$125,340,674	$40,077,591	$18,139,696	$478,493	$184,036,422
Total		*43,866*	*$168,467,595*	*$52,400,892*	*$24,665,869*	*$642,852*	*$246,177,170*
Will	P	17,990	$141,739,178	$23,094,564	$9,595,001	$175,479	$174,604,239
	U	23,165	$50,563,509	$21,408,260	$7,881,545	$125,236	$79,978,539
Total		*41,154*	*$192,302,687*	*$44,502,825*	*$17,476,546*	*$300,715*	*$254,582,779*
CMAP	P	46,059	$359,548,415	$67,757,143	$40,197,377	$801,567	$468,304,567
	U	92,966	$298,228,956	$95,119,035	$45,034,743	$955,399	$439,338,078
Total		**139,024**	**$657,777,372**	**$162,876,178**	**$85,232,120**	**$1,756,966**	**$907,642,645**

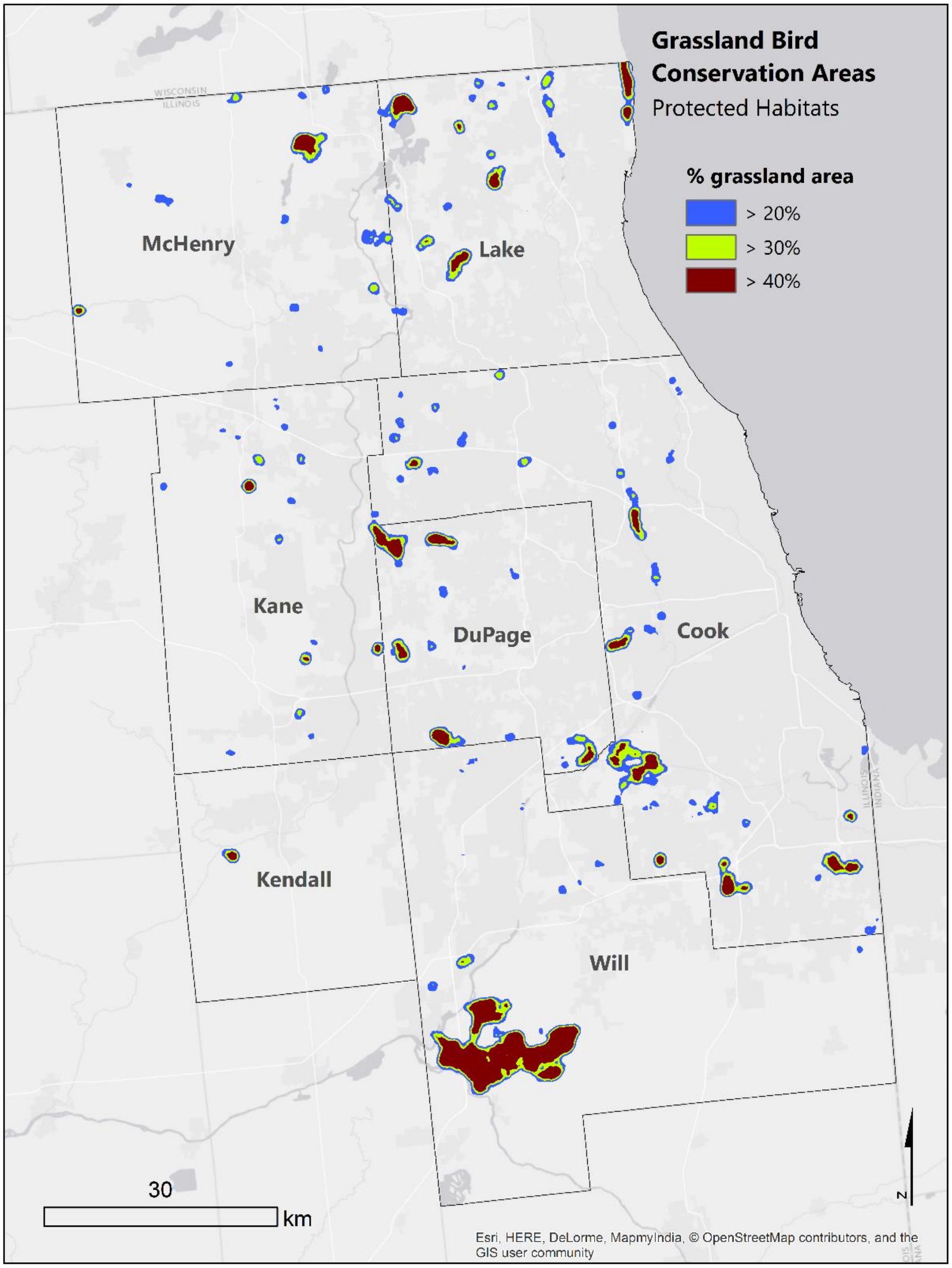
The CMAP region support multiple GBCAs based on current protected areas (Figure 8A), and could expand the size and number of GBCAs with further protection of currently unprotected lands (Figure 8B). Patch grid cells surrounded by at least 40%, 30%, and 20% suitable habitat were classified as Tier 1, 2 and 3 GBCAs, respectively. Increasing the protection status on currently unprotected habitat patches could increase the acreage of Tier 1 GBCAs from 34,423 to 81,026 acres (Table 9). However, much of this available land is currently under private ownership.

TABLE 9. TOTAL ACREAGES COVERED BY EACH TIER IN PROTECTED HABITATS VS. ALL HABITATS.

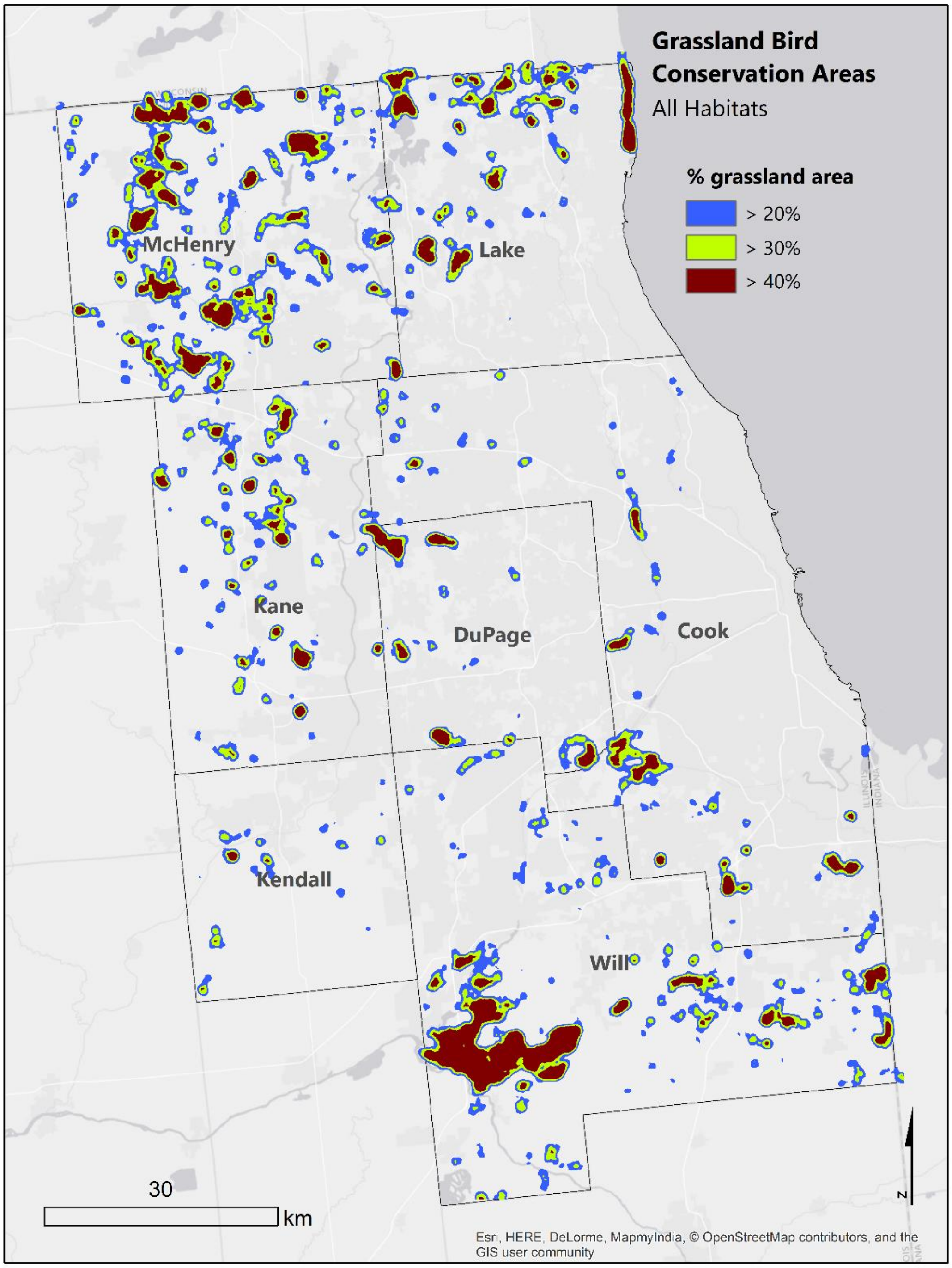
	Total Acreage	
	Protected Habitats	**All Habitats**
Tier 1	34,423	81,026
Tier 2	21,290	80,375
Tier 3	43,786	157,605

FIGURE 8A-B. POTENTIAL GRASSLAND BIRD CONSERVATION AREAS FOR PROTECTED VS. ALL HABITATS. Focal statistics were calculated for A) protected grassland patch grid cells and B) all grassland patch grid cells using an 800 m neighborhood radius.

A)



B)



Conclusions

Standardized avian point count surveys conducted primarily by citizen volunteers were combined with landcover composition, landscape configuration, soils, and productivity data to model abundance of five grassland birds. Model performance was low to intermediate across species and depended on the proportion of non-zero counts included in the dataset. Models were used to estimate the regional population of each species within the Chicago Metropolitan Region and to generate abundance maps for each species. These population estimates will be useful for assessing conservation successes, setting future population targets for conservation, and focusing resources. For example, with relatively low abundance of Sedge Wren, Henslow's Sparrow, and Grasshopper Sparrow in the region, future habitat conservation or restoration plans should focus on their unique grassland habitat needs.

Ecosystem services offer a unique opportunity for people to benefit from green infrastructure while also protecting wildlife in the process. Spatially explicit ecosystem service valuation tools are increasingly being used to quantify the economic value provided by natural resources. We used abundance estimates and ecosystem service valuation data based on the Chicago Wilderness GIV datasets to highlight areas that are rich in both ecosystem services and bird habitat. Our analysis covered the seven-county CMAP region and found that four of these counties have significant unprotected habitat patches that should be prioritized for protection. McHenry County was found to have the most potential for immediate conservation of grassland bird habitat and ecosystem service value, with 26 patches having large proportions of unprotected areas that could provide over $45.5 million in ecosystem services as well as valuable habitat for grassland birds.

Our research demonstrates a methodology for identifying patches of grassland bird habitat while also illustrating that grassland protection has benefits for both humans and birds. Our results also show the importance of considering ecosystem services when making land-management decisions, which can protect ecosystems and their services for people.

Next Steps

The Partners in Flight North American Landbird Conservation Plan (Rich et. al 2004) established a goal of increasing grassland bird populations by 1.5 or 2 times their current (2004) numbers. Similar aspirational targets were also incorporated in Illinois's 2005 Wildlife Action Plan, the 1999 Chicago Wilderness Biodiversity Recovery Plan, and the 2002 Chicago Wilderness Grassland Bird Conservation Design. With improved monitoring and more localized and accurate population estimates we can now update these goals and work with land managers to develop an appropriate conservation plan.

The Grassland Bird Conservation Area (GBCA) conceptual model describes the benefit of a large core grassland (~2,000 acres) surrounded by at least 2,000 additional acres in surrounding smaller parcels within a 10,000 acre landscape. (Sample and Mossman 1997, Johnson et al 2010). Establishing grassland bird conservation areas within northeast Illinois is a reasonable next step.

These grassland bird abundance models could be improved with additional effort. More extensive monitoring throughout the Chicago Wilderness would reduce extrapolation errors outside the Chicago Metropolitan Region. More detailed information on vegetation condition and species composition within each of these grasslands would improve model accuracy if such data could be collected extensively. Improved models and grassland data would increase the accuracy of population estimates and help tailor population and grassland acreage targets.

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Appendix A

County	Patch ID	Map Label	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
McHenry	1714	1	P	152	122	0.20%	33	0.10%	5	0.16%	5	0.11%	5	0.12%	$823,048	$344,420	$110,873	$6,360	$1,284,701
			U	1009	816	1.30%	221	0.66%	34	1.08%	35	0.74%	32	0.80%	$5,481,082	$2,293,660	$738,356	$42,357	$8,555,455
Lake	1261	2	P	110	2	0.00%	2	0.01%	-	-	1	0.03%	2	0.04%	$2,375,856	$302,220	$288,112	$3,081	$2,969,269
			U	988	18	0.03%	21	0.06%	-	-	11	0.23%	14	0.36%	$21,407,851	$2,723,181	$2,596,059	$27,762	$26,754,853
McHenry	1791	3	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
			U	909	1178	1.88%	317	0.95%	35	1.11%	85	1.83%	45	1.14%	$2,986,860	$1,396,660	$184,309	$6,523	$4,574,352
Will	2008	4	P	1	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$1,118	$445	$212	$4	$1,779
			U	609	340	0.54%	157	0.47%	34	1.06%	16	0.34%	10	0.24%	$660,016	$262,806	$125,167	$2,563	$1,050,552
Will	684	5	P	4	1	0.00%	0	0.00%	0	0.00%	-	-	0	0.00%	$16,918	$9,882	$1,836	$45	$28,681
			U	604	79	0.13%	64	0.19%	18	0.56%	-	-	26	0.66%	$2,286,881	$1,335,777	$248,154	$6,082	$3,876,894
Will	813	6	P	684	473	0.75%	170	0.51%	27	0.84%	45	0.96%	37	0.93%	$8,006,421	$1,025,120	$1,298,525	$5,405	$10,335,471
			U	562	388	0.62%	140	0.42%	22	0.69%	37	0.79%	30	0.77%	$6,580,279	$842,520	$1,067,225	$4,443	$8,494,467
Will	788	7	P	67	112	0.18%	36	0.11%	4	0.12%	8	0.18%	6	0.14%	$400,763	$61,362	$69,664	$387	$532,176
			U	437	731	1.17%	232	0.69%	24	0.77%	55	1.18%	37	0.94%	$2,615,507	$400,472	$454,652	$2,526	$3,473,157
McHenry	1811	8	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$289	$2	$57	$2	$350
			U	430	208	0.33%	105	0.31%	12	0.38%	12	0.26%	21	0.54%	$521,031	$3,066	$103,379	$3,229	$630,705
McHenry	1110	9	P	1	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$1,218	$297	$101	$3	$1,619
			U	415	193	0.31%	103	0.31%	15	0.49%	-	-	-	-	$656,339	$160,152	$54,407	$1,445	$872,343
Lake	1033	10	P	127	35	0.06%	16	0.05%	4	0.12%	5	0.11%	18	0.46%	$472,802	$52,307	$64,872	$926	$590,907
			U	413	113	0.18%	51	0.15%	12	0.39%	16	0.35%	58	1.48%	$1,531,588	$169,441	$210,146	$3,001	$1,914,176
Kane	1863	11	P	21	13	0.02%	5	0.02%	1	0.02%	1	0.02%	1	0.02%	$82,794	$16,853	$13,688	$319	$113,654
			U	411	244	0.39%	99	0.30%	11	0.36%	14	0.31%	14	0.36%	$1,613,246	$328,390	$266,717	$6,214	$2,214,567
Kane	175	12	P	262	374	0.60%	94	0.28%	16	0.49%	26	0.56%	16	0.39%	$423,152	$203,459	$81,664	$4,165	$712,440
			U	407	581	0.93%	146	0.44%	24	0.76%	41	0.87%	24	0.61%	$657,878	$316,319	$126,965	$6,476	$1,107,638
Will	993	13	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	399	70	0.11%	93	0.28%	18	0.56%	-	-	-	-	$190,788	$0	$40,492	$16	$231,296
McHenry	1793	14	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$44	$23	$5	$0	$72
			U	378	372	0.59%	101	0.30%	16	0.51%	47	1.01%	7	0.18%	$829,517	$435,744	$95,918	$6,373	$1,367,552

County	Patch ID	Map Label	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
Kane	1928	15	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	371	268	0.43%	112	0.34%	16	0.51%	-	-	-	-	$34,244	$19,224	$13,994	$60	$67,522
McHenry	1559	16	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	356	180	0.29%	82	0.25%	11	0.36%	-	-	-	-	$520,579	$340,692	$52,263	$12,492	$926,026
Kane	1958	17	P	116	52	0.08%	25	0.08%	4	0.14%	-	-	-	-	$80,403	$0	$16,868	$975	$98,246
			U	330	147	0.24%	71	0.21%	12	0.38%	-	-	-	-	$228,683	$0	$47,977	$2,773	$279,433
McHenry	1221	18	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
			U	329	270	0.43%	91	0.27%	12	0.38%	13	0.27%	15	0.39%	$967,478	$475,215	$88,920	$8,466	$1,540,079
McHenry	1742	19	P	1	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$7,582	$2,119	$1,449	$36	$11,186
			U	328	155	0.25%	98	0.29%	20	0.62%	14	0.29%	16	0.40%	$2,780,858	$777,047	$531,347	$13,042	$4,102,294
Lake	1551	20	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
			U	321	227	0.36%	122	0.37%	18	0.56%	28	0.61%	7	0.19%	$1,429,350	$445,126	$280,886	$7,705	$2,163,067
Will	823	21	P	2	0	0.00%	0	0.00%	-	-	-	-	0	0.00%	$12,901	$1,440	$2,540	$13	$16,894
			U	311	40	0.06%	25	0.07%	-	-	-	-	10	0.25%	$1,754,928	$195,930	$345,458	$1,710	$2,298,026
McHenry	1466	22	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	0	0.00%	$0	$0	$0	$0	$0
			U	296	326	0.52%	90	0.27%	11	0.35%	-	-	7	0.17%	$659,601	$268,099	$58,354	$1,842	$987,896
McHenry	1259	23	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	293	168	0.27%	84	0.25%	9	0.29%	-	-	-	-	$437,092	$29,382	$58,476	$901	$525,851
McHenry	1645	24	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	291	323	0.52%	101	0.30%	14	0.43%	-	-	-	-	$336,098	$60,452	$3,857	$1,319	$401,726
Lake	1014	25	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
			U	291	116	0.19%	116	0.35%	17	0.52%	26	0.56%	15	0.38%	$161,436	$7,476	$33,167	$99	$202,178
McHenry	1430	26	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
			U	287	336	0.54%	92	0.28%	9	0.28%	14	0.30%	10	0.26%	$535,325	$178,598	$16,039	$2,120	$732,082
Lake	1183	27	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	-	-	$0	$0	$0	$0	$0
			U	286	138	0.22%	119	0.36%	17	0.55%	18	0.38%	-	-	$748,347	$97,268	$104,036	$949	$950,600
McHenry	1167	28	P	82	48	0.08%	16	0.05%	2	0.06%	-	-	2	0.04%	$1,102,101	$240,991	$143,695	$3,906	$1,490,693
			U	286	168	0.27%	55	0.16%	7	0.22%	-	-	6	0.16%	$3,837,599	$839,149	$500,355	$13,602	$5,190,705

County	Patch ID	Map Label	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
Will	762	29	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	286	152	0.24%	126	0.38%	21	0.65%	-	-	-	-	$127,192	$0	$129,560	$983	$257,735
McHenry	1333	30	P	16	14	0.02%	5	0.01%	0	0.01%	-	-	-	-	$86,138	$14,428	$13,876	$250	$114,692
			U	286	255	0.41%	80	0.24%	8	0.25%	-	-	-	-	$1,521,203	$254,793	$245,058	$4,414	$2,025,468
McHenry	1090	31	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	285	143	0.23%	70	0.21%	11	0.33%	-	-	-	-	$547,143	$256,548	$58,176	$946	$862,813
Lake	1135	32	P	80	51	0.08%	32	0.10%	5	0.17%	5	0.10%	11	0.28%	$181,242	$28,734	$39,204	$900	$250,080
			U	284	180	0.29%	114	0.34%	19	0.60%	16	0.35%	39	0.99%	$640,614	$101,562	$138,569	$3,183	$883,928
Will	728	33	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	283	87	0.14%	91	0.27%	15	0.47%	-	-	-	-	$273,557	$212,532	$14,183	$1,610	$501,882
McHenry	1429	34	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	0	0.00%	$0	$0	$0	$0	$0
			U	282	48	0.08%	67	0.20%	8	0.26%	-	-	8	0.20%	$59,671	$13,565	$7,336	$595	$81,167
McHenry	1476	35	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	280	143	0.23%	63	0.19%	9	0.30%	-	-	-	-	$113,283	$65,148	$14,983	$5,988	$199,402
McHenry	1346	36	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$1,502	$868	$219	$3	$2,592
			U	280	136	0.22%	55	0.16%	9	0.28%	-	-	-	-	$1,315,389	$759,895	$192,048	$2,772	$2,270,104
Will	657	37	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	278	74	0.12%	58	0.17%	17	0.53%	-	-	-	-	$330,469	$398,364	$16,017	$2,439	$747,289
McHenry	1302	38	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	0	0.00%	$0	$0	$0	$0	$0
			U	273	168	0.27%	70	0.21%	9	0.28%	-	-	15	0.39%	$403,113	$594,221	$1,156	$2,419	$1,000,909
McHenry	1628	39	P	3	2	0.00%	1	0.00%	0	0.00%	-	-	-	-	$5,135	$3,499	$141	$13	$8,788
			U	271	225	0.36%	71	0.21%	10	0.32%	-	-	-	-	$557,094	$379,585	$15,298	$1,423	$953,400
Will	985	40	P	92	53	0.08%	24	0.07%	4	0.14%	4	0.08%	6	0.15%	$185,812	$81,326	$38,004	$1,422	$306,564
			U	269	155	0.25%	70	0.21%	13	0.40%	11	0.25%	18	0.44%	$544,952	$238,513	$111,460	$4,171	$899,096
McHenry	1655	41	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	266	103	0.16%	61	0.18%	10	0.33%	-	-	-	-	$739,861	$199,651	$137,781	$2,377	$1,079,670
McHenry	1341	42	P	15	13	0.02%	4	0.01%	-	-	-	-	-	-	$46,819	$19,896	$4,547	$68	$71,330
			U	265	219	0.35%	64	0.19%	-	-	-	-	-	-	$810,407	$344,389	$78,704	$1,182	$1,234,682

County	Patch ID	Map Label	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
McHenry	1385	43	P	131	67	0.11%	31	0.09%	4	0.13%	-	-	2	0.06%	$546,176	$233,508	$73,144	$1,173	$854,001
			U	259	133	0.21%	62	0.19%	8	0.25%	-	-	4	0.11%	$1,082,964	$463,004	$145,032	$2,326	$1,693,326
Kane	131	44	P	79	44	0.07%	19	0.06%	4	0.11%	3	0.06%	2	0.06%	$354,177	$112,981	$66,090	$1,010	$534,258
			U	257	143	0.23%	62	0.19%	12	0.37%	9	0.19%	7	0.19%	$1,157,873	$369,357	$216,063	$3,304	$1,746,597
McHenry	1769	45	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	0	0.00%	$0	$0	$0	$0	$0
			U	253	154	0.25%	59	0.18%	9	0.29%	-	-	15	0.38%	$364,293	$221,076	$47,139	$662	$633,170
McHenry	1561	46	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	252	93	0.15%	55	0.16%	11	0.35%	-	-	-	-	$1,268,340	$471,722	$211,251	$4,022	$1,955,335
McHenry	1095	47	P	8	6	0.01%	2	0.01%	-	-	-	-	0	0.01%	$28,574	$3,385	$5,431	$52	$37,442
			U	251	187	0.30%	71	0.21%	-	-	-	-	9	0.24%	$863,651	$102,301	$164,161	$1,586	$1,131,699
Will	621	48	P	334	73	0.12%	53	0.16%	12	0.37%	22	0.47%	18	0.45%	$868,678	$687,673	$272,754	$2,857	$1,831,962
			U	244	53	0.09%	39	0.12%	9	0.27%	16	0.34%	13	0.33%	$634,332	$502,157	$199,173	$2,087	$1,337,749
Will	904	49	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	0	0.00%	$0	$0	$0	$0	$0
			U	232	22	0.04%	73	0.22%	11	0.35%	-	-	10	0.26%	$344,136	$247,776	$4,157	$1,085	$597,154
Will	647	50	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	230	98	0.16%	73	0.22%	15	0.48%	-	-	-	-	$142,078	$43,788	$23,964	$820	$210,650
Will	708	51	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
			U	229	119	0.19%	53	0.16%	12	0.39%	-	-	-	-	$277,892	$227,484	$11,004	$1,377	$517,757

*Status is classified as protected (P) or unprotected (U).

Percentages are based on the total number of a species across entire CMAP region.

Appendix B

Cook County

Patch ID	Overall Rank	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
434	1	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	-	-	$0	$0	$0	$0	$0
		U	222	83	4.07%	66	5.21%	11	5.76%	32	5.62%	-	-	$264,168	$87,576	$57,131	$2,369	$411,244
1849	2	P	1	1	0.02%	0	0.02%	0	0.04%	0	0.04%	-	-	$4,468	$2,709	$155	$7	$7,339
		U	209	81	3.98%	44	3.48%	12	6.22%	32	5.59%	-	-	$712,918	$432,315	$24,703	$1,109	$1,171,041
1827	3	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	-	-	$0	$0	$0	$0	$0
		U	174	55	2.68%	33	2.62%	9	4.64%	22	3.99%	-	-	$2,848	$652,902	$1,734	$828	$658,312
1903	4	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
		U	173	57	2.81%	42	3.33%	10	5.09%	-	-	-	-	$545,902	$246,708	$133,236	$990	$926,836
576	5	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
		U	137	38	1.88%	40	3.19%	13	6.76%	-	-	-	-	$233,428	$201,852	$9,648	$909	$445,837
556	6	P	0	0	0.00%	0	0.00%	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	93	18	0.87%	11	0.90%	-	-	-	-	-	-	$582,552	$351,372	$92,710	$1,092	$1,027,730
530	7	P	0	-	-	0	0.00%	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	83	-	-	8	0.64%	-	-	-	-	-	-	$1,214,440	$371,810	$235,948	$4,605	$1,826,800
526	8	P	0	-	-	-	-	-	-	-	-	0	0.00%	$0	$0	$0	$0	$0
		U	81	-	-	-	-	-	-	-	-	6	4.46%	$0	$0	$0	$35	$35
2006	9	P	15	5	0.23%	4	0.33%	-	-	-	-	1	0.85%	$53,574	$36,195	$12,884	$285	$102,938
		U	74	23	1.12%	20	1.61%	-	-	-	-	5	4.08%	$257,843	$174,201	$62,009	$1,370	$495,423
481	10	P	0	0	0.00%	0	0.00%	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	64	14	0.69%	10	0.76%	-	-	-	-	-	-	$24,460	$1,068	$7,436	$0	$32,964

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Percentages are based on the total number of a species in the county.

DuPage County

Patch ID	Overall Rank	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
245	1	P	126	61	1.21%	51	2.45%	12	4.81%	28	3.43%	4	1.72%	$34,271	$69,478	$18,027	$677	$122,453
		U	91	44	0.88%	37	1.77%	9	3.48%	21	2.48%	3	1.24%	$24,789	$50,256	$13,040	$489	$88,574
141	2	P	42	8	0.16%	7	0.32%	-	-	-	-	-	-	$168,536	$18,788	$35,364	$711	$223,399
		U	72	14	0.28%	12	0.55%	-	-	-	-	-	-	$291,312	$32,476	$61,125	$1,229	$386,142
41	3	P	441	566	11.28%	192	9.25%	23	9.05%	93	11.17%	52	20.45%	$1,369,250	$463,162	$290,380	$5,276	$2,128,073
		U	65	84	1.67%	28	1.37%	3	1.34%	14	1.65%	8	3.02%	$202,200	$68,396	$42,881	$779	$314,257
76	4	P	132	78	1.55%	30	1.46%	6	2.35%	30	0.0357	-	-	$794,458	$219,092	$164,845	$1,951	$1,180,343
		U	56	33	0.65%	13	0.62%	3	0.99%	12	0.015	-	-	$334,482	$92,242	$69,403	$821	$496,947
49	5	P	614	656	13.07%	250	12.02%	33	12.79%	66	0.0798	53	20.51%	$3,097,547	$355,908	$613,618	$11,853	$4,078,929
		U	44	47	0.95%	18	0.87%	2	0.93%	5	0.0058	4	1.48%	$224,124	$25,752	$44,399	$858	$295,133
116	6	P	0	0	0.00%	0	0.00%	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	43	33	0.65%	13	0.63%	-	-	-	-	-	-	$220,140	$58,740	$45,827	$150	$324,857
174	7	P	71	22	0.0044	12	0.56%	-	-	8	0.0094	-	-	$471,216	$77,999	$98,475	$1,631	$649,321
		U	35	11	0.0022	6	0.28%	-	-	4	0.0047	-	-	$234,300	$38,783	$48,965	$811	$322,859
112	8	P	0	0	0	0	0	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	34	24	0.0048	11	0.0054	-	-	-	-	-	-	$13,005	$9,612	$0	$24	$22,641
282	9	P	232	-	-	-	-	-	-	-	-	7	2.61%	$1,833,132	$592,620	$367,551	$4,861	$2,798,168
		U	26	-	-	-	-	-	-	-	-	1	0.29%	$202,177	$65,360	$40,537	$536	$308,612
71	10	P	69	9	0.19%	8	0.38%	-	-	-	-	-	-	$360,131	$5,568	$78,502	$933	$445,134
		U	23	3	0.06%	3	0.13%	-	-	-	-	-	-	$119,641	$1,850	$26,079	$310	$147,880

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Kane County

Patch ID	Overall Rank	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
1863	1	P	21	13	0.15%	5	0.11%	1	0.17%	1	0.20%	1	0.15%	$82,794	$16,853	$13,688	$319	$113,654
		U	411	244	2.83%	99	2.17%	11	3.39%	14	3.96%	14	2.97%	$1,613,246	$328,390	$266,717	$6,214	$2,214,566
175	2	P	262	374	4.33%	94	2.06%	16	4.58%	26	7.16%	16	3.24%	$423,152	$203,459	$81,664	$4,165	$712,437
		U	407	581	6.73%	146	3.20%	24	7.13%	41	11.13%	24	5.04%	$657,878	$316,319	$126,965	$6,476	$1,107,633
1928	3	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
		U	371	268	3.11%	112	2.46%	16	4.75%	-	-	-	-	$34,244	$19,224	$13,994	$60	$67,522
1958	4	P	116	52	0.60%	25	0.55%	4	1.27%	-	-	-	-	$80,403	$0	$16,868	$975	$98,246
		U	330	147	1.71%	71	1.56%	12	3.61%	-	-	-	-	$228,683	$0	$47,977	$2,773	$279,433
131	5	P	79	44	0.51%	19	0.41%	4	1.07%	3	0.0076	2	0.47%	$354,177	$112,981	$66,090	$1,010	$534,257
		U	257	143	1.66%	62	1.35%	12	3.49%	9	0.0248	7	1.54%	$1,157,873	$369,357	$216,063	$3,304	$1,746,593
33	6	P	0	0	0.00%	0	0.00%	0	0	-	-	-	-	$20	$30	$5	$0	$55
		U	220	144	1.67%	55	1.20%	12	0.0366	-	-	-	-	$130,062	$193,278	$29,472	$2,609	$355,421
84	7	P	0	0	0	0	0.00%	-	-	-	-	-	-	$248	$22	$48	$1	$319
		U	208	38	0.0044	29	0.64%	-	-	-	-	-	-	$1,548,172	$138,952	$298,077	$6,985	$1,992,181
1970	8	P	43	18	0.0021	10	0.0023	2	0.0069	2	0.0064	-	-	$164,343	$17,044	$32,838	$215	$214,439
		U	205	88	0.0101	49	0.0108	11	0.0329	11	0.0305	-	-	$779,813	$80,874	$155,816	$1,020	$1,017,521
1879	9	P	0	0	0.00%	0	0.00%	0	0.0001	-	-	-	-	$414	$195	$76	$1	$687
		U	195	154	1.79%	66	1.44%	10	0.0292	-	-	-	-	$185,587	$87,381	$34,047	$653	$307,667
202	10	P	68	79	0.92%	28	0.62%	5	0.014	5	0.0136	2	0.46%	$52,766	$164,555	$10,809	$752	$228,882
		U	190	221	2.56%	80	1.74%	13	0.0392	14	0.038	6	1.29%	$147,233	$459,157	$30,161	$2,100	$638,651

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Percentages are based on the total number of a species in the county.

Kendall County

Patch ID	Overall Rank	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
668	1	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
		U	215	33	4.85%	36	4.46%	13	15.11%	-	-	-	-	$29,352	$0	$11,582	$1,026	$41,960
420	2	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
		U	175	31	4.60%	35	4.27%	11	12.83%	-	-	-	-	$220,477	$130,945	$11,882	$1,075	$364,379
415	3	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	0	0.00%	$0	$0	$0	$0	$0
		U	173	44	6.42%	37	4.53%	14	16.93%	-	-	6	9.09%	$214,328	$117,480	$28,010	$935	$360,753
519	4	P	0	-	-	0	0.00%	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	146	-	-	11	1.31%	-	-	-	-	-	-	$291,454	$202,920	$4,835	$801	$500,010
438	5	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
		U	142	32	4.67%	36	4.48%	12	13.60%	-	-	-	-	$0	$0	$0	$19	$19
571	6	P	0	0	0.00%	0	0.00%	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	125	35	5.11%	24	2.98%	-	-	-	-	-	-	$237,658	$143,112	$11,304	$252	$392,326
563	7	P	0	0	0	0	0.00%	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	114	20	0.0296	22	2.71%	-	-	-	-	-	-	$184,435	$61,944	$23,208	$219	$269,806
633	8	P	0	-	-	0	0	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	113	-	-	24	0.03	-	-	-	-	-	-	$9,784	$0	$4,246	$0	$14,030
403	9	P	41	14	2.11%	7	0.92%	-	-	-	-	3	5.29%	$87,840	$51,121	$7,805	$237	$147,003
		U	106	38	5.52%	20	2.40%	-	-	-	-	8	13.83%	$229,640	$133,643	$20,405	$618	$384,306
557	10	P	0	0	0.00%	0	0.00%	-	-	-	-	-	-	$0	$0	$0	$0	$0
		U	105	13	1.90%	23	2.87%	-	-	-	-	-	-	$160,621	$110,004	$2,901	$208	$273,734

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Lake County

Patch ID	Overall Rank	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
1261	1	P	110	2	0.03%	2	0.06%	-	-	1	0.19%	2	0.13%	$2,375,856	$302,220	$288,112	$3,081	$2,969,268
		U	988	18	0.31%	21	0.50%	-	-	11	1.70%	14	1.16%	$21,407,851	$2,723,181	$2,596,059	$27,762	$26,754,841
1033	2	P	127	35	0.61%	16	0.38%	4	1.01%	5	0.80%	18	1.49%	$472,802	$52,307	$64,872	$926	$590,906
		U	413	113	1.99%	51	1.23%	12	3.28%	16	2.58%	58	4.82%	$1,531,588	$169,441	$210,146	$3,001	$1,914,174
1551	3	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
		U	321	227	3.99%	122	2.91%	18	4.67%	28	4.47%	7	0.60%	$1,429,350	$445,126	$280,886	$7,705	$2,163,070
1014	4	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
		U	291	116	2.03%	116	2.78%	17	4.39%	26	4.11%	15	1.25%	$161,436	$7,476	$33,167	$99	$202,178
1183	5	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	-	-	$0	$0	$0	$0	$0
		U	286	138	2.42%	119	2.83%	17	4.58%	18	2.81%	-	-	$748,347	$97,268	$104,036	$949	$950,600
1135	6	P	80	51	0.89%	32	0.77%	5	1.42%	5	0.73%	11	0.91%	$181,242	$28,734	$39,204	$900	$250,081
		U	284	180	3.15%	114	2.71%	19	5.01%	16	2.58%	39	3.22%	$640,614	$101,562	$138,569	$3,183	$883,929
1537	7	P	159	68	1.20%	51	1.21%	10	2.57%	7	1.07%	19	1.58%	$1,996,718	$327,241	$282,970	$5,420	$2,612,346
		U	221	95	1.66%	70	1.68%	14	3.57%	9	1.48%	27	2.19%	$2,769,732	$453,929	$392,519	$7,518	$3,623,694
1043	8	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
		U	206	76	1.34%	80	1.91%	14	3.77%	16	2.48%	12	0.95%	$1,724,080	$431,934	$327,802	$2,264	$2,486,080
1057	9	P	45	14	0.25%	6	0.15%	2	0.51%	3	0.54%	5	0.43%	$489,292	$142,457	$100,593	$1,175	$733,518
		U	187	59	1.03%	26	0.61%	8	2.11%	14	2.25%	22	1.78%	$2,042,791	$594,757	$419,977	$4,907	$3,062,436
1036	10	P	50	39	0.69%	17	0.41%	4	0.99%	3	0.45%	10	0.80%	$209,780	$8,639	$36,259	$321	$254,999
		U	184	146	2.55%	64	1.52%	14	3.64%	11	1.66%	36	2.95%	$773,524	$31,853	$133,700	$1,185	$940,261

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McHenry County

Patch ID	Overall Rank	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
1714	1	P	152	122	0.60%	33	0.32%	5	1.00%	5	0.96%	5	0.46%	$823,048	$344,420	$110,873	$6,360	$1,284,702
		U	1009	816	3.97%	221	2.16%	34	6.63%	35	6.41%	32	3.07%	$5,481,082	$2,293,660	$738,356	$42,357	$8,555,458
1791	2	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$0	$0	$0	$0	$0
		U	909	1178	5.74%	317	3.10%	35	6.82%	85	15.78%	45	4.35%	$2,986,860	$1,396,660	$184,309	$6,523	$4,574,350
1811	3	P	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$289	$2	$57	$2	$350
		U	430	208	1.01%	105	1.03%	12	2.36%	12	2.25%	21	2.06%	$521,031	$3,066	$103,379	$3,229	$630,705
1110	4	P	1	0	0.00%	0	0.00%	0	0.01%	-	-	-	-	$1,218	$297	$101	$3	$1,620
		U	415	193	0.94%	103	1.01%	15	3.00%	-	-	-	-	$656,339	$160,152	$54,407	$1,445	$872,343
1793	5	P	0	0	0.00%	0	0.00%	0	0.00%	0	0	0	0.00%	$44	$23	$5	$0	$72
		U	378	372	1.81%	101	0.99%	16	3.11%	47	0.0873	7	0.68%	$829,517	$435,744	$95,918	$6,373	$1,367,548
1559	6	P	0	0	0.00%	0	0.00%	0	0	-	-	-	-	$0	$0	$0	$0	$0
		U	356	180	0.88%	82	0.81%	11	0.0223	-	-	-	-	$520,579	$340,692	$52,263	$12,492	$926,026
1221	7	P	0	0	0	0	0.00%	0	0	0	0	0	0.00%	$0	$0	$0	$0	$0
		U	329	270	0.0132	91	0.89%	12	0.0231	13	0.0234	15	1.49%	$967,478	$475,215	$88,920	$8,466	$1,540,080
1742	8	P	1	0	0	0	0	0	0.0001	0	0.0001	0	0.00%	$7,582	$2,119	$1,449	$36	$11,185
		U	328	155	0.0075	98	0.0096	20	0.038	14	0.0252	16	1.55%	$2,780,858	$777,047	$531,347	$13,042	$4,102,295
1466	9	P	0	0	0.00%	0	0.00%	0	0	-	-	0	0.00%	$0	$0	$0	$0	$0
		U	296	326	1.59%	90	0.88%	11	0.0213	-	-	7	0.67%	$659,601	$268,099	$58,354	$1,842	$987,896
1259	10	P	0	0	0.00%	0	0.00%	0	0	-	-	-	-	$0	$0	$0	$0	$0
		U	293	168	0.82%	84	0.82%	9	0.0178	-	-	-	-	$437,092	$29,382	$58,476	$901	$525,851

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Will County

Patch ID	Overall Rank	Status*	Acreage	Bobolink (#)	Bobolink (%)	Eastern Meadowlark (#)	Eastern Meadowlark (%)	Grasshopper Sparrow (#)	Grasshopper Sparrow (%)	Henslow's Sparrow (#)	Henslow's Sparrow (%)	Sedge Wren (#)	Sedge Wren (%)	Flood Control	Groundwater Recharge	Water Purification	Carbon Sequestration	All Services
2008	1	P	1	1	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	$1,118	$445	$212	$4	$1,780
		U	609	340	1.70%	157	1.53%	34	2.39%	16	0.91%	10	1.21%	$660,016	$262,806	$125,167	$2,563	$1,050,551
684	2	P	4	1	0.00%	0	0.00%	0	0.01%	-	-	0	0.02%	$16,918	$9,882	$1,836	$45	$28,681
		U	604	79	0.40%	64	0.62%	18	1.26%	-	-	26	3.30%	$2,286,881	$1,335,777	$248,154	$6,082	$3,876,897
813	3	P	684	473	2.36%	170	1.66%	27	1.90%	45	2.61%	37	4.68%	$8,006,421	$1,025,120	$1,298,525	$5,405	$10,335,450
		U	562	388	1.94%	140	1.36%	22	1.56%	37	2.14%	30	3.84%	$6,580,279	$842,520	$1,067,225	$4,443	$8,494,450
788	4	P	67	112	0.56%	36	0.35%	4	0.26%	8	0.0049	6	0.72%	$400,763	$61,362	$69,664	$387	$532,178
		U	437	731	3.65%	232	2.26%	24	1.73%	55	0.0321	37	4.71%	$2,615,507	$400,472	$454,652	$2,526	$3,473,162
993	5	P	0	0	0.00%	0	0.00%	0	0.00%	-	-	-	-	$0	$0	$0	$0	$0
		U	399	70	0.35%	93	0.90%	18	1.26%	-	-	-	-	$190,788	$0	$40,492	$16	$231,296
823	6	P	2	0	0.00%	0	0.00%	-	-	-	-	0	0.01%	$12,901	$1,440	$2,540	$13	$16,894
		U	311	40	0.20%	25	0.24%	-	-	-	-	10	1.24%	$1,754,928	$195,930	$345,458	$1,710	$2,298,026
762	7	P	0	0	0	0	0.00%	0	0	-	-	-	-	$0	$0	$0	$0	$0
		U	286	152	0.0076	126	1.23%	21	0.0147	-	-	-	-	$127,192	$0	$129,560	$983	$257,735
728	8	P	0	0	0	0	0	0	0	-	-	-	-	$0	$0	$0	$0	$0
		U	283	87	0.0044	91	0.0089	15	0.0105	-	-	-	-	$273,557	$212,532	$14,183	$1,610	$501,882
657	9	P	0	0	0.00%	0	0.00%	0	0	-	-	-	-	$0	$0	$0	$0	$0
		U	278	74	0.37%	58	0.56%	17	0.012	-	-	-	-	$330,469	$398,364	$16,017	$2,439	$747,289
985	10	P	92	53	0.26%	24	0.23%	4	0.0031	4	0.0023	6	0.76%	$185,812	$81,326	$38,004	$1,422	$306,564
		U	269	155	0.77%	70	0.68%	13	0.0091	11	0.0067	18	2.23%	$544,952	$238,513	$111,460	$4,171	$899,096

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