

Illinois State University
ISU ReD: Research and eData

North American Prairie Conference Proceedings

2016

04. Population Trends of Breeding Grassland Birds at Midewin National Tallgrass Prairie, 1985–2015

James R. Herkert

Illinois Audubon Society, jherkert@illinoisaudubon.org

William D. Glass

Midewin National Tallgrass Prairie

Follow this and additional works at: <https://ir.library.illinoisstate.edu/napc>



Part of the [Plant Sciences Commons](#)

Recommended Citation

Herkert, James R. and Glass, William D., "04. Population Trends of Breeding Grassland Birds at Midewin National Tallgrass Prairie, 1985–2015" (2016). *North American Prairie Conference Proceedings*. 10.

<https://ir.library.illinoisstate.edu/napc/10>

This Conference Proceeding is brought to you for free and open access by ISU ReD: Research and eData. It has been accepted for inclusion in North American Prairie Conference Proceedings by an authorized administrator of ISU ReD: Research and eData. For more information, please contact ISURed@ilstu.edu.

Population Trends of Breeding Grassland Birds at Midewin National Tallgrass Prairie, 1985–2015

JAMES R. HERKERT AND WILLIAM D. GLASS

Illinois Audubon Society, P.O. Box 2547, Springfield, IL 62708, USA (JRH)

U.S. Department of Agriculture, U.S. Forest Service, Midewin National Tallgrass Prairie, Wilmington, IL 60481, USA (WDG)

ABSTRACT We use data from ongoing bird monitoring programs to assess long-term population trends at Midewin National Tallgrass Prairie in northeastern Illinois. Midewin is the nation's first National Tallgrass Prairie and was established in 1996 on the site of the former Joliet Army Ammunition Plant. Annual bird monitoring began at the site in the early 1980s when it was discovered that the pastures and hayfields maintained by the Army contained significant grassland bird populations. Ninety-four species of breeding birds were recorded at the site between 2009 and 2015, including large populations of several grassland-obligate birds including dickcissel (*Spiza americana*), eastern meadowlark (*Sturnella magna*), grasshopper sparrow (*Ammodramus savannarum*), bobolink (*Dolichonyx oryzivorus*), and Henslow's sparrow (*Ammodramus henslowii*). Trend analyses showed that populations of bobolink, grasshopper sparrow, and savannah sparrow (*Passerculus sandwichensis*) were stable on the site between 1985 and 2015, whereas dickcissel and Henslow's sparrow showed significant population increases during this interval. Three species declined significantly between 1985 and 2015: eastern meadowlark, upland sandpiper (*Bartramia longicauda*), and vesper sparrow (*Pooecetes gramineus*). The stable population trends for bobolink, grasshopper sparrow, and savannah sparrow contrast sharply with statewide and regional trends for these species, which show large population declines. The recent introduction of bison to the site may help provide the habitat structure needed to maintain large grassland bird populations at the site.

Grassland birds have experienced greater population declines than any other group of North American birds (Knopf 1994, Sauer et al. 2017). These species are under continued threat primarily because of habitat degradation and loss (Askins et al. 2007). Midewin National Tallgrass Prairie is an 18,180-acre (2,023-ha) unit of the U.S. Department of Agriculture Forest Service located 40 miles SW of Chicago, Illinois. Before the Forest Service assumed management, the land was part of the Joliet Army Ammunition Plant (JAAP). The Army leased out portions of the plant as grazing tracts and hayfields, a total area in excess of 5,000 acres (7,357 ha). For security reasons, access to the plant was restricted, but in the early 1980s it was discovered that the Illinois state endangered upland sandpiper (*Bartramia longicauda*) was breeding at the ammunition plant. As a result, biologists from the Illinois Department of Natural Resources (then Department of Conservation) initiated a yearly grassland bird survey. It soon became evident that the ammunition plant supported large numbers of other grassland birds as well, such as eastern meadowlark (*Sturnella magna*), grasshopper sparrow (*Ammodramus savannarum*), bobolink (*Dolichonyx oryzivorus*), and savannah sparrow (*Passerculus sandwichensis*) and was an important grassland bird area in the Midwest. In addition, a small but stable population of the migrant loggerhead shrike (*Lanius ludovicianus migrans*) was found. The grazing and haying at the JAAP along with

the large unfragmented grassland tracts created a landscape that many species of grassland birds favored.

In the early 1990s, the Army announced that they would be closing the plant. After the closure of the ammunition plant, legislation was passed by Congress in 1996 to create the Midewin National Tallgrass Prairie, the first such national grassland designation in the country. The grassland bird populations determined by the past yearly surveys were a significant factor in the protection of the land. Without the data from the grassland bird surveys it is doubtful that such a large tract of land would have been protected. Currently 18,180 acres (7,357 ha) are protected, with another 1,445 acres (585 ha) scheduled to be transferred from the Army in the future. The U.S. Forest Service has maintained much of the hayfield and pasture habitat previously managed by the Army, and in 2002, initiated tallgrass prairie and wetland restoration that continues today (U.S. Department of Agriculture, Forest Service 2002). The Prairie Plan calls for the establishment of at least 10,260 acres (4,152 ha) of unfragmented grasslands including at least two tracts in excess of 3,000 acres (1,214 ha) each (Midewin National Tallgrass Prairie 2002). The plan also establishes goals for creating and maintaining a mosaic of grassland heights, including short-stature grasslands (4–12 inches [10–30 cm] tall from late April to July), medium-stature grasslands (8–14 inches [20–36 cm] tall), and tall-stature grasslands (16–32 inches [41–81 cm] tall). Acreage goals for these habitats were also identified in the Prairie Plan: 4,000 acres [91,619 ha] of short-stature grasslands, 2,400 acres (971 ha) of medium-stature grasslands, and 2,000 acres (809 ha) per year of unburned tall-stature grasslands (U.S. Department of

Table 1. Summary of bird survey protocols.

Survey ^a	Years	Date (Date Range)	Median		Point	
			No. of Points (Points Range)	No. of Fields (Fields Range)	Survey Duration	Survey Area
MGBS	1985–2008	10 May (1 May–7 June)	176 (86–261)	30.5 (12–39)	4 min	Unlimited
JGBS	2009–2015	6 June (25 May–8 July)	207 (152–312)	31 (24–34)	5 min	100-m fixed radius
SGBS	1995–2015	12 June (22 May–14 July)	47 (22–97)	7 (3–10)	5 min	100-m fixed radius

^a MGBS, JGBS, and SGBS are May Grassland Bird Survey, June Grassland Survey, and Supplement Grassland Bird Survey, respectively.

Agriculture, Forest Service 2002). Currently, the tallgrass prairie restorations that have been initiated on the site are providing approximately 3,000 acres (1,214 ha) of tall- and medium-stature grasses. Continued cattle grazing of another approximately 3,500 acres (1,416 ha) is being maintained to provide short- and medium-stature grasses. Bison were reintroduced onto an additional 1,200 acres (486 ha) of grassland in October 2015. It is anticipated that the bison will provide good grassland bird habitat.

Here we use data from ongoing breeding bird monitoring programs to assess population trends for the eight most common obligate grassland bird species on the site from 1985 to the present. Obligate grassland birds are species that are exclusively adapted to and entirely dependent on grassland habitats and make little or no use of other habitat types (Vickery et al. 1999).

METHODS

We used three sources of bird monitoring data in our trend analysis (Table 1). The first was a set of annual surveys initiated in 1985 after the discovery of a sizable population of upland sandpipers on the property. Typically, these surveys were conducted in early May (date range 1 May to 7 June, median date 10 May) and were intended to monitor the upland sandpiper population on the site and assess other breeding birds, especially grassland birds (Glass and Cole 1987). Within this survey, observation points were selected within each field to allow for as complete viewing as possible and to allow for total coverage (Glass and Cole 1987). Surveys consisted of 4-minute point counts during which observers recorded all birds seen or heard from the point (Glass and Cole 1987). Although the distance of bird observations (observation radius) that could be included in this survey was not limited (as it was in the other two counts to be described later), effort was made to avoid double counting of birds. This protocol was used annually between 1985 and 2008 in what will subsequently be referred to as the May Grassland Bird Survey (MGBS) data set. Between 1985 and 2008, 86 to 261 points were surveyed annually (median number of points = 176) from 12 to 39 different

fields (median 30.5 fields) by the MGBS. Fields were defined on the basis of agricultural leases, which typically focused on grazing or haying.

Beginning in 2009, the target dates of the annual survey were moved to early June to better correspond with the breeding season of the focal species. For this survey, counts occurred between 25 May and 8 July (median 6 June). Also at this time, point counts were switched to 100-m fixed-radius counts and extended to 5-minute duration. The point locations used in this survey were the same as those used previously by the MGBS. We refer to this survey as the June Grassland Bird Survey (JGBS). Between 2009 and 2015, 152 to 312 points were surveyed (median 270 points) from 24 to 34 fields (median 31 fields). A third data set spanning 1995–2015 was also used in the analysis. This survey consisted of data from 5-minute 100-m fixed-radius point counts (range 22–97 points, median 47) conducted between late May and early July (median date 12 June) in 3 to 10 fields (median 7) surveyed by the other two data sets. We referred to this data set as the Supplemental Grassland Bird Survey (SGBS).

Our primary objective in the analysis was to assess trends for eight common grassland-obligate birds: upland sandpiper, eastern meadowlark, bobolink, dickcissel (*Spiza americana*), grasshopper sparrow, Henslow's sparrow (*Ammodramus henslowii*), savannah sparrow, and vesper sparrow (*Pooecetes gramineus*). We used a linear regression approach for our trend analysis. For each year, and each of the three data sets, we calculated a mean number of birds recorded per point, by averaging all points conducted within a given data set within a given year to generate a single index of abundance for each species from each data set in each year. We then analyzed the mean abundance data with a general linear model in which the mean abundance per point was regressed against year. We included covariates to account for the three different surveys. We expected differences in mean counts among surveys because of the differences in timing within the breeding season at which they were conducted. If there were no significant differences among surveys with respect to trend (i.e., slopes), we judged

that the models had performed satisfactorily and used the slope of the year term in the model to assign a trend status of significantly increasing, stable, or significantly decreasing to each species on the basis of the significance of the year term. Species for which the year term had a significant negative slope were classified as significantly declining; species for which the year term had a significant positive slope were classified as significantly increasing species. Species for which the year term in the models did not differ from zero were classified as stable.

Because upland sandpipers can be detected from long distances, tend to move within fields during the count period, were often detected displaying above the ground, and were often detected from multiple point-count stations within a field, we used a different approach for this species. In each year, observations of upland sandpipers were plotted on maps, taking care to not double count individuals. Once all areas were surveyed, the maps were reviewed and an estimate of the minimum number of individuals on the site in each year was determined. As a result, trend analysis for this species was restricted to the MGBS and JGBS data sets, which were the two data sets that used this approach.

One species, dickcissel, had significant differences in slope among the three data sets. The differences were believed to be the result of this species' generally late arrival on breeding grounds this far north within its range (Basili 1997). As a result, for this species we restricted the trend analysis to data collected from the two surveys conducted later in the breeding season, the JGBS and the SGBS.

Trend analyses were performed using the linear regression program within the statistics package Statistix 9 (Analytical Software 2008). Follow-up tests for differences in slope were performed using the comparison of regression lines package in Statistix. A significance value of $P = 0.05$ was used in all analyses to indicate statistical significance.

RESULTS

Midewin National Tallgrass Prairie contains a diverse assemblage of breeding birds, with 94 species being recorded during point counts conducted between 2009 and 2015 (Table 2). Five of the 10 most abundant birds observed during monitoring were grassland-obligate birds—dickcissel, eastern meadowlark, grasshopper sparrow, bobolink, and Henslow's sparrow (Table 2). These five birds combined accounted for more than half (54%) of all birds recorded during monitoring conducted between 2009 and 2015. Grassland birds were also widely distributed within the site. Dickcissels were recorded within 100 m of slightly more than 80% of all census points conducted between 2009 and 2015. Eastern meadowlarks were recorded at 71%, grasshopper sparrows 59%, bobolinks at 45%, and Henslow's sparrows at 20% of all census points (2009–2015). Other species of conservation concern in the Midwest region

(U.S. Fish and Wildlife Service 2008) such as red-headed woodpecker (*Melanerpes erythrocephalus*), loggerhead shrike, and Bell's vireo (*Vireo bellii*) were also recorded on the surveys (Table 2), although they all tended to be more common in more wooded and shrubbier areas generally not targeted for the grassland breeding bird censuses.

Trend analyses of the eight focal grassland-obligate species showed that three species declined significantly, three species were stable, and two species increased significantly between 1985 and 2015 (Table 3). Two of the species that declined significantly, upland sandpiper and vesper sparrow, were more common in surveys conducted in the late 1980s and early 1990s and had become somewhat rare by the late 1990s on (Figures 1 and 2). Upland sandpipers reached their peak abundance in 1992 (190 total birds) and were not detected on site in either 2014 or 2015. Vesper sparrows were regular in occurrence in the early years of the study and reached their peak abundance in 1992. In subsequent years they declined, and became sporadic in their occurrence and were not detected in every year (Figure 1). The other species showing a significant decline, eastern meadowlark, remains one of the most common species found on the site (Table 2), but annual indices show a consistent decline and the species now appears to be much less common than it used to be at the site (Figure 1). Populations of bobolink, grasshopper sparrow, and savannah sparrow had trend slopes that were not significantly different from zero and were therefore judged to be stable over the 31-year period (Table 3; Figure 1). Populations of dickcissel and Henslow's sparrow both increased significantly during the study (Figures 3 and 1 respectively). Dickcissel and Henslow's sparrow were rarely encountered in the early years of the surveys. For dickcissels, only seven total birds were recorded in the first 13 years of the MGBS (1985–1997). Starting in 1998 dickcissels were recorded in every year on the MGBS (1998–2008), and when the annual survey switched to June in 2009, the species was found to be one of the most common species on the site (Table 2). Henslow's sparrow also was rare in the early years of the survey. Only a single Henslow's sparrow was recorded before 1998, but from 1998 to 2015 it was encountered every year. Henslow's sparrow is now among the 10 most common species recorded on the site (Table 2).

A majority of species examined (seven of the eight species, 87%) showed consistent trends among the three data sets used in the analysis (Table 3). There was one species that showed a significant difference in trend among data sets—dickcissel. Dickcissels were the least commonly encountered bird on the MGBS than on either of the June surveys (Figure 3). The difference between surveys was likely due to dickcissels generally being late-arriving birds during the breeding season compared with other species in the study. A simple regression of just the MGBS showed a nearly significant ($P = 0.6$) population increase between

Table 2. Bird abundance totals from grassland bird surveys conducted at Midewin National Tallgrass Prairie, 2009–2015. Only birds detected within 100 m of a point-count station are included. The total number of points conducted in each year is shown in the first line of the table. Species are listed in order of decreasing total abundance.

Species	2009	2010	2011	2012	2013	2014	2015	Total
No. of Points	232	270	273	312	299	169	152	1,707
Dickcissel	554	512	667	721	500	363	301	3,618
Red-winged blackbird	398	457	491	775	552	377	299	3,349
Eastern meadowlark	371	445	439	515	512	317	203	2,802
Grasshopper sparrow	354	345	434	311	281	198	166	2,089
Bobolink	246	311	417	332	380	174	184	2,044
European starling	140	102	50	329	134	135	41	931
Field sparrow	68	81	104	122	83	45	28	531
Henslow's sparrow	47	97	100	130	62	46	47	529
Barn swallow	118	86	84	68	77	28	33	494
Eastern kingbird	50	66	61	48	83	30	43	381
American goldfinch	55	75	50	67	72	21	22	362
Savannah sparrow	49	70	59	48	73	17	26	342
American robin	27	48	57	84	42	39	34	331
Common yellowthroat	32	54	38	90	71	15	27	327
Song sparrow	23	45	60	68	68	11	15	290
Brown-headed cowbird	48	36	45	34	34	13	19	229
Tree swallow	22	56	30	38	31	24	19	220
Common grackle	32	22	49	28	41	27	9	208
Brown thrasher	24	25	20	14	11	11	4	109
Northern mockingbird	13	11	16	21	25	13	3	102
Indigo bunting	7	9	15	12	13	3	3	62
Killdeer	13	7	0	16	8	10	7	61
Mourning dove	7	7	10	5	14	9	1	53
Canada goose	0	0	0	20	20	2	10	52
Gray catbird	7	6	3	6	13	7	6	48
Yellow warbler	0	2	8	14	14	4	6	48
Northern rough-winged swallow	3	8	13	8	7	1	7	47
Orchard oriole	4	8	9	11	11	3	1	47
Ring-billed gull	7	0	13	14	5	7	0	46
Great egret	2	4	1	1	8	12	15	43
Baltimore oriole	2	6	7	12	9	1	3	40
Cedar waxwing	2	2	16	1	6	6	1	34
Upland sandpiper	12	1	13	4	4	0	0	34
Great blue heron	6	7	4	7	7	0	1	32
House wren	4	6	6	3	5	2	4	30
Mallard	3	8	1	2	7	1	4	26
Northern cardinal	2	5	6	4	7	2	0	26
Sedge wren	4	8	3	10	1	0	0	26
Vesper sparrow	1	0	2	18	3	2	0	26
Willow flycatcher	1	1	5	2	11	2	4	26

Table 2. Continued.

Species	2009	2010	2011	2012	2013	2014	2015	Total
Blue jay	3	4	1	11	4	1	0	24
Turkey vulture	5	5	5	5	3	0	0	23
Red-tailed hawk	0	9	1	7	4	0	0	21
Wood duck	0	10	2	9	0	0	0	21
Yellow-shafted flicker	6	3	2	4	0	2	2	19
Ring-necked pheasant	2	5	2	1	2	3	0	15
Blue-winged teal	2	2	1	1	7	1	0	14
Marsh wren	0	7	0	1	4	0	0	12
American crow	0	1	0	4	6	0	0	11
Eastern phoebe	0	2	0	0	5	0	4	11
Bell's vireo	1	0	0	1	7	0	0	9
Eastern bluebird	1	2	0	2	0	3	1	9
Chimney swift	3	1	3	0	0	1	0	8
Loggerhead shrike	2	0	3	0	1	1	0	7
Red-headed woodpecker	2	0	0	1	3	0	1	7
Chipping sparrow	1	2	1	0	0	1	1	6
Horned lark	2	1	0	0	0	3	0	6
Rock pigeon	3	1	2	0	0	0	0	6
Blue grosbeak	0	0	0	2	2	1	0	5
Double-crested cormorant	0	0	0	0	1	1	2	4
Eastern towhee	1	1	0	0	2	0	0	4
Great crested flycatcher	1	0	1	0	2	0	0	4
Warbling vireo	0	0	0	0	2	1	1	4
Black-capped chickadee	0	0	0	0	2	0	1	3
Cliff swallow	0	3	0	0	0	0	0	3
Red-eyed vireo	0	0	1	0	0	2	0	3
Western meadowlark	1	0	0	0	0	0	2	3
American kestrel	0	0	1	0	1	0	0	2
Broad-winged hawk	0	0	0	0	0	2	0	2
Common snipe	0	2	0	0	0	0	0	2
Rose-breasted grosbeak	1	0	0	0	1	0	0	2
Sora	0	1	0	0	0	1	0	2
Wild turkey	2	0	0	0	0	0	0	2
Yellow-breasted chat	0	0	0	1	1	0	0	2
American coot	0	0	0	0	0	1	0	1
Blue-gray gnatcatcher	0	0	0	0	0	0	1	1
Downy woodpecker	0	0	0	1	0	0	0	1
Eastern wood-pewee	1	0	0	0	0	0	0	1
Green heron	0	0	1	0	0	0	0	1
House finch	0	0	1	0	0	0	0	1
House sparrow	0	0	0	1	0	0	0	1
King rail	0	0	0	0	0	0	1	1
Lark sparrow	1	0	0	0	0	0	0	1

Table 2. Continued.

Species	2009	2010	2011	2012	2013	2014	2015	Total
Northern bobwhite	0	0	0	0	1	0	0	1
Purple martin	1	0	0	0	0	0	0	1
Red-bellied woodpecker	1	0	0	0	0	0	0	1
Sandhill crane	0	0	0	0	1	0	0	1
Spotted sandpiper	0	1	0	0	0	0	0	1
Swamp sparrow	1	0	0	0	0	0	0	1
White-throated sparrow	1	0	0	0	0	0	0	1
Yellow-billed cuckoo	0	0	0	0	0	1	0	1

1985 and 2008. Analysis of the two later data sets (JGBS and SGBS) showed a significant population increase between 1995 and 2015, and also showed that the trend estimates among the two data sets was consistent ($P=0.23$). The trend analysis from the June surveys indicated a significant population increase, and the May data trended positive; consequently, we felt confident in assigning a trend status of significantly increasing to this species.

DISCUSSION

Midewin National Tallgrass Prairie supports both large populations and a diverse assemblage of grassland birds. Five of the 10 most common species at the site are

grassland-obligate birds that are widely distributed within the pastures and hayfields at the site. Collectively these five species (dickcissel, eastern meadowlark, grasshopper sparrow, bobolink, and Henslow's sparrow) make up more than 54% of all birds recorded on site during our bird-monitoring surveys between 2008 and 2015 (Table 2). These numbers compare very favorably with other large federal grassland preserves. Bird surveys at the 3,502-ha Neil Smith National Wildlife Refuge (NWR) in Iowa did not record any grassland-obligate birds among the 10 most common species observed during the summer of 2004 (Anonymous 2004). Dickcissel was the most common grassland obligate bird at Neil Smith NWR, accounting for less than 3% of the total number of birds recorded within 113 point counts conducted

Table 3. Results of the trend analysis of grassland birds at Midewin National Tallgrass Prairie 1985–2015. Trend assessment was based on the year term in a multiple regression model that included year and covariates accounting for the three different surveys used in the analysis. The slope of the year term, expressed as change in the mean number of birds per point/yr, is shown as is the significance of the year term. Birds with a significant negative slope were categorized as significantly declining, birds with a significant positive slope were categorized as significantly increasing, and birds with a nonsignificant slope ($P > 0.05$) were categorized as stable. Results of the comparison of regression slopes among different survey data sets are also given. Trends were assessed from the composite models (including all three bird-monitoring data sets) if analysis revealed consistency in trend as assessed by the lack of statistical differences among slopes. Graphs of the bird-monitoring data presented in Figures 1–3.

Species	Statistics for Year Term in Regression		Probability (Comparison of Regression Lines)
	Slope (Birds/yr)	Probability (yr)	
Upland sandpiper ^a	−5.55	<0.0001	0.4705
Vesper sparrow	−0.008	0.0068	0.7459
Eastern meadowlark	−0.077	<0.0001	0.6281
Bobolink	−0.006	0.7081	0.9445
Grasshopper sparrow	0.02	0.0873	0.4564
Savannah sparrow	0.0006	0.8895	0.1361
Dickcissel ^b	0.057	0.0111	0.0309
Henslow's sparrow	0.021	0.0002	0.3412

^a Comparison of slope estimates included just two data sets, May Grassland Bird Survey and June Grassland Bird Survey. ^b Slope and P (year) parameter estimates restricted to the two June data sets, June Grassland Bird Survey and Supplemental Survey.

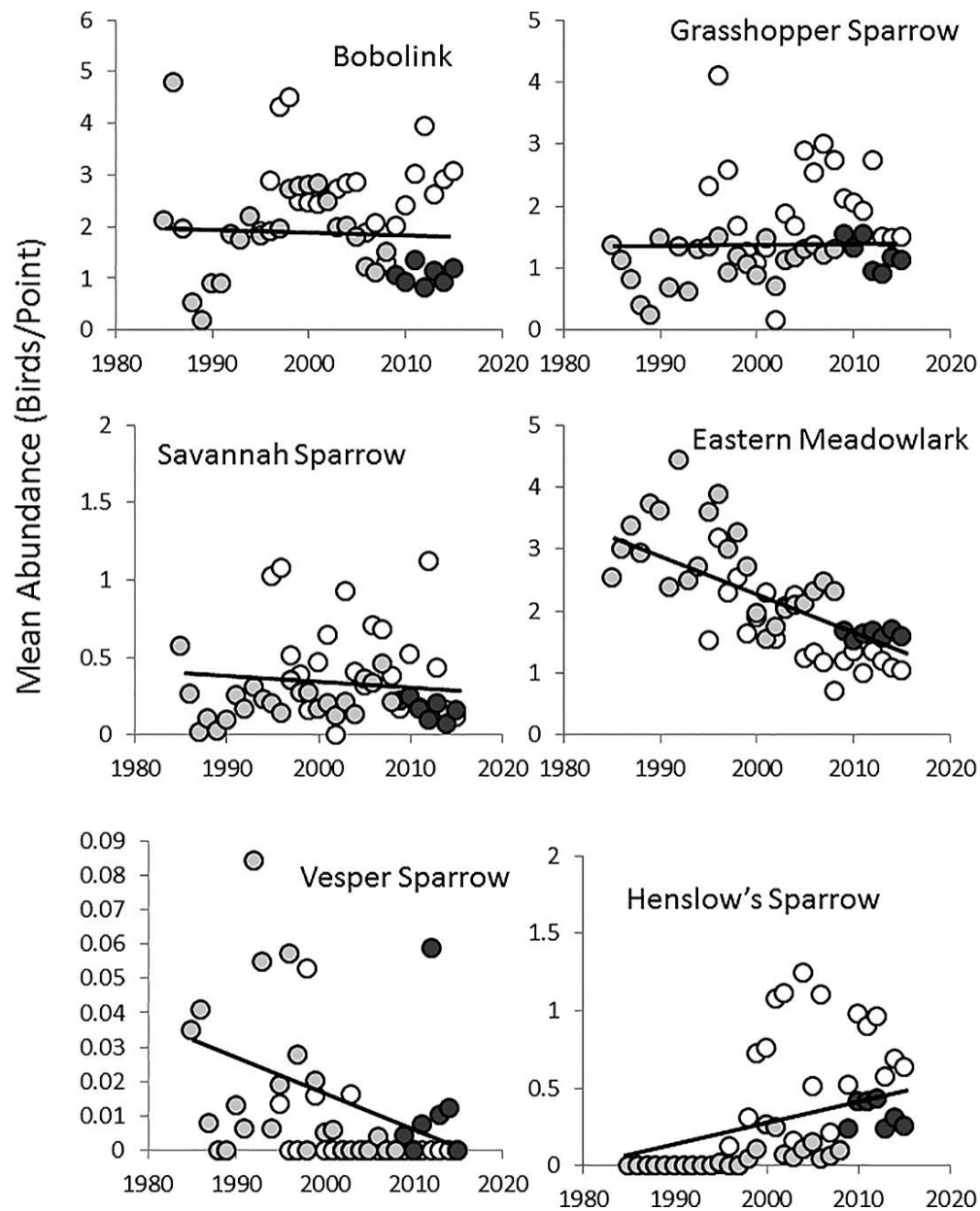


Figure 1. Population trends for obligate grassland bird species at Midewin National Tallgrass Prairie, 1985–2015. Solid black circles represent data from the June Grassland Bird Survey, gray circles represent data from the May Grassland Bird Survey, and open circles represent data from the Supplemental Grassland Bird Survey. Lines represent the trend from the composite trend analysis, including data from all three data sets. Placement of the line was based on least-square mean estimates for the two end points (1985 and 2015) after adjusting for potential differences in abundance among data sets.

on site between 5 June and 13 July 2004 (Anonymous 2004). At the Tallgrass Prairie Preserve in Kansas, five species of grassland-obligate birds were among the 10 most common species encountered in surveys of the site conducted in 2011—dickcissel, eastern meadowlark, Henslow's sparrow, upland sandpiper, and grasshopper sparrow (National Park Service 2011). Collectively these five species made up 45% of the birds recorded on the Tallgrass Prairie National

Preserve in 2011 (Peitz et al. 2011). Dickcissel was the most common grassland-obligate bird at all three of these federal grassland sites. Three obligate grassland birds, eastern meadowlark, grasshopper sparrow, and Henslow's sparrow, also were among the 10 most common birds at both Midewin National Tallgrass Prairie and Tallgrass Prairie National Preserve. Bobolinks were the fourth most common species at Midewin, and not recorded at the federal

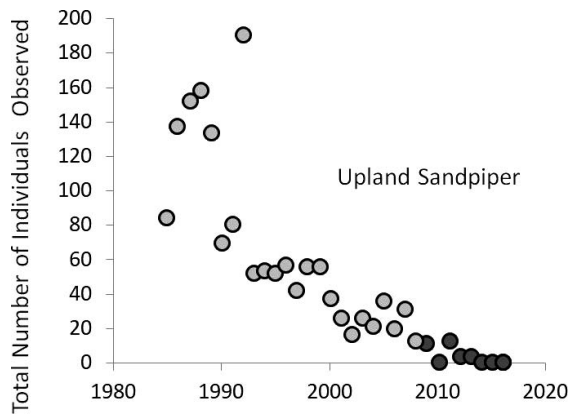


Figure 2. Population trend for the upland sandpiper at Midewin National Tallgrass Prairie, 1985–2015. Numbers represent the estimated minimum number of individuals detected annually during the May (gray circles) and June (dark circles) Grassland Bird Surveys.

grasslands in either Kansas or Iowa. Upland sandpiper was the fifth most common species found at Kansas, but was just the 34th most common at Midewin (Table 2) and was not detected at Neil Smith in 2004 (Anonymous 2004).

Trends for grassland birds at Midewin varied; some populations increased significantly, some decreased significantly, and others were found to be stable. Three species had stable trends at Midewin: bobolink, grasshopper sparrow, and savannah sparrow. The local trends observed at Midewin for these three species contrast sharply with their statewide trends. In fact, these three species are currently among the fastest declining birds in Illinois on the basis of data from the Breeding Bird Survey (BBS; Sauer et al. 2017). Statewide, bobolinks declined at an estimated annual rate of $-6.76\%/yr$ between 1966 and 2015, grasshopper sparrow populations decreased at a rate of $-6.54\%/yr$, and savannah sparrows declined by $-4.3\%/yr$ (Sauer et al. 2017). The stability of these three species at Midewin may be due to the abundance of intermediate-height grasslands on the site as a result of past and continued grazing and mowing. All three of these species prefer intermediate grass height and litter layers. Savannah sparrow habitat is generally described as having intermediate vegetation height, intermediate vegetation density, and a well-developed litter layer (Swanson 1998, Wheelwright and Rising 2008). Whereas bobolinks prefer moderate to tall vegetation, moderate to dense vegetation, and moderately deep litter without the presence of woody vegetation (Dechant et al. 2001, Renfrew et al. 2015), grasshopper sparrows also prefer intermediate-height vegetation interspersed with patches of bare ground, moderately deep litter, and sparse coverage of woody vegetation (Vickery 1996, Dechant et al. 2002d). Grazed or mowed cool-season

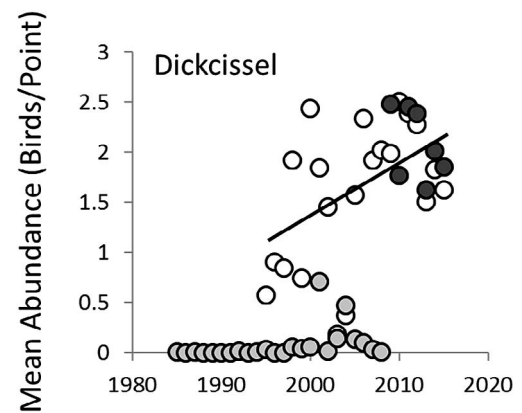


Figure 3. Population trend for the dickcissel at Midewin National Tallgrass Prairie, 1985–2015. Data from all three data sets are shown. Solid black circles represent data from the June Grassland Bird Survey (JGBS), gray circles represent data from the May Grassland Bird Survey (MGBS), and open circles represent data from the Supplemental Grassland Bird Survey (SGBS). Because of differences in trend estimates among data sources in the composite analysis involving all three data sets (see Table 2), the final trend for this species was based on only the JGBS and the SGBS. The trend line that is presented is the composite trend from the two surveys included in the trend analysis. The MGBS data given (gray circles) are for illustrative purposes only and were not included in the final trend assessment for this species.

grasslands provide the intermediate-height grasslands that these species prefer (McMaster and Davis 1998, Walk and Warner 2000, Ribic et al. 2009).

The two species that increased significantly at Midewin between 1985 and 2015 were Henslow's sparrow and dickcissel (Table 3). Both species prefer taller vegetation than most other grassland birds occurring on the site. Dickcissels prefer habitat with dense, moderate to tall vegetation and moderately deep litter (Dechant et al. 2002a, Temple 2002), whereas Henslow's sparrows prefer tall, dense vegetation, also with a moderately deep litter layer (Herkert 1998, Herkert et al. 2002). The amount of undisturbed (idle) grassland at the site has increased since the site was designated a national tallgrass prairie. During the years the site was being managed by the Army, idle grass was rare on site (personal observation). Henslow's sparrow populations have also increased at the statewide level (Sauer et al. 2017). Dickcissel populations within the state have shown long-term declines ($-1.45\%/yr$ between 1966 and 2015), but have increased significantly ($+5.26\%/yr$) over the past decade (2005–2015; Sauer et al. 2017).

Among the three species that declined significantly, two tend to prefer vegetation on the short end of the spectrum.

Vesper sparrows prefer dry, open areas with short, sparse, and patchy vegetation (Dechant et al. 2002b, Jones and Cornely 2002), and upland sandpipers also prefer areas with relatively short vegetation cover (Dechant et al. 2002c, Houston et al. 2011). Both upland sandpipers and vesper sparrows also appear to have stable statewide population trends on the basis of BBS data (Sauer et al. 2017), which is in contrast to their trend at Midewin. The reasons for their decline at the site are not known, as large acreage of apparently suitable habitat (i.e., grazed and mowed grasslands) continues to be available at Midewin.

Eastern meadowlark is a species that prefers moderately tall grasslands with abundant litter cover, high proportion of grass, moderate to high forb density, and low coverage of woody vegetation (Hull 2000, Jaster et al. 2012). Their populations have declined significantly at the statewide level (−3%/yr) between 1966 and 2015, and their population at Midewin has also significantly declined.

Maintenance of intermediate-height grasslands via grazing and late-season mowing at Midewin may be important to continue to support stable populations of bobolinks, grasshopper sparrows, and savannah sparrows. Walk and Warner (2000) found that light to moderate grazing was the preferred management for several grassland-obligate birds (e.g., eastern meadowlark, dickcissel, grasshopper sparrow, and Henslow's sparrow) in south-central Illinois. Although currently all of the pastures at Midewin are dominated by cool-season grasses, restoration activities are quickly increasing the acreage of native warm-season grasses at the site. Light to moderate grazing of warm-season grasses also may be appealing for eastern meadowlark, dickcissel, and grasshopper and Henslow's sparrows (Jensen 1999, Walk and Warner 2000). However, undisturbed warm-season grasses would not be expected to support populations of eastern meadowlark, bobolink, dickcissel, and grasshopper sparrow as well as grazed cool-season grass fields do (e.g., Delisle and Savidge 1997, McCoy et al. 2001).

Our analysis shows the success of past management by the Army and Midewin National Tallgrass Prairie at the site in maintaining large and mostly stable or increasing populations of grassland-obligate birds—a group of birds that are experiencing rapid declines throughout Illinois, the Midwest region, and the country (Sauer et al. 2017). That success is likely the result of the maintenance of large acreages of unfragmented, grazed cool-season grass pastures. Whether that success can be replicated and maintained as the site shifts toward warm-season grasses is not clear and should be monitored closely to ensure that the site continues to provide sufficient habitat to maintain large populations of grassland-obligate birds as it currently does. Monitoring and evaluation of bird response to the warm-season prairie restoration at the site also is needed, especially bird response to bison grazing and the resulting vegetation structure provided by grazed warm-season grasses.

LITERATURE CITED

- Analytical Software. 2008. Statistix 9 user's manual. Analytical software, Tallahassee, Florida, USA.
- Anonymous. 2004. Neal Smith National Wildlife Refuge, Prairie City, Iowa, fiscal year 2004. <https://ecos.fws.gov/ServCat/DownloadFile/996?Reference=1005>. Accessed 31 October 2017.
- Askins, R. A., F. Chávez-Ramírez, B. C. Dale, C. A. Haas, J. R. Herkert, F. L. Knopf, and P. D. Vickery. 2007. Conservation of grassland birds in North America: understanding ecological processes in different regions. *Ornithological Monographs* 64.
- Basili, G. D. 1997. Continental-scale ecology and conservation of dickcissels. Ph.D. dissertation. University of Wisconsin-Madison. 151 pp.
- Dechant, J. A., M. F. Dinkins, D. H. Johnson, L. D. Igl, C. M. Goldade, and B. R. Euliss. 2002b. Effects of management practices on grassland birds: Vesper sparrow. U.S. Geological Survey Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Dechant, J. A., M. F. Dinkins, D. H. Johnson, L. D. Igl, C. M. Goldade, B. D. Parkin, and B. R. Euliss. 2002c. Effects of management practices on grassland birds: upland sandpiper. U.S. Geological Survey Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, C. M. Nenneman, A. L. Zimmerman, and B. R. Euliss. 2002d. Effects of management practices on grassland birds: grasshopper sparrow. U.S. Geological Survey Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2001. Effects of management practices on grassland birds: bobolink. U.S. Geological Survey Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2002a. Effects of management practices on grassland birds: dickcissel. U.S. Geological Survey Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Delisle, J. M. and J. A. Savidge. 1997. Avian use and vegetation characteristics of Conservation Reserve Program fields. *Journal of Wildlife Management* 1:318–325.
- Glass, W. D. and M. A. R. Cole. 1987. Report on the 1987 upland sandpiper survey at the Joliet Army Ammunition Plant in Will County, Illinois. Unpublished report.

- Illinois Department of Conservation, Springfield, Illinois. 27 pp.
- Herkert, J. R. 1998. Effects of management practices on grassland birds: Henslow's sparrow. U.S. Geological Survey Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Herkert, J. R., P. D. Vickery, and D. E. Kroodsma. 2002. Henslow's sparrow (*Ammodramus henslowii*), version 2.0. In P. G. Rodewald, editor. The birds of North America. Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.672>
- Houston, C. S., C. Jackson, and D. E. Bowen, Jr. 2011. Upland sandpiper (*Bartramia longicauda*), version 2.0. In P. G. Rodewald, editor. The birds of North America. Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.580>
- Hull, S. D. 2000. Effects of management practices on grassland birds: eastern meadowlark. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Jaster, L. A., W. E. Jensen, and W. E. Lanyon. 2012. Eastern meadowlark (*Sturnella magna*), version 2.0. In P. G. Rodewald, editor. The birds of North America. Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.160>
- Jensen, W. E. 1999. Nesting habitat and responses to habitat edges of three grassland passerine species. M.S. thesis. Emporia State University, Emporia, Kansas. 58 pp.
- Jones, S. L. and J. E. Cornely. 2002. Vesper sparrow (*Pooecetes gramineus*), version 2.0. In P. G. Rodewald, editor. The birds of North America. Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.624>
- Knopf, F. L. 1994. Avian assemblages on altered grasslands. *Studies in Avian Biology* 15:247–257.
- McCoy, T. D., M. R. Ryan, Jr., L. W. Burger, and E. W. Kurzejeski. 2001. Grassland bird conservation: CP1 vs. CP2 plantings in Conservation Reserve Program fields in Missouri. *American Midland Naturalist* 145:1–17.
- McMaster, D. G. and S. K. Davis. 1998. Non-game evaluation of the Permanent Cover Program. Unpublished report. Saskatchewan Wetland Conservation Corporation, Regina, Saskatchewan. 75+ pages.
- Peitz, D. G., K. M. James, and C. S. Gross. 2011. 2011 Breeding Bird Survey Results for Tallgrass Prairie National Preserve, Kansas. National Park Service U.S. Department of the Interior, Republic, Missouri.
- Renfrew, R., A. M. Strong, N. G. Perlut, S. G. Martin, and T. A. Gavin. 2015. Bobolink (*Dolichonyx oryzivorus*), version 2.0. In P. G. Rodewald, editor. The birds of North America. Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.176>
- Ribic, C. A., M. J. Guzy, and D. W. Sample. 2009. Grassland bird use of remnant prairie and Conservation Reserve Program fields in an agricultural landscape in Wisconsin. *American Midland Naturalist* 161(1):110–122.
- Sauer, J. R., D. K. Niven, J. E. Hines, D. J. Ziolkowski, Jr., K. L. Pardieck, J. E. Fallon, and W. A. Link. 2017. The North American Breeding Bird Survey, Results and Analysis 1966–2015. Version 2.07.2017. U.S. Geological Survey Patuxent Wildlife Research Center, Laurel, Maryland, USA
- Swanson, D. A. 1998. Effects of management practices of grassland birds: savannah sparrow. U.S. Geological Survey Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Temple, S. A. 2002. Dickcissel (*Spiza americana*), version 2.0. In P. G. Rodewald, editor. The birds of North America. Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.703>
- U.S. Department of Agriculture, Forest Service. 2002. Midewin National Tallgrass Prairie, prairie plan, Wilmington, Illinois.
- U.S. Fish and Wildlife Service. 2008. Birds of conservation concern 2008. U.S. Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp.
- Vickery, P. D. 1996. Grasshopper sparrow (*Ammodramus savaannarum*), version 2.0. In P. G. Rodewald, editor. The birds of North America. Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.239>
- Vickery, P. D., P. L. Tubaro, J. M. Cardosa da Silva, B. G. Peterjohn, J. R. Herkert, and R. B. Cavalcanti. 1999. Conservation of grassland birds in the Western Hemisphere. *Studies in Avian Biology* 19:2–26
- Walk, J. W. and R. E. Warner. 2000. Grassland management for the conservation of songbirds in the Midwestern USA. *Biological Conservation* 94:165–172.
- Wheelwright, N. T. and J. D. Rising. 2008. Savannah sparrow (*Passerculus sandwichensis*), version 2.0. In P. G. Rodewald, editor. The birds of North America. Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.45>