National Park Service
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Natural Resource Stewardship and Science

# Bird Monitoring at Pipestone National Monument, Minnesota

## *Status Report 2009–2017*

Natural Resource Report NPS/HTLN/NRR—2019/1939

ON THE COVER
Prairie at Pipestone National Monument
Photography by NPS/Heartland Inventory and Monitoring Network

# Bird Monitoring at Pipestone National Monument, Minnesota

## *Status Report 20009–2017*

Natural Resource Report NPS/HTLN/NRR—2019/1939

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# Contents

Page

Figures . . . . . iv
Tables . . . . . iv
Appendices . . . . . iv
Executive Summary . . . . . v
Acknowledgments . . . . . v
Introduction . . . . . 1
Methods . . . . . 3
    Site Selection . . . . . 3
    Bird Surveys . . . . . 4
    Data Analysis . . . . . 4
Results . . . . . 7
    Bird Surveys . . . . . 7
Discussion . . . . . 13
Literature Cited . . . . . 15

# Figures

Page

**Figure 1.** Location of Pipestone National Monument (PIPE), Minnesota, within the Prairie Potholes Bird Conservation Region. . . . . 1

**Figure 2.** Bird plot locations on Pipestone National Monument (PIPE), Minnesota. Vegetation mapping and classification provided by Diamond et al. (2014). . . . . 3

**Figure 3.** Comparison of bird population trends from Pipestone National Monument (PIPE), Minnesota, (2009 through 2017) with those of the larger Prairie Potholes Prairie Bird Conservation Region (2005 through 2015) from the Breeding Bird Surveys (BBS). . . . . 11

**Figure 4.** Trends in bird community diversity, richness, and species distribution evenness on Pipestone National Monument, Minnesota, from 2009 through 2017. . . . . 12

# Tables

Page

**Table 1.** Number of plots sampled and sampling dates for breeding bird surveys conducted at Pipestone National Monument, Minnesota, by year. . . . . 4

**Table 2.** Bird species recorded during breeding bird surveys at Pipestone National Monument, Minnesota, from 2009 through 2017. . . . . 7

# Appendices

Page

**Appendix A.** Plots Sampled . . . . . 17

**Appendix B.** Proportion of Plots Occupied and Abundance (Corrected for Undetected Individuals) . . . . . 20

**Appendix C.** Proportion of Plots Occupied and Abundance (Not Corrected for Undetected Individuals) . . . . . 21

**Appendix D.** Pipestone National Monument Trends . . . . . 26

**Appendix E.** Regional Trends . . . . . 27

# Executive Summary

In 2009, the Heartland Inventory & Monitoring Network initiated breeding bird surveys on Pipestone National Monument, Minnesota, to address two objectives: (1) to monitor changes in bird community composition and abundance, and (2) to improve our understanding of relationships between breeding birds and habitat, and the effects of management actions on those relationships. This report evaluates trends in the park's breeding bird populations in the context of trends observed within the North American Bird Conservation Initiative's (NABCI) Prairie Potholes Bird Conservation Region, the region in which the park is located. By doing so, we can assess the influence of park habitat management on bird populations with an understanding of regional population trends that are outside the influence of natural resource management activities at Pipestone National Monument.

Ninety-two species of birds were recorded during May and June site visits in the nine years since initiating monitoring. Eighty of the species are considered breeding species because they are permanent or summer residents. Six of the breeding species recorded on Pipestone National Monument are species of concern for the Prairie Potholes Bird Conservation Region. Twelve species were observed during the survey period in sufficient numbers to calculate annual abundances and trends with some degree of confidence.

The Bobolink (*Dolichonyx oryzivorus*), Clay-colored Sparrow (*Spizella pallida*), and Common Grackle (*Quiscalus quiscula*) were the most abundant and widespread species on Pipestone National Monument. Six of the species with sufficient numbers to calculate trends on the park had increasing populations, and no species had a population in decline. Within the Prairie Potholes Bird Conservation Region, only three of the species with positive population trends on the park had positive trends. Only one species, Red-winged Blackbird (*Agelaius phoeniceus*), with an uncertain trend on the park had a positive trend region-wide. Common Yellowthroat (*Geothlypis trichas*) had a strong increasing population on the park, but its population is declining within the region. The remaining species had uncertain population trends region-wide. Our findings suggests that for most bird species, populations on the park are faring as well/or better than populations in the region.

This report provides current regional and local breeding bird trends for future comparisons with bird data collected as part of the long-term monitoring efforts at Pipestone National Monument. This information will help park staff plan management objectives and assess the effectiveness of management alternatives. These monitoring data also provide park staff with additional information for interpreting natural resources.

# Acknowledgments

We would like to thank the staff of Pipestone National Monument, Minnesota for allowing us to access the park during our site visits. We would also like to thank park staff and volunteers who assisted with bird surveys on the park: Leticia A. Blauert, Susan C. Bury, Sarah E. Campbell, Jordan W. Croatt, Seth B. Hendriks, Chris D. Langland, Peter R. Loso, Julianne L. Pierson, Shannon M. Regan, Sarah E. Schmit, Creighton C. Schroyer, and Jonathan A. Wendel.

# Introduction

Birds are an important component of park ecosystems, as their high body temperature, rapid metabolism, and high ecological position in most food webs make them good indicators of the effects of local and regional changes in ecosystems. It has been suggested that management activities aimed at preserving habitat for bird populations, such as neotropical migrants, can have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991; Maurer 1993). Moreover, birds have a tremendous following among the public and many parks provide information on the status and trends of birds through their interpretive programs.

Pipestone National Monument, Minnesota, is located on the southeastern edge of the Prairie Potholes Bird Conservation Region (Figure 1). This bird conservation region is one of 67 regions identified in the North American Bird Conservation Initiative (NABCI). Started in 1999, the NABCI is a coalition of government agencies and private organizations in the United States working to ensure the long-term health of North America's native bird populations (NABCI 2012).

The Prairie Potholes Bird Conservation Region is a glaciated area of mixed-grass prairie in the west and tallgrass prairie in the east (NABCI 2012). This is the most important waterfowl production area on the North American continent, despite extensive wetland drainage and tillage of native grasslands. The region comprises the core of the breeding range of most

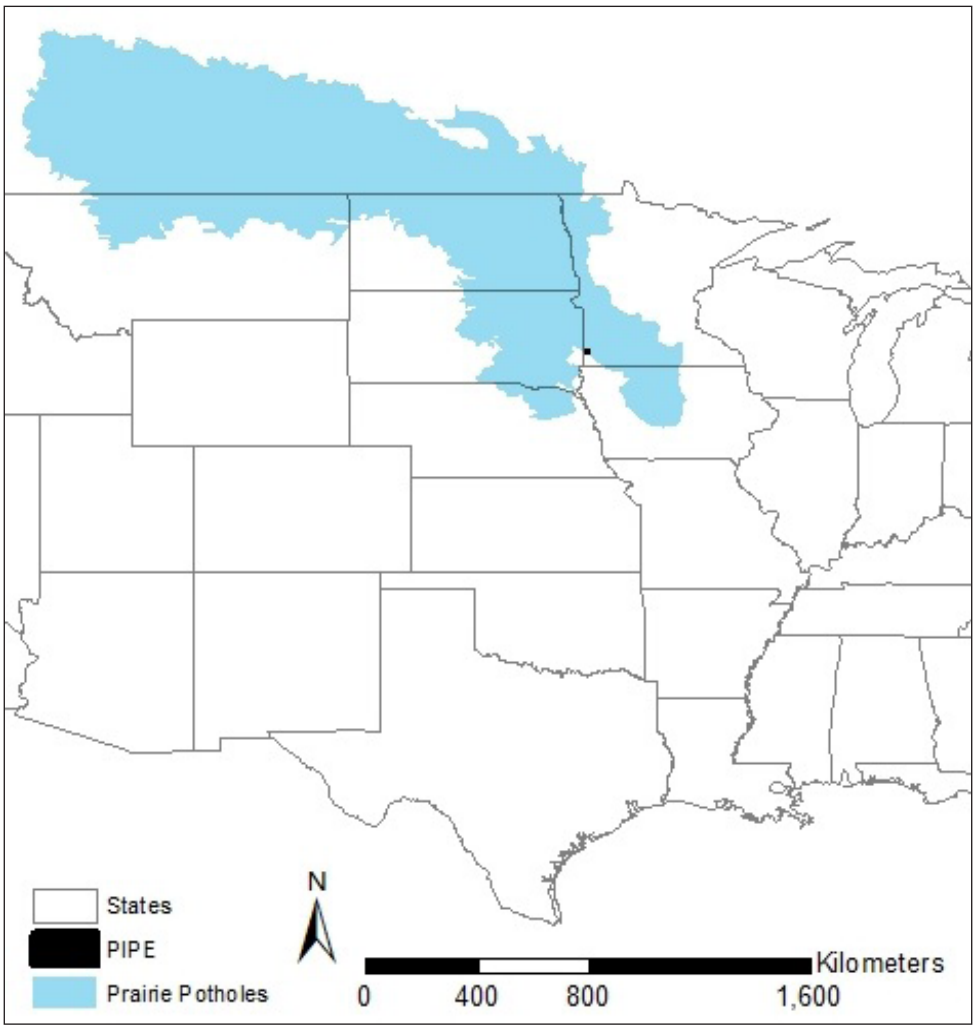


**Figure 1.** Location of Pipestone National Monument (PIPE), Minnesota, within the Prairie Potholes Bird Conservation Region.

dabbling duck and several diving duck species, and provides critical breeding and migration habitat for over 200 other bird species, including many species of continental concern. Approximately 105 of the 200 species of breeding birds can be found in and around Pipestone National Monument (Janssen et al. 2003). Continued wetland degradation, widespread habitat loss to agriculture and urban and industrial development, and fragmentation of remaining grasslands threaten many species in the region.

Data collected during the U.S. Geological Survey's (USGS) annual North American Breeding Bird Surveys (BBS) between 2005 and 2015 indicate that a number (31) of potential breeding bird species occurring at Pipestone National Monument show evidence of population decline (Sauer et al. 2017). In fact, 34% of the bird species in the Prairie Potholes Bird Conservation Region that breed or have some potential to breed on the park have populations reported to be in decline, with species such as the Sedge Wren (*Cistothorus platensis*) declining at alarming rates.

Long-term trends in community composition and abundance of breeding bird populations provide one measure for assessing the ecological stability and sustainability of a system. We will use trends in the composition and abundance of bird populations as long-term indicators of ecosystem stability at Pipestone National Monument. *Ecosystem stability* is defined as the system's capability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitats of the region. Research has demonstrated that birds serve as good indicators of changes in ecosystems (Cairns et al. 2004; Mallory et al. 2006; Wood et al. 2006). Therefore, changes in the numbers and composition of bird communities may reflect the effectiveness of management actions implemented to restore and maintain bird habitat at the park.

There are two primary objectives for monitoring breeding birds at Pipestone National Monument:

- Identify significant temporal changes in the species composition and abundance of bird communities that occur at the park during the breeding season.
- Improve our understanding of relationships between breeding birds and habitat and the effects of management actions (such as prairie restorations or prescribed fire) on bird populations by examining potential correlations between changes in specific habitat variables (e.g., vegetation structure, ground cover) and changes in bird community composition and abundance.

This report summarizes species composition and population trends for birds recorded during nine years (2009–2017) of monitoring.

# Methods

## Site Selection

Permanent monitoring locations or 'plots' were selected by overlaying a systematic grid of 100 x 100-m cells (originating from a random start point). The orientation of the grid was rotated 45 degrees to prevent monitoring sites from being influenced by man-made features (roads, fences, etc.) located along cardinal directions. We established 68 permanent plots on Pipestone National Monument (Figure 2). However, due to various reasons (i.e. volunteer availability and other reasons) the number of plots sample annually ranged from 17 to 68 (Table 1).

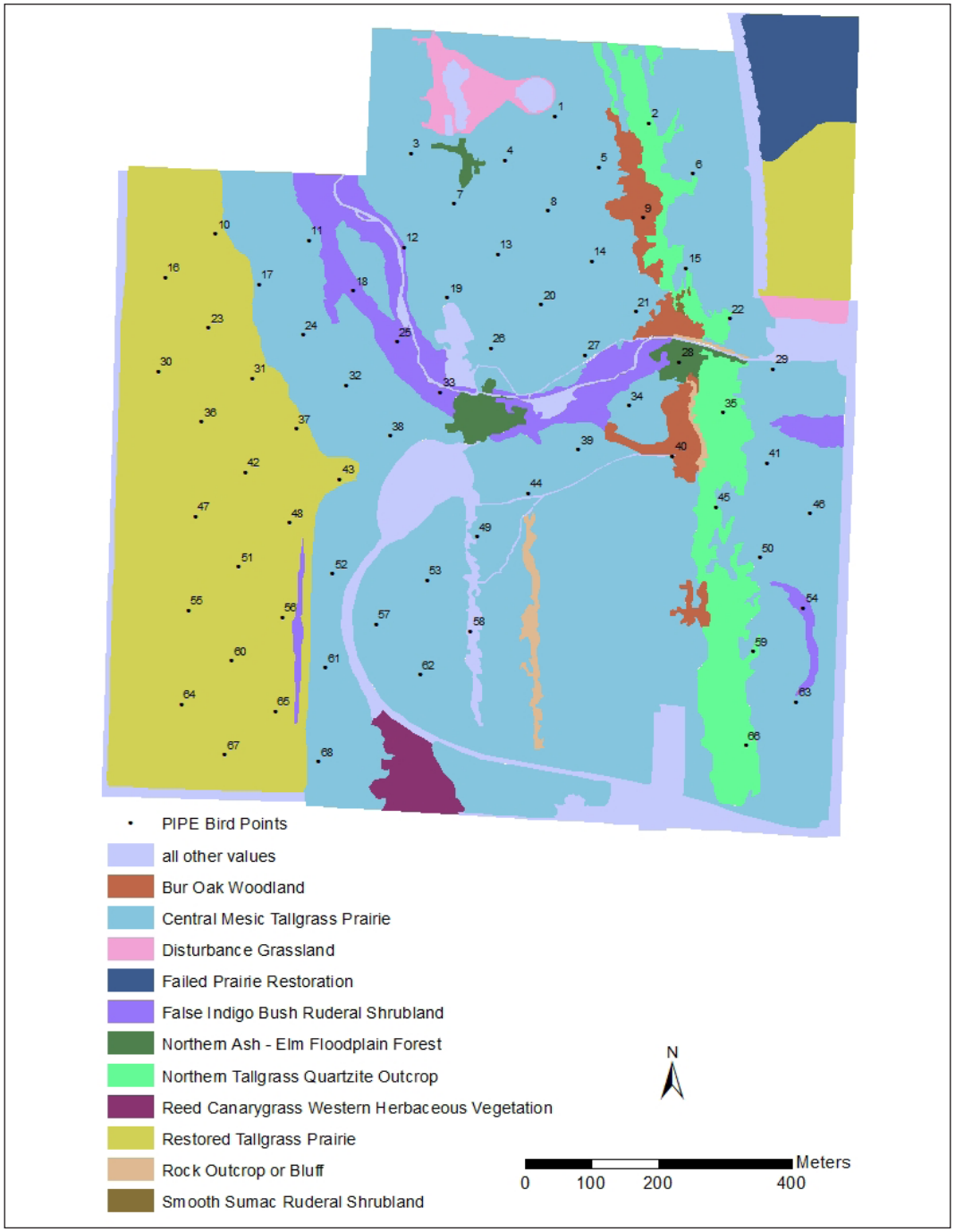


**Figure 2.** Bird plot locations on Pipestone National Monument (PIPE), Minnesota. Vegetation mapping and classification provided by Diamond et al. (2014).

**Table 1.** Number of plots sampled and sampling dates for breeding bird surveys conducted at Pipestone National Monument, Minnesota, by year. Also listed are observer(s) who conducted the surveys and whether or not habitat data were collected during the survey year.

| Year | Sampling Dates | Number of Plots Sampled | Observer(s) | Habitat Data Collected |
|---|---|---|---|---|
| 2009 | May 14 – May 16 | 68 | D. G. Peitz* | Yes |
| 2010 | May 27 – June 4 | 67 | L. A. Blauert, J. W. Croatt, S. B. Hendriks, and P. R. Loso | No |
| 2011 | May 26 – June 9 | 68 | S. B. Hendriks, J. L. Pierson, and C. C. Schroyer | No |
| 2012 | June 5 – June 8 | 67 | S. B. Hendriks and J. A. Wendel | No |
| 2013 | May 15 – May 16 | 17 | D. G. Peitz* | Yes |
| 2014 | June 4 – June 9 | 17 | S. B. Hendriks and C. D. Langland | No |
| 2015 | June 6 - June 10 | 17 | S. E. Campbell, C. D. Langland, and S. M. Regan | No |
| 2016 | June 1 – June 2 | 17 | S. B. Hendriks, C. D. Langland, S. C. Bury, and S. E. Schmit | No |
| 2017 | May 18 – May 19 | 68 | D. G. Peitz* and D. W. Marcum | Yes |

* Heartland I&M Network staff.

During bird surveys in 2009, monitoring plots were located using navigation waypoints (Peitz 2010) in a Trimble Geo XT GPS unit and temporarily marked with 36-in pin flags to aid in relocating the plots for habitat assessment, eliminating the need for permanent plot markers. We collected pin flags from each plot once the habitat work was completed. In 2013 and 2017, the habitat assessment crews worked independent of the bird surveyor, and monitoring plots were located using a GPS unit but not marked with pin flags. From 2010 to 2012 and 2014 to 2016, habitat assessments were not conducted. Bird monitoring plots in these years were also located using a GPS unit and were not marked with pin flags.

## Bird Surveys

Bird surveys followed methods outlined in the bird monitoring protocol by Peitz et al. (2008) and summarized in this report. Variable circular plot counts, a point count methodology that incorporates a measure of detectability into population estimates, were used to survey birds present (Fancy 1997). All birds seen or heard at plots during 5-min sampling periods were recorded along with their corresponding distance from the observer. For most species, we recorded each individual bird as a separate observation. For species that usually occur in clusters or flocks, the units recorded were cluster or flock size, and not the individual bird. During analysis, each individual in a cluster or flock was treated as a separate observation. After completing a count at a plot and filling out the data sheet, the observer navigated to the next plot using a GPS unit. While traveling between plots, the observer was vigilant for the presence of species not recorded during timed surveys. These species help formulate a more complete species list for the park by identifying species missed during timed surveys. However, these observations were not included in any analysis as they did not directly relate to any individual plot. We sampled birds in the morning starting when it was light enough to observe birds to four hours after sunrise.

Variable circular plot counts were conducted in an attempt to get an “instantaneous count” of all birds present. The observer recorded birds flushed from a plot when approached and the counts were started as soon as the observer reached plot center. We recorded all birds seen or heard, including flyovers, along with distance from the observer when possible. For this report, all birds seen or heard during the 5-min surveys are included.

## Data Analysis

Prior to summary analysis, the residency status (migrant, outside normal range, permanent resident, summer resident, and winter resident) of each bird species recorded was determined. Identifying the

residency of each species helps to exclude species outside their normal range, migrants, and winter residents from analysis of breeding birds within Pipestone National Monument. Proportion of plots occupied by each bird species was calculated (total number of plots occupied by a species/plots surveyed) and reported in Appendices B and C.

For species with greater than 60 observations recorded (12 species), Distance software (Distance 6.0 Release 2) was used to determine park-wide abundance (Buckland et al. 2001). A central part of the analysis in Distance is the modeling of a detection function to account for individuals present but not observed before calculating species abundance. Four candidate functions plus series expansion were considered in determining the detection function of each species (half-normal + cosine, uniform + cosine, half-normal + hermite polynomial, and hazard-rate + simple polynomial), and the most robust models were selected by Distance based on the lowest Akaike Information Criteria (AIC) values.

The hazard-rate + simple polynomial function was selected for eight species: American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Brown-headed Cowbird (*Molothrus ater*), Clay-colored Sparrow (*Spizella pallida*), Common Grackle (*Quiscalus quiscula*), Common Yellowthroat (*Geothlypis trichas*), Grasshopper Sparrow (*Ammodramus savannarum*), and Ring-necked Pheasant (*Phasianus colchicus*). The half-normal + cosine function was selected for four species: Bobolink (*Dolichonyx oryzivorus*), Dickcissel (*Spiza americana*), Red-winged Blackbird (*Agelaitus phoeniceus*), and Song Sparrow (*Melospiza melodia*). Abundances for these species are reported in Appendix B.

For species with fewer than 60 observations, park-wide abundance was calculated by first deriving a species density from observations recorded within a 50-m radius (0.79 ha) around each plot center and then calculating abundance based on average plot densities. Park-wide abundances for species with less than 60 observations are reported in Appendix C.

For species with adequate abundance (those with greater than 60 observations), trends were calculated by regressing abundance against survey years in TRIM Version 3.54 statistical software (Pannekoek and van Strien 2005; Appendix D). TRIM is a program developed for the analysis of count data obtained from wildlife population monitoring. It

Boblink (*Dolichonyx oryzivorus*) at Pipestone National Monument. NPS

analyzes time series of counts using Poisson regression and produces estimates of yearly indices and trends. We employed a linear trend model with changepoints selected by a stepwise procedure. Serial correlation in count data among years and overdispersion are taken into account with this software. Although TRIM has the capacity to estimate missing data, we restricted our regression analysis to 17 plots that were surveyed in most years (Appendix A). By doing this, we analyzed a consistent ratio of the various habitat types across years.

For this report we also obtained regional breeding bird trends for the Prairie Potholes Bird Conservation Region during the period of 2005 to 2015 (Appendix E; Sauer et al. 2017). It is possible to determine trends for many bird species, and many regions of interest for periods ranging from 1966 to 2015 by using the interactive calculator available at https://www.mbr-pwrc.usgs.gov/bbs/trend/tf15.html. However, we chose the last 11 year period of available data to maximize the accuracy of regional trend results without going too far beyond the sampling period at Pipestone National Monument.

We compared regional trends with those calculated using TRIM for Pipestone National Monument bird populations (Figure 3). Regional trends with a confidence interval that straddled zero were classified as uncertain for comparison with results from the park. It should be noted that trends determined by the BBS were calculated using a different methodology; due to

limitations in the BBS field data collections, hierarchical modeling was used to produce an annual index of abundance, and trends were then estimated as constant annual rates based only on the first and last years of the intervals selected. Since all but the first and last year indices are ignored in this approach, trends based on BBS data tend to display variability when compared among different broadly overlapping intervals, and caution should be used when interpreting BBS results.

Trends in the diversity, richness, and species distribution evenness of the breeding bird community on Pipestone National Monument were assessed by regressing each metric against survey years in the add-in statistical software of Microsoft Excel 2010, and then graphing the results. Prior to trend analysis, bird community diversity values were calculated annually using the Shannon Diversity Index:

$$H' = -\sum(n_i/N)\ln(n_i/N)$$

where $n_i/N$ is the proportion of the total number of individuals in a community consisting of the $i^{th}$ species (Shannon 1949). Species richness values were determined as the total number of bird taxa recorded annually. Species distribution evenness values were calculated using Pielou (J):

$$J' = H'/Hmax$$

where $H'$ is the Shannon Diversity Index and Hmax is the maximum possible diversity for a given number of species if all species are present in equal numbers (ln(annual species richness)). $J'$ is a measure of how evenly individuals are distributed within a community when compared to the equal distribution and maximum diversity a community can have (Pielou 1969).

Because some species occurring in an area may not actually be observed in a survey (i.e., rare species may be missed), recorded species richness is often an underestimate. Statistical species richness estimators utilize the information in species distribution and abundance patterns to produce an estimate of true species richness. Species richness estimators are also useful in comparing surveys with unequal sampling effort (e.g., different numbers of plots) since more species are usually discovered with greater sampling effort. Different species richness estimators will produce varying estimates, however, and no single estimator is consistently superior to others. Nonparametric statistical estimators have generally performed better than parametric types (Walther and Moore 2005). Reese et al. (2014) recently reviewed nonparametric species richness estimators, and found that two coverage-based estimators, the Abundance Coverage-based Estimator (ACE) and Incidence Coverage-based Estimator (ICE), provide less biased and more accurate estimates than many of the others. Thus, we employed these two species richness estimators and report estimated species richness along with observed species richness. The software application, EstimateS (Colwell 2013) was used to calculate the ACE and ICE estimators.

American Goldfinch (*Spinus tristus*). NPS

# Results

## Bird Surveys

Between 2009 and 2017, 406 cumulative plots were surveyed and 92 different bird species were recorded, 80 of which are species with the potential to breed within the park (Table 2; Janssen et al. 2003). Six of the breeding species recorded, Black Tern (*Chlidonias niger*), Dickcissel (*Spiza americana*), Grasshopper Sparrow (*Ammodramus savannarum*), Least Bittern (*Ixobrychus exilis*), Swainson's Hawk (*Buteo swainsoni*), and Upland Sandpiper (*Bartramia longicauda*) are considered species of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008).

**Table 2.** Bird species recorded during breeding bird surveys at Pipestone National Monument, Minnesota, from 2009 through 2017. The American Ornithologists' Union code (AOU code) and residency status of each species is given. Species names are valid and verified names taken from the Integrated Taxonomic Information system website (ITIS 2017).

| Common name | Species name | AOU code | Residency[A] |
|---|---|---|---|
| American Crow | *Corvus brachyrhynchos* | AMCR | R |
| American Goldfinch | *Spinus tristis* | AMGO | R |
| American Restart | *Setophaga ruticilla* | AMRE | SR |
| American Robin | *Turdus migratorius* | AMRO | R |
| Baltimore Oriole | *Icterus galbula* | BAOR | SR |
| Bank Swallow | *Riparia riparia* | BANS | SR |
| Barn Swallow | *Hirundo rustica* | BARS | SR |
| Belted Kingfisher | *Megaceryle alcyon* | BEKI | SR |
| Black and White Warbler | *Mniotilta varia* | BAWW | SR |
| Black-capped Chickadee | *Poecile atricapillus* | BCCH | R |
| Blackpoll Warbler | *Setophaga striata* | BLPW | M |
| **Black Tern[C]** | ***Chlidonias niger*** | **BLTE** | **SR** |
| Blue Jay | *Cyanocitta cristata* | BLJA | R |
| Blue-gray Gnatcatcher | *Polioptila caerulea* | BGGN | SR |
| Blue Grosbeak | *Passerina caerulea* | BLGR | SR |
| Blue-headed Vireo | *Vireo solitarius* | BHVI | M |
| Blue-winged Teal | *Anas discors* | BWTE | SR |
| Bobolink | *Dolichonyx oryzivorus* | BOBO | SR |
| Brewer's Blackbird | *Euphagus cyanocephalus* | BRBL | O |
| Brown Thrasher | *Toxostoma rufum* | BRTH | SR |
| Brown-headed Cowbird | *Molothrus ater* | BHCO | SR |
| Canada Goose | *Branta canadensis* | CAGO | SR |
| Cedar Waxwing | *Bombycilla cedrorum* | CEDW | R |
| Cerulean Warbler | *Setophaga cerulea* | CERW | M |
| Chimney Swift | *Chaetura pelagica* | CHSW | SR |

[A] Residency: M = migrant through the area; R = year around resident; SR = summer resident (According to Jackson et al. [1996]).

[B] Species recorded only while traveling between survey plots or at other times outside of 5-min survey periods.

[C] Species considered of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

**Table 2 (continued).** Bird species recorded during breeding bird surveys at Pipestone National Monument, Minnesota, from 2009 through 2017. The American Ornithologists' Union code (AOU code) and residency status of each species is given. Species names are valid and verified names taken from the Integrated Taxonomic Information system website (ITIS 2017).

| Common name | Species name | AOU code | Residency[A] |
|---|---|---|---|
| Chipping Sparrow | *Spizella passerina* | CHSP | SR |
| Clay-colored Sparrow | *Spizella pallida* | CCSP | SR |
| Common Grackle | *Quiscula quiscula* | COGR | SR |
| Common Nighthawk | *Chordeiles minor* | CONI | SR |
| Common Yellowthroat | *Geothlypis trichas* | COYE | SR |
| Cooper's Hawk | *Accipiter cooperii* | COHA | R |
| Dickcissel | *Spiza americana* | DICK | SR |
| Double-crested Cormorant | *Phalacrocorax auritus* | DCCO | SR |
| Downy Woodpecker | *Picoides pubescens* | DOWO | R |
| Eastern Kingbird | *Tyrannus tryannus* | EAKI | SR |
| Eastern Meadowlark | *Sturnella magna* | EAME | O |
| Eastern Phoebe | *Sayornis phoebe* | EAPH | SR |
| Eastern Towhee | *Pipilo erythrophthalmus* | EATO | SR |
| European Starling | *Sturnus vulgaris* | EUST | R |
| Field Sparrow | *Spizella pusilla* | FISP | SR |
| **Grasshopper Sparrow[C]** | ***Ammodramus savannarum*** | **GRSP** | **SR** |
| Gray Catbird | *Dumetella carolinensis* | GRCA | SR |
| Great Blue Heron | *Ardea herodias* | GBHE | SR |
| Great Crested Flycatcher | *Myiarchus crinitus* | GCFL | SR |
| Green Heron | *Butorides virescens* | GRHE | SR |
| Hairy Woodpecker | *Picoides villosus* | HAWO | R |
| Henslow's Sparrow | *Ammodramus henslowii* | HESP | SR |
| Horned Lark | *Eremophila alpestris* | HOLA | R |
| House Finch | *Haemorhous mexicanus* | HOFI | R |
| House Sparrow | *Passer domesticus* | HOSP | SR |
| House Wren | *Troglodytes aedon* | HOWR | SR |
| Killdeer | *Charadrius vociferus* | KILL | SR |
| Lapland Longspur[B] | *Calcarius lapponicus* | LALO | WR |
| **Least Bittern[C]** | ***Ixobrychus exilis*** | **LEBI** | **SR** |
| Least Flycatcher | *Empidonax minimus* | LEFL | SR |
| Mallard | *Anas platyrhynchos* | MALL | R |
| Marsh Wren | *Cistothorus palustris* | MAWR | SR |
| Mourning Dove | *Zenaida macroura* | MODO | R |
| Nashville Warbler | *Leiothlypis ruficapilla* | NAWA | M |
| Northern Flicker | *Colaptes auratus* | YSFL | R |

[A] Residency: M = migrant through the area; R = year around resident; SR = summer resident (According to Jackson et al. [1996]).

[B] Species recorded only while traveling between survey plots or at other times outside of 5-min survey periods.

[C] Species considered of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

**Table 2 (continued).** Bird species recorded during breeding bird surveys at Pipestone National Monument, Minnesota, from 2009 through 2017. The American Ornithologists' Union code (AOU code) and residency status of each species is given. Species names are valid and verified names taken from the Integrated Taxonomic Information system website (ITIS 2017).

| Common name | Species name | AOU code | Residency[A] |
|---|---|---|---|
| Northern Harrier | *Circus cyaneus* | NOHA | R |
| Northern Rough-winged Swallow | *Stelgidopteryx serripennis* | NRWS | SR |
| Northern Shoveler | *Anas clypeata* | NSHO | SR |
| Orchard Oriole | *Icterus spurius* | OROR | SR |
| Red-tailed Hawk | *Buteo jamaicensis* | RTHA | R |
| Red-winged Blackbird | *Agelaitus phoeniceus* | RWBL | SR |
| Ring-necked Pheasant | *Phasianus colchicus* | RPHE | R |
| Rock Dove | *Columba livia* | RODO | R |
| Ruby-throated Hummingbird | *Archilochus colubris* | RTHU | M |
| Savannah Sparrow | *Passerculus sandwichensis* | SAVS | SR |
| Sedge Wren | *Cistothorus platensis* | SEWR | SR |
| Song Sparrow | *Melospiza melodia* | SOSP | R |
| Sora | *Porzana carolina* | SORA | SR |
| **Swainson's Hawk[C]** | ***Buteo swainsoni*** | **SWHA** | **SR** |
| Tennessee Warbler | *Leiothlypis peregrina* | TEWA | M |
| Tree Swallow | *Tachycineta bicolor* | TRES | SR |
| Turkey Vulture | *Cathartes aura* | TUVU | SR |
| **Upland Sandpiper[C]** | ***Bartramia longicauda*** | **UPSA** | **SR** |
| Vesper Sparrow | *Pooecetes gramineus* | VESP | SR |
| Warbling Vireo | *Vireo gilvus* | WAVI | SR |
| Western Kingbird | *Tyrannus verticalis* | WEKI | SR |
| Western Meadowlark | *Sturnella neglecta* | WEME | SR |
| White-crowned Sparrow[B] | *Zonotrichia leucophrys* | WCSP | M |
| Wild Turkey | *Meleagris gallopavo* | WITU | R |
| Willow Flycatcher | *Empidonax traillii* | WIFL | SR |
| Wilson's Warbler | *Cardellina pusilla* | WIWA | M |
| Wood Duck | *Aix sponsa* | WODU | SR |
| Yellow Warbler | *Setophaga petechia* | YWAR | SR |
| Yellow-breasted Chat | *Icteria virens* | YBCH | O |
| Yellow-headed Blackbird | *Xanthocephalus xanthocephalus* | YHBL | SR |
| Yellow-rumped Warbler | *Setophaga coronata* | MYWA | SR |
| Yellow-throated Vireo | *Vireo flavifrons* | YTVI | SR |

[A] Residency: M = migrant through the area; R = year around resident; SR = summer resident (According to Jackson et al. [1996]).

[B] Species recorded only while traveling between survey plots or at other times outside of 5-min survey periods.

[C] Species considered of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Twelve breeding species were observed during the survey period in sufficient numbers to calculate annual abundances with some degree of confidence (Appendix B). Of these twelve species, Bobolink (*Dolichonyx oryzivoru*), Clay-colored Sparrow (*Spizella pallida*), and Common Grackle (*Quiscula quiscula*) were the most abundant and widespread species on Pipestone National Monument. Two of the twelve species recorded, Common Yellowthroat (*Geothlypis trichas*) and Ring-necked Pheasant (*Phasianus colchicus*), had strong increases in population size over the nine years of monitoring (Figure 3; Appendix D). Four additional species, American Goldfinch (*Carduelis tristis*), American Robin (*Turdus migratorius*), Bobolink, and Common Grackle, had moderate increases in population size. We were unable to detect with certainty either positive or negative population trends for five of the six remaining species reported. One species, Song Sparrow (*Melospiza melodia*) had an unreliable population trend estimate.

Regional trends (2005–2015) reported by Sauer et al. (2017, Figure 3; Appendix E) for the Prairie Potholes Bird Conservation Region were uncertain for seven of the twelve species, including the Bobolink and Ring-necked Pheasant. One species with a strong population increase on the park, the Common Yellowthroat had a declining population region-wide. Three species with moderate increases in populations on the park, American Goldfinch, American Robin, and Common Grackle, also had region-wide population increases. The Red-winged Blackbird (*Agelaitus phoeniceus*) had a population increasing region-wide, but trend was uncertain on the park.

Diversity ($p = 0.35$), richness ($p = 0.64$), and evenness ($p = 0.39$) in distribution of individuals across species in the breeding bird community on Pipestone National Monument were unchanged over the nine monitoring years since 2009 (Figure 4). Bird richness averaged 42 species annually on the park. Average estimated species richness was 50 by the ACE estimator and 54 by the ICE estimator. These results should be interpreted with caution, however, as inter-annual variability in the number of plots sampled may have influenced estimation metrics.

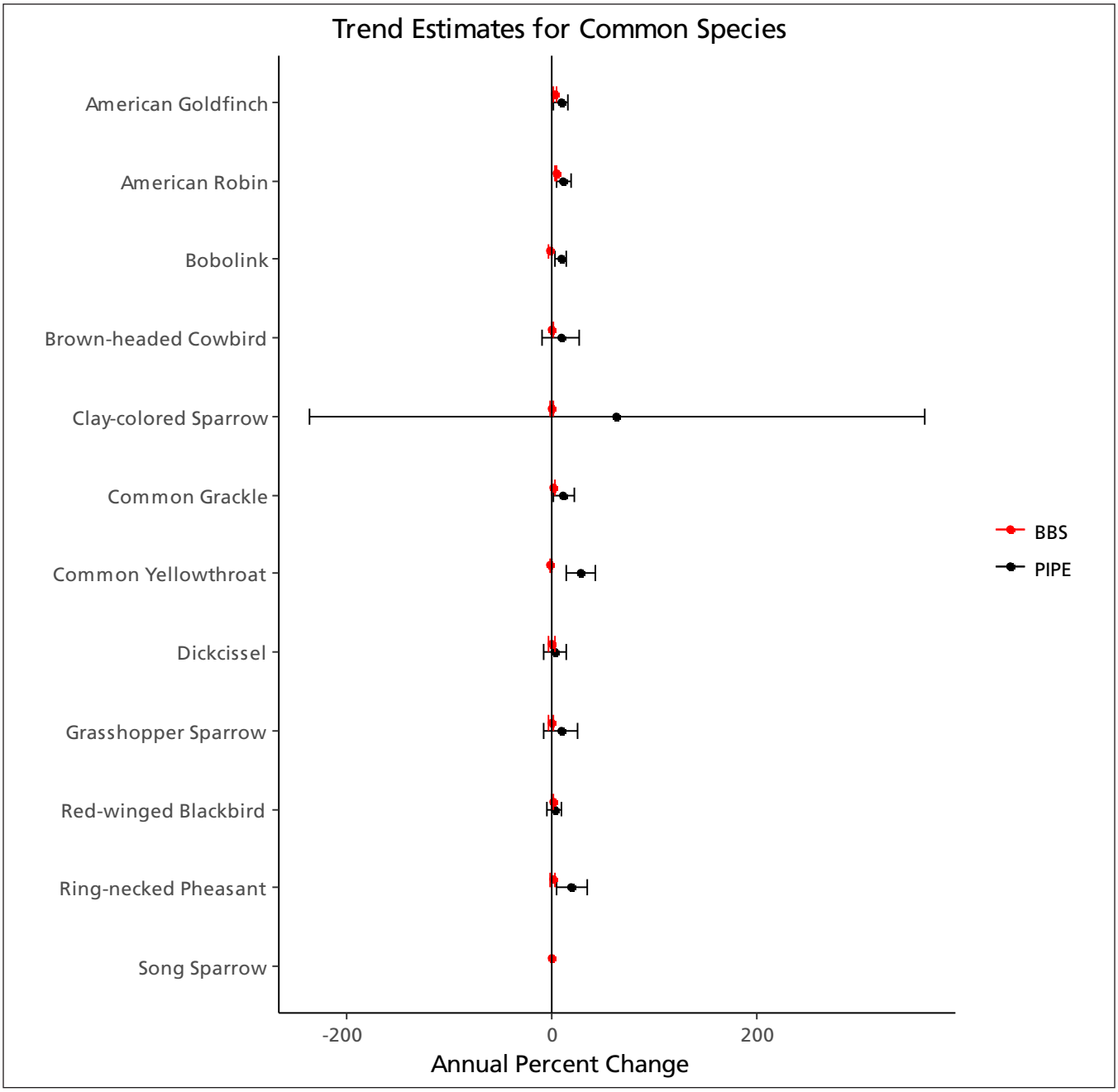


**Figure 3.** Comparison of bird population trends from Pipestone National Monument (PIPE), Minnesota, (2009 through 2017) with those of the larger Prairie Potholes Prairie Bird Conservation Region (2005 through 2015) from the Breeding Bird Surveys (BBS). Error bars represent 95% confidence intervals.

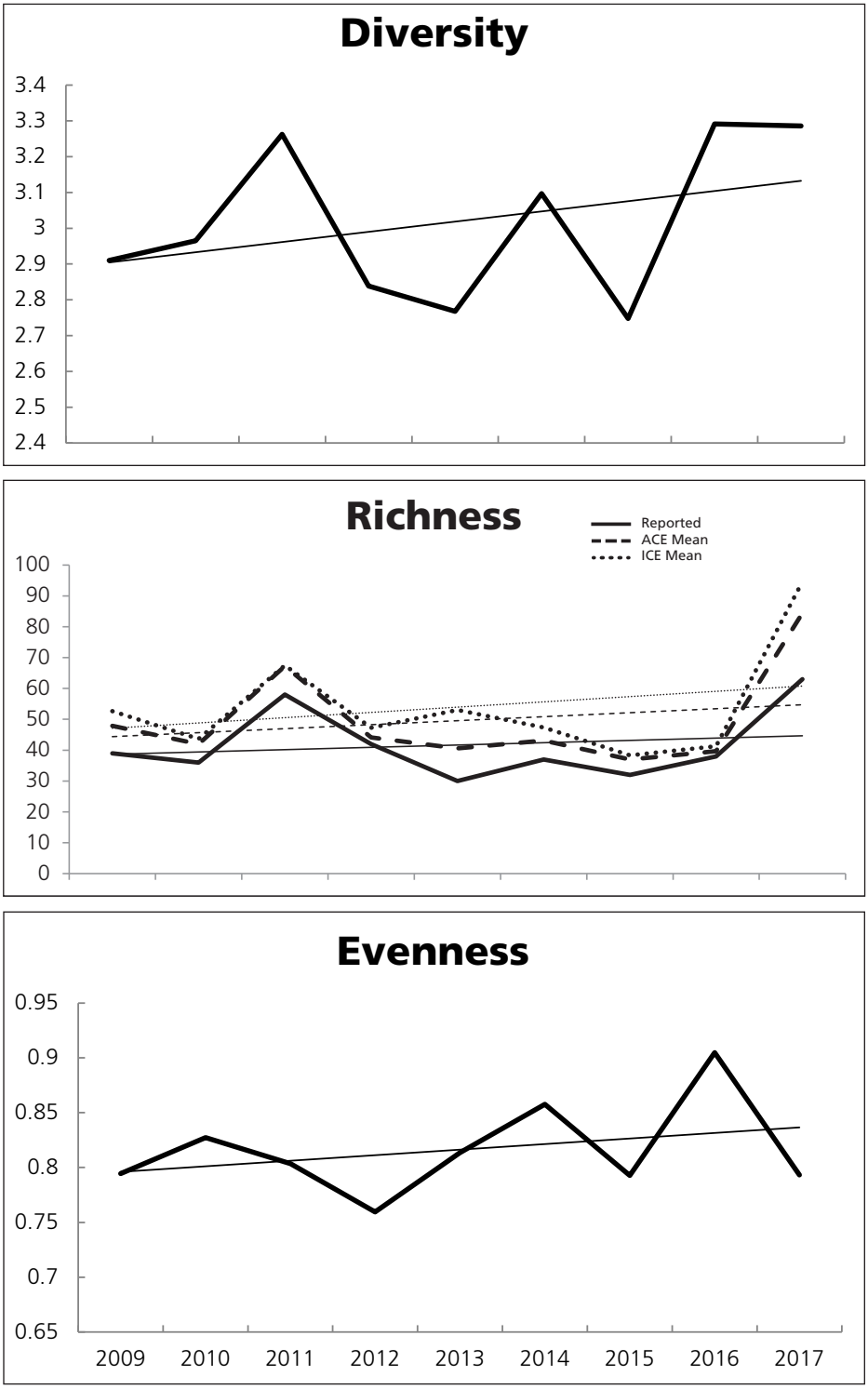


**Figure 4.** Trends in bird community diversity, richness, and species distribution evenness on Pipestone National Monument, Minnesota, from 2009 through 2017.

# Discussion

Breeding bird surveys were initiated at Pipestone National Monument in 2009 to assist the park in assessing the integrity of their grasslands and woodlands through time. During the nine years of monitoring, 92 bird species have been recorded. Eighty are permanent or summer residents to the area (Janssen et al. 2003). Therefore, these 80 species have some value in characterizing the park's breeding bird community and their habitat.

The six breeding species of concern for the Prairie Potholes Bird Conservation Region should be given additional consideration when managing natural resources on the park: Black Tern (*Chlidonias niger*), Dickcissel (*Spiza americana*), Grasshopper Sparrow (*Ammodramus savannarum*), Least Bittern (*Ixobrychus exilis*), Swainson's Hawk (*Buteo swainsoni*), and Upland Sandpiper (*Bartramia longicauda*). Two of these species happen to be recorded in sufficient numbers to calculate population trends: Dickcissel and Grasshopper Sparrow. These two species require open prairie and or weedy field habitat, the main habitat type in the park. If it is not feasible to manage habitat for the four remaining species of conservation concern directly, then at least habitat should be managed in a way that does not conflict with their needs. Habitat requirements for the Swainson's Hawk and Upland Sandpiper are similar to habitat requirements of the Dickcissel and Grasshopper Sparrow, making it easier to manage for these four species as a group. But, the Black Tern and Least Bittern require wet meadows, marshes with dense vegetation, and pond habitat that is quite different from the requirements of the other four species, making management for them a little more complex.

Twelve breeding species were observed during the survey period in sufficient numbers to calculate annual abundances and trends with some degree of confidence. The Bobolink (*Dolichonyx oryzivoru*), Clay-colored Sparrow (*Spizella pallida*), and Common Grackle (*Quiscula quiscula*) were the most abundant and widespread species on Pipestone National Monument and provide for the best characterization of habitat present. The Bobolink utilizes grasslands, Clay-colored Sparrow occupies brushy areas often near water, and Common Grackle uses open areas with some trees (Stokes and Stokes 1996). Habitat on the park is primarily open grasslands and prairie with an element of Bur Oak and Northern Ash – Elm woodlands, and thick herbaceous vegetation along a stream corridor (Diamond et al. 2014), habitat that is well suited for the three common and wide spread species. As suggested by Pashley and Barrow (1993), the mix of habitat (structural composition) on the park is important for the species of regional concern since they have varying microhabitat requirements.

Comparing population trends on Pipestone National Monument with regional trends for the Prairie Potholes Bird Conservation Region were inconclusive, but suggest that many of the park's bird populations are faring similar to or better than populations found region-wide. While we were unable to detect with certainty either positive or negative population trends for six of the twelve species that we calculated abundance and trends for on the park, the six remaining species had populations that were increasing in numbers. None of the species with sufficient numbers to calculate trends had a population in decline on the park. However, only three of the species with positive population trends on the park had positive regional trends, and one species with an uncertain trend on the park had a region-wide positive trend. The Common Yellowthroat (*Geothlypis trichas*), with a strong population increase on the park, had a declining population region-wide, and the seven remaining species had uncertain population trends region-wide.

Common Grackle (*Quiscula quiscula*). NPS

Over the nine years of bird monitoring on Pipestone National Monument, the unchanging diversity, richness, and evenness in distribution of individuals across species values suggest habitat on the park has remained similar across years (Figure 3), and provides for an array of breeding species (average of 42 species annually). However, this stable species community structure could be altered if significant portions of the parks prairies and grasslands were converted to woodlands or invaded by shrubby vegetation.

Our reported data are a baseline for placing bird populations at the park into the context of those seen in the larger Prairie Potholes Bird Conservation Region, and should help the park make informed natural resource management decisions. Our reported data also contribute information to efforts of other agencies researching the full life cycle of migratory birds (Partners in Flight, U.S. Geological Survey, U.S. Fish and Wildlife Service, Cornell Lab, Bird Conservancy of the Rockies, etc.).

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# Appendix A. Plots Sampled

**Table A1.** Plots sampled on Pipestone National Monument, Minnesota, between 2009 and 2017 and gross habitat type. "Yes" indicates plot was sampled; "No" indicates it was not.

| | Year sampled | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Plot** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **Plot type** |
| PIPE 1 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 2 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 3*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 4 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 5*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 6 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 7 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 8 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 9 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland/Shrubland |
| PIPE 10 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 11*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 12 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 13*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 14 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 15*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 16 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 17 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 18 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland/Shrubland |
| PIPE 19 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 20 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 21 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 22 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 23*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 24 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |

* Plots included in the analysis of individual bird species trends (also in bold).

**Table A1 (continued).** Plots sampled on Pipestone National Monument, Minnesota, between 2009 and 2017 and gross habitat type. "Yes" indicates plot was sampled; "No" indicates it was not.

| Plot | Year sampled | | | | | | | | | Plot type |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | |
| **PIPE 25*** | **Yes** | **Yes** | **Yes** | **yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Woodland/Shrubland** |
| PIPE 26 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 27*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 28 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland/Shrubland |
| **PIPE 29*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 30 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 31 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 32 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 33 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland/Shrubland |
| PIPE 34 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 35 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 36 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 37*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 38 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 39 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 40*** | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Woodland/Shrubland** |
| PIPE 41 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 42 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 43 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 44 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 45 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 46 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 47*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 48 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 49 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 50*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |

* Plots included in the analysis of individual bird species trends (also in bold).

**Table A1 (continued).** Plots sampled on Pipestone National Monument, Minnesota, between 2009 and 2017 and gross habitat type. "Yes" indicates plot was sampled; "No" indicates it was not.

| | Year sampled | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Plot** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **Plot type** |
| PIPE 51 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 52 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 53 | Yes | Yes | Yes | Yes | No | No | No | No | Ywa | Grassland/Prairie |
| PIPE 54 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland/Shrubland |
| PIPE 55 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 56*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 57 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 58*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 59 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 60 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 61 | Yes | Yes | Yes | No | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 62 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 63 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 64*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 65 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| **PIPE 66*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Prairie** |
| PIPE 67 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |
| PIPE 68 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Prairie |

*Plots included in the analysis of individual bird species trends (also in bold).

# Appendix B. Proportion of Plots Occupied and Abundance (Corrected for Undetected Individuals)

**Table B1.** Annual proportion of plots occupied by each breeding bird species, and estimated abundance (determined using Distance software) of each species at Pipestone National Monument, Minnesota, during the 2009 to 2017 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance using Distance does not.

| | Proportion of plots occupied (Abundance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Common name** | **2009 n=44** | **2010 n=47** | **2011 n=44** | **2012 n=43** | **2013 n=9** | **2014 n=9** | **2015 n=9** | **2016 n=8** | **2017 n=44** |
| American Goldfinch | 0.24 (21) | 0.36 (40) | 0.60 (22) | 0.40 (34) | 0.06 (7) | 0.59 (35) | 0.41 (28) | 0.65 (57) | 0.59 (55) |
| American Robin | 0.28 (39) | 0.42 (36) | 0.56 (20) | 0.40 (40) | 0.29 (32) | 0.76 (52) | 0.47 (65) | 0.41 (19) | 0.47 (84) |
| Bobolink | 0.44 (91) | 0.37 (74) | 0.65 (58) | 0.49 (79) | 0.71 (102) | 0.35 (38) | 0.71 (159) | 0.65 (121) | 0.37 (57) |
| Brown-headed Cowbird | 0.27 (41) | 0.10 (32) | 0.27 (22) | 0.19 (35) | 0.24 (38) | 0.53 (38) | 0.24 (50) | 0.29 (25) | 0.40 (66) |
| Clay-colored Sparrow | 0.18 (28) | 0 (0) | 0.03 (6) | 0.19 (27) | 0.06 (8) | 0.71 (16) | 0.76 (291) | 0.65 (16) | 0.40 (77) |
| Common Grackle | 0.47 (29) | 0.67 (49) | 0.78 (19) | 0.76 (29) | 0.29 (0) | 0.71 (26) | 0.77 (179) | 0.71 (26) | 0.44 (6) |
| Common Yellowthroat | .02 (1) | 0.05 (4) | 0.37 (3) | 0.28 (29) | 0.06 (5) | 0.35 (0) | 0.65 (102) | 0.53 (11) | 0.41 (51) |
| **Dickcissel*** | **0.03 (6)** | **0 (0)** | **0.19 (17)** | **0.51 (127)** | **0.06 (11)** | **0 (0)** | **0.24 (66)** | **0.12 (22)** | **0.03 (6)** |
| **Grasshopper Sparrow*** | **0.19 (28)** | **0.27 (50)** | **0.62 (17)** | **0.15 (26)** | **0.24 (42)** | **0.18 (17)** | **0.47 (110)** | **0.53 (0)** | **0.15 (21)** |
| Red-winged Blackbird | 0.22 (19) | 0.21 (17) | 0.38 (12) | 0.31 (21) | 0.24 (14) | 0.59 (32) | 0.53 (40) | 0.59 (14) | 0.49 (25) |
| Ring-necked Pheasant | 0.26 (7) | 0.09 (3) | 0.35 (1) | 0.22 (7) | 0.53 (17) | 0.53 (1) | 0.59 (19) | 0.59 (1) | 0.40 (14) |
| Song Sparrow | 0.01 (1) | 0.12 (8) | 0.18 (3) | 0.06 (3) | 0 (0) | 0.29 (4) | 0.47 (38) | 0.47 (11) | 0.35 (38) |

*Species considered of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

# Appendix C. Proportion of Plots Occupied and Abundance (Not Corrected for Undetected Individuals)

**Table C1.** Annual proportion of plots occupied by each breeding bird species, and estimated abundance (determined using birds within 50-m of plot center) of each species at Pipestone National Monument, Minnesota, during the 2009 to 2017 spring bird surveys (n=number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. "–" denotes when a species was present, but outside of 50 m from the plot center, and therefore their annual abundance value could not be calculated.

| | Proportion of plots occupied (Abundance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Common name** | **2009 n=68** | **2010 n=67** | **2011 n=68** | **2012 n=67** | **2013 n=17** | **2014 n=17** | **2015 n=17** | **2016 n=17** | **2017 n=68** |
| American Crow | 0.04 (–) | 0.09 (–) | 0.32 (4) | 0.04 (–) | 0.12 (–) | 0.18 (–) | 0.29 (–) | 0.18 (–) | 0.18 (–) |
| American Redstart | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.06 (–) | 0 (0) | 0.02 (–) |
| Baltimore Oriole | 0 (0) | 0.05 (2) | 0.04 (4) | 0.13 (7) | 0.12 (9) | 0.06 (–) | 0 (0) | 0 (0) | 0.04 (–) |
| Bank Swallow | 0.04 (–) | 0 (–) | 0 (–) | 0 (–) | 0.06 (–) | 0.12 (–) | 0 (–) | 0.12 (–) | 0 (–) |
| Barn Swallow | 0.03 (–) | 0.19 (11) | 0.21 (9) | 0.15 (–) | 0.06 (–) | 0.24 (–) | 0.41 (–) | 0.12 (–) | 0.18 (–) |
| Belted Kingfisher | 0.01 (–) | 0.03 (–) | 0.03 (–) | 0.01 (–) | 0 (0) | 0.06 (–) | 0 (0) | 0.12 (–) | 0.01 (–) |
| Black and White Warbler | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.01 (2) |
| Black-capped Chickadee | 0 (0) | 0 (0) | 0 (0) | 0.05 (7) | 0 (0) | 0.06 (–) | 0 (0) | 0 (0) | 0.02 (–) |
| **Black Tern*** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0.01 (–)** |
| Blue Jay | 0 (0) | 0 (0) | 0.07 (–) | 0.03 (4) | 0 (0) | 0 (0) | 0 (0) | 0.12 (9) | 0 (0) |
| Blue-gray Gnatcatcher | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| Blue Grosbeak | 0 (0) | 0 (0) | 0.01 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.03 (2) |

*Species considered of regional concern for the Central Mixed Grass Bird Conservation Region (USFWS 2008; also in bold).

**Table C1 (continued).** Annual proportion of plots occupied by each breeding bird species, and estimated abundance (determined using birds within 50-m of plot center) of each species at Pipestone National Monument, Minnesota, during the 2009 to 2017 spring bird surveys (n=number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. "–" denotes when a species was present, but outside of 50 m from the plot center, and therefore their annual abundance value could not be calculated.

| | Proportion of plots occupied (Abundance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Common name** | **2009 n=68** | **2010 n=67** | **2011 n=68** | **2012 n=67** | **2013 n=17** | **2014 n=17** | **2015 n=17** | **2016 n=17** | **2017 n=68** |
| Blue-winged Teal | 0 (0) | 0 (0) | 0.03 (–) | 0.03 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.03 (–) |
| Brown Thrasher | 0.06 (2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.06 (9) | 0 (0) | 0 (0) | 0 (0) |
| Canada Goose | 0.18 (–) | 0.02 (–) | 0.19 (2) | 0 (0) | 0.35 (43) | 0 (0) | 0 (0) | 0.24 (–) | 0.27 (6) |
| Cedar Waxwing | 0.02 (–) | 0 (0) | 0.06 (–) | 0.02 (26) | 0 (0) | 0 (0) | 0.06 (–) | 0 (0) | 0 (0) |
| Chimney Swift | 0 (0) | 0 (0) | 0.07 (2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Chipping Sparrow | 0 (0) | 0.01 (4) | 0.31 (4) | 0.03 (4) | 0.06 (9) | 0.24 (–) | 0.06 (–) | 0 (0) | 0.03 (–) |
| Common Nighthawk | 0 (0) | 0.09 (4) | 0.19 (–) | 0 (0) | 0 (0) | 0 (0) | 0.06 (9) | 0.06 (9) | 0.03 (–) |
| Cooper's Hawk | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (–) |
| Double-crested Cormorant | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Downy Woodpecker | 0 (0) | 0.04 (7) | 0.03 (–) | 0 (0) | 0 (0) | 0.06 (17) | 0 (0) | 0 (0) | 0 (0) |
| Eastern Kingbird | 0.03 (–) | 0.07 (2) | 0.15 (11) | 0.07 (11) | 0 (0) | 0.18 (34) | 0.41 (86) | 0.12 (–) | 0.06 (2) |
| Eastern Meadowlark | 0.02 (–) | 0.02 (2) | 0.04 (–) | 0.03 (–) | 0.12 (9) | 0 (0) | 0.12 (–) | 0.06 (–) | 0.12 (2) |
| Eastern Phoebe | 0 (0) | 0 (0) | 0.04 (2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.06 (9) | 0.03 (–) |
| Eastern Towhee | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.06 (9) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| European Starling | 0 (0) | 0.01 (2) | 0.16 (2) | 0.06 (4) | 0 (0) | 0.06 (–) | 0 (0) | 0.12 (–) | 0.01 (4) |

*Species considered of regional concern for the Central Mixed Grass Bird Conservation Region (USFWS 2008; also in bold).

**Table C1 (continued).** Annual proportion of plots occupied by each breeding bird species, and estimated abundance (determined using birds within 50-m of plot center) of each species at Pipestone National Monument, Minnesota, during the 2009 to 2017 spring bird surveys (n=number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. "–" denotes when a species was present, but outside of 50 m from the plot center, and therefore their annual abundance value could not be calculated.

| | Proportion of plots occupied (Abundance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Common name** | **2009 n=68** | **2010 n=67** | **2011 n=68** | **2012 n=67** | **2013 n=17** | **2014 n=17** | **2015 n=17** | **2016 n=17** | **2017 n=68** |
| Field Sparrow | 0.15 (17) | 0.18 (11) | 0.31 (15) | 0.09 (7) | 0.06 (–) | 0 (0) | 0.24 (–) | 0.24 (9) | 0.07 (4) |
| Gray Catbird | 0.03 (2) | 0.05 (4) | 0.06 (2) | 0 (0) | 0 (0) | 0.06 (–) | 0.06 (–) | 0.06 (–) | 0.04 (4) |
| Great Blue Heron | 0.02 (–) | 0.02 (2) | 0 (0) | 0.02 (–) | 0 (0) | 0.06 (–) | 0 (0) | 0.12 (–) | 0.09 (–) |
| Great Crested Flycatcher | 0 (0) | 0 (0) | 0.01 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Green Heron | 0 (0) | 0 (0) | 0.02 (–) | 0.03 (–) | 0 (0) | 0 (0) | 0.06 (–) | 0 (0) | 0 (0) |
| Hairy Woodpecker | 0 (0) | 0 (0) | 0.03 (–) | 0 (0) | 0 (0) | 0.06 (–) | 0 (0) | 0 (0) | 0 (0) |
| Henslow's Sparrow | 0 (0) | 0 (0) | 0 (0) | 0.01 (2) | 0 (0) | 0 (0) | 0.12 (26) | 0 (0) | 0 (0) |
| Horned Lark | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| House Finch | 0 (0) | 0.01 (0) | 0.01 (2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| House Sparrow | 0 (0) | 0.02 (–) | 0.02 (–) | 0 (0) | 0.06 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| House Wren | 0.03 (4) | 0.07 (4) | 0.31 (4) | 0.06 (9) | 0.06 (–) | 0.12 (–) | 0.12 (9) | 0.18 (–) | 0.06 (4) |
| Killdeer | 0.03 (2) | 0.02 (9) | 0.10 (–) | 0.05 (2) | 0.18 (–) | 0.35 (26) | 0 (0) | 0.18 (–) | 0.03 (–) |
| **Least Bittern*** | **0 (0)** | **0 (0)** | **0.01 (–)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** |
| Least Flycatcher | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.03 (4) |
| Mallard | 0.03 (–) | 0.09 (–) | 0.07 (2) | 0.03 (–) | 0 (0) | 0.12 (–) | 0 (0) | 0.24 (9) | 0.16 (–) |

*Species considered of regional concern for the Central Mixed Grass Bird Conservation Region (USFWS 2008; also in bold).

**Table C1 (continued).** Annual proportion of plots occupied by each breeding bird species, and estimated abundance (determined using birds within 50-m of plot center) of each species at Pipestone National Monument, Minnesota, during the 2009 to 2017 spring bird surveys (n=number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. "–" denotes when a species was present, but outside of 50 m from the plot center, and therefore their annual abundance value could not be calculated.

| | Proportion of plots occupied (Abundance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Common name** | **2009 n=68** | **2010 n=67** | **2011 n=68** | **2012 n=67** | **2013 n=17** | **2014 n=17** | **2015 n=17** | **2016 n=17** | **2017 n=68** |
| Marsh Wren | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.24 (9) | 0 (0) | 0 (0) | 0 (0) | 0.03 (2) |
| Mourning Dove | 0.09 (–) | 0.22 (–) | 0.34 (2) | 0.12 (7) | 0.06 (–) | 0.12 (–) | 0.24 (9) | 0.24 (–) | 0.10 (–) |
| Northern Flicker | 0.01 (–) | 0.06 (2) | 0.03 (–) | 0.04 (2) | 0 (0) | 0.06 (–) | 0.12 (–) | 0 (0) | 0.03 (–) |
| Northern Harrier | 0.02 (–) | 0.02 (2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.03 (–) |
| Northern Rough-winged Swallow | 0.06 (–) | 0 (0) | 0.12 (4) | 0.05 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (–) |
| Northern Shoveler | 0.06 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (–) |
| Orchard Oriole | 0 (0) | 0 (0) | 0.07 (9) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| Red-tailed Hawk | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.06 (–) | 0 (0) | 0.03 (–) |
| Rock Dove | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.06 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Ruby-throated Hummingbird | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.06 (–) | 0 (0) | 0 (–) |
| Savannah Sparrow | 0 (0) | 0.06 (7) | 0.01 (2) | 0.03 (4) | 0.59 (51) | 0.12 (9) | 0.18 (0) | 0.24 (17) | 0.01 (–) |
| Sedge Wren | 0.03 (6) | 0 (0) | 0.02 (2) | 0.22 (22) | 0 (0) | 0.24 (9) | 0.12 (0) | 0.29 (9) | 0.24 (26) |
| Sora | 0 (0) | 0 (0) | 0.03 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **Swainson's Hawk*** | **0 (0)** | **0 (0)** | **0 (0)** | **0.02 (–)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** |

*Species considered of regional concern for the Central Mixed Grass Bird Conservation Region (USFWS 2008; also in bold).

**Table C1 (continued).** Annual proportion of plots occupied by each breeding bird species, and estimated abundance (determined using birds within 50-m of plot center) of each species at Pipestone National Monument, Minnesota, during the 2009 to 2017 spring bird surveys (n=number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. "–" denotes when a species was present, but outside of 50 m from the plot center, and therefore their annual abundance value could not be calculated.

| | Proportion of plots occupied (Abundance) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Common name** | **2009 n=68** | **2010 n=67** | **2011 n=68** | **2012 n=67** | **2013 n=17** | **2014 n=17** | **2015 n=17** | **2016 n=17** | **2017 n=68** |
| Tree Swallow | 0.09 (–) | 0.16 (4) | 0.28 (4) | 0.15 (4) | 0.06 (–) | 0.18 (–) | 0 (0) | 0.29 (90 | 0.03 (–0 |
| Turkey Vulture | 0 (0) | 0.02 (–) | 0.07 (–) | 0 (0) | 0 (0) | 0.06 (–) | 0 (0) | 0.18 (–) | 0.07 (–) |
| **Upland Sandpiper*** | **0.02 (–)** | **0 (0)** | **0.02 (–)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** |
| Vesper Sparrow | 0 (0) | 0 (0) | 0.01 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Warbling Vireo | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| Western Kingbird | 0 (0) | 0 (0) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Western Meadowlark | 0.06 (4) | 0.18 (15) | 0 (0) | 0.06 (–) | 0 (0) | 0.18 (–) | 0 (0) | 0 (0) | 0.01 (–) |
| Wild Turkey | 0 (0) | 0 (0) | 0.06 (–) | 0.05 (–) | 0 (0) | 0.18 (26) | 0 (0) | 0.12 (–0 | 0.03 (–) |
| Willow Flycatcher | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.01 (–) |
| Wood Duck | 0 (0) | 0 (0) | 0.03 (–) | 0 (0) | 0.06 (–) | 0 (0) | 0 (0) | 0.06 (–) | 0.03 (–) |
| Yellow Warbler | 0.02 (4) | 0 (0) | 0.07 (2) | 0.02 (7) | 0.18 (26) | 0.35 (0) | 0.18 (9) | 0.18 (–) | 0.16 (21) |
| Yellow-headed Blackbird | 0 (0) | 0 (0) | 0.03 (–) | 0.01 (4) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Yellow-rumped Warbler | 0.01 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Yellow-throated Vireo | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.01 (–) |

*Species considered of regional concern for the Central Mixed Grass Bird Conservation Region (USFWS 2008; also in bold).

# Appendix D. Pipestone National Monument Trends

**Table D1.** Trends, annual change in abundance (individuals), of breeding birds recorded on Pipestone National Monument, Minnesota, from 2009 through 2017. "–" denotes species with unreliable trend estimates.

| Common name | Trend[A] | SE of slope | Trend Classification[B] |
|---|---|---|---|
| American Goldfinch | 1.09 | 0.04 | Moderate Increase |
| American Robin | 1.12 | 0.04 | Moderate Increase |
| Bobolink | 1.09 | 0.03 | Moderate Increase |
| Brown-headed Cowbird | 1.09 | 0.10 | Uncertain |
| Clay-colored Sparrow | 1.64 | 1.54 | uncertain |
| Common Grackle | 1.12 | 0.06 | Moderate Increase |
| Common Yellowthroat | 1.29 | 0.08 | Strong Increase |
| Dickcissel | 1.03 | 0.06 | Uncertain |
| Grasshopper Sparrow | 1.09 | 0.09 | Uncertain |
| Red-winged Blackbird | 1.03 | 0.04 | Uncertain |
| Ring-necked Pheasant | 1.20 | 0.08 | Strong Increase |
| Song Sparrow | – | – | – |

[A] Trends were determined using the statistical software TRIM Version 3.54 (2006).

[B] Trend classification types depending on statistical significance and magnitude (Pannekoek and van Strien 2005; Van Strien et al. 2001), and following Gregory et al. (2007). The multiplicative overall slope estimate in TRIM was converted into one of the following categories depending on the overall slope as well as its 95% confidence interval (= slope ± 1.96 times the standard error of the slope). Strong increase – increase significantly more than 5% per year. Criterion: lower limit of confidence interval > 1.05. Moderate increase – significant increase, but not significantly more than 5% per year. Criterion: 1.00 < lower limit of confidence interval < 1.05. Stable – no significant increase or decline, and it is certain that trends are less than 5% per year. Criterion: confidence interval encloses 1.00 but lower limit > 0.95 and upper limit < 1.05. Uncertain – no significant increase or decline, but not certain if trends are less than 5% per year. Criterion: confidence interval encloses 1.00 but lower limit < 0.95 or upper limit > 1.05. Moderate decline – significant decline, but not significantly more than 5% per year. Criterion: 0.95 < upper limit of confidence interval < 1.00. Steep decline – decline significantly more than 5% per year. Criterion: upper limit of confidence interval < 0.95.

# Appendix E. Regional Trends

**Table E1.** Regional trends (Prairie Potholes Bird Conservation Region) in breeding birds recorded on Pipestone National Monument, Minnesota, from 2005 through 2015. Regional trend data from the BBS surveys (Sauer et al. 2017). "NA" signifies that few observations of the species were made, so calculations of trends could not be made.

| | 95% Confidence Interval | | |
|---|---|---|---|
| **Common name** | **Trend** | **Lower** | **Upper** |
| American Crow | -2.23 | -3.17 | -1.27 |
| American Goldfinch | 3.89 | 2.54 | 5.34 |
| American Restart | 4.09 | 1.46 | 7.13 |
| American Robin | 4.26 | 3.53 | 5.00 |
| Baltimore Oriole | 1.29 | -0.13 | 2.85 |
| Bank Swallow | -0.54 | -3.33 | 3.98 |
| Barn Swallow | -0.11 | -1.12 | 0.97 |
| Belted Kingfisher | 0.50 | -3.65 | 4.35 |
| Black and White Warbler | 5.87 | 1.47 | 11.54 |
| Black-capped Chickadee | 1.02 | -1.57 | 3.75 |
| **Black Tern*** | **4.50** | **-1.62** | **10.95** |
| Blue Jay | -2.16 | -4.18 | -0.25 |
| Blue-gray Gnatcatcher | NA | NA | NA |
| Blue Grosbeak | 3.36 | -0.84 | 10.23 |
| Blue-winged Teal | 4.88 | 1.06 | 9.03 |
| Bobolink | -0.90 | -2.54 | 0.60 |
| Brown Thrasher | -1.23 | -2.56 | 0.12 |
| Brown-headed Cowbird | 0.61 | -0.42 | 1.71 |
| Canada Goose | 9.92 | 5.29 | 14.68 |
| Cedar Waxwing | 5.22 | 1.47 | 9.02 |
| Chimney Swift | -1.66 | -5.90 | 2.34 |
| Chipping Sparrow | 1.71 | 0.33 | 2.92 |
| Clay-colored Sparrow | 0.41 | -0.63 | 1.49 |
| Common Grackle | 1.80 | 0.64 | 3.06 |
| Common Nighthawk | 1.95 | -0.39 | 5.01 |
| Common Yellowthroat | -0.96 | -1.80 | -0.10 |
| Cooper's Hawk | 2.62 | -2.78 | 8.02 |
| Dickcissel | -0.06 | -3.55 | 3.49 |
| Double-crested Cormorant | 4.43 | -2.88 | 11.82 |
| Downy Woodpecker | 1.97 | -0.13 | 4.28 |
| Eastern Kingbird | -0.38 | -1.49 | 0.75 |
| Eastern Phoebe | 3.35 | 0.20 | 7.32 |
| Eastern Towhee | 1.48 | -6.95 | 9.62 |
| European Starling | -2.47 | -4.03 | -0.97 |

* Species considered of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

**Table E1 (continued).** Regional trends (Prairie Potholes Bird Conservation Region) in breeding birds recorded on Pipestone National Monument, Minnesota, from 2005 through 2015. Regional trend data from the BBS surveys (Sauer et al. 2017). "NA" signifies that few observations of the species were made, so calculations of trends could not be made.

| | | 95% Confidence Interval | |
|---|---|---|---|
| **Common name** | **Trend** | **Lower** | **Upper** |
| Field Sparrow | 4.82 | 1.51 | 8.04 |
| **Grasshopper Sparrow*** | **-0.41** | **-2.74** | **1.81** |
| Gray Catbird | 1.42 | 0.25 | 2.73 |
| Great Blue Heron | 1.20 | -2.01 | 4.45 |
| Great Crested Flycatcher | 0.97 | -1.17 | 3.12 |
| Green Heron | 3.46 | -3.72 | 19.45 |
| Hairy Woodpecker | 2.07 | 0.01 | 4.28 |
| Henslow's Sparrow | NA | NA | NA |
| Horned Lark | -4.16 | -5.48 | -2.82 |
| House Finch | 3.80 | -2.84 | 10.54 |
| House Sparrow | -3.97 | -5.24 | -2.76 |
| House Wren | 1.63 | 0.69 | 2.60 |
| Killdeer | 0.28 | -0.67 | 1.22 |
| **Least Bittern*** | **31.95** | **1.53** | **85.31** |
| Least Flycatcher | 1.49 | 0.36 | 2.63 |
| Mallard | 1.88 | -0.23 | 4.38 |
| Marsh Wren | 2.22 | -1.36 | 5.76 |
| Mourning Dove | 0.99 | 0.10 | 1.95 |
| Northern Flicker | -2.24 | -3.70 | -0.73 |
| Northern Harrier | -1.69 | -3.43 | -0.17 |
| Northern Rough-winged Swallow | 4.82 | -1.47 | 16.11 |
| Northern Shoveler | 2.42 | -2.00 | 7.11 |
| Orchard Oriole | 2.05 | 0.06 | 3.92 |
| Red-tailed Hawk | 0.65 | -0.96 | 2.15 |
| Red-winged Blackbird | 1.42 | 0.49 | 2.36 |
| Ring-necked Pheasant | 1.29 | -1.48 | 4.09 |
| Rock Dove | 0.20 | -1.45 | 1.66 |
| Savannah Sparrow | -0.14 | -1.07 | 0.73 |
| Sedge Wren | -4.91 | -7.99 | -1.90 |
| Song Sparrow | -0.16 | -1.13 | 0.83 |
| Sora | 2.95 | -0.21 | 6.21 |
| **Swainson's Hawk*** | **0.06** | **-1.18** | **1.32** |
| Tennessee Warbler | 0.41 | -7.63 | 9.41 |
| Tree Swallow | 2.34 | 0.79 | 3.93 |
| Turkey Vulture | 14.27 | 4.38 | 24.73 |
| Upland Sandpiper | 1.09 | -0.28 | 2.63 |

* Species considered of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

**Table E1 (continued).** Regional trends (Prairie Potholes Bird Conservation Region) in breeding birds recorded on Pipestone National Monument, Minnesota, from 2005 through 2015. Regional trend data from the BBS surveys (Sauer et al. 2017). "NA" signifies that few observations of the species were made, so calculations of trends could not be made.

| | | 95% Confidence Interval | |
|---|---|---|---|
| **Common name** | **Trend** | **Lower** | **Upper** |
| Vesper Sparrow | -0.04 | -0.93 | 0.88 |
| Warbling Vireo | 4.14 | 2.59 | 5.98 |
| Western Kingbird | -0.98 | -2.63 | 0.67 |
| Western Meadowlark | -1.23 | -2.01 | -0.48 |
| Wild Turkey | 11.45 | 3.94 | 17.36 |
| Willow Flycatcher | 0.73 | -1.95 | 3.34 |
| Wood Duck | 4.53 | 0.15 | 8.78 |
| Yellow Warbler | 2.35 | 1.19 | 3.66 |
| Yellow-headed Blackbird | 2.60 | -0.36 | 5.84 |
| Yellow-rumped Warbler | -2.99 | -10.68 | 4.74 |
| Yellow-throated Vireo | 6.48 | 2.36 | 10.72 |

* Species considered of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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**National Park Service**
**U.S. Department of the Interior**

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