



Bird Monitoring at Pipestone National Monument, Minnesota

Status Report 2009–2022



Prairie at Pipestone National Monument.
NPS/HEARTLAND NETWORK

Bird monitoring at Pipestone National Monument, Minnesota: Status report 2009–2022

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Abstract

In 2009, the Heartland Inventory and Monitoring Network initiated bird surveys on Pipestone National Monument to monitor changes in bird community composition and abundance and improve our understanding of relationships between breeding birds and their habitat and the effects of management actions on those relationships. This information helps park staff plan management objectives and assess the effectiveness of management alternatives. We evaluated park breeding bird trends in the context of trends observed within the North American Bird Conservation Initiative's Prairie Potholes Bird Conservation Region where the park is located. This allows us to 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 the park.

In 14 years (2009–2022) of monitoring, 109 bird species were recorded on the park. Ninety-two of the species are considered breeding species (permanent or summer residents). Seven of these are species of concern for the Prairie Potholes Bird Conservation Region. Fifteen species were observed in sufficient numbers to calculate annual abundances and trends with some degree of statistical confidence. The Bobolink, American Robin, and Red-winged Blackbird were the most abundant and widespread species on the park. Comparisons of regional trends (2009–2019; Sauer et al. 2020) with park trends were inconclusive. Trends in 14 of the 15 abundant species on the park were uncertain. Common Yellowthroat was moderately increasing on the park. Regionally, American Robin, Dickcissel, and Yellow Warbler were increasing; the Bobolink, Clay-colored Sparrow, Eastern Kingbird, Grasshopper Sparrow, and Ring-necked Pheasant were declining; and the remaining seven species had uncertain population trends. Diversity, richness, and evenness in distribution of individuals across species in the breeding bird community on the park were unchanged over the 14 years.

When sampled, habitats on the plots at Pipestone National Monument consisted primarily of the old field/prairie vegetation type, with lesser amounts of other types present. Canopy cover of hardwood trees averaged 5 to 7% on plots, basal area averaged 1 to 2 m²/ha, and canopy height averaged between 1 and 3 m. Tree species from 10 different families contributed to the canopy cover and basal area of plots. Plots sampled were primarily unvegetated at ground level, with grass litter common, and rock and bare soil exposed. Total foliar cover at ground level on plots consisted primarily of cool season grasses and forbs.

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Introduction

Birds are an important component of park ecosystems. 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 (e.g., habitat for neotropical migrants) can have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991; Maurer 1993). Birds also 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), one of 67 bird conservation 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 2024).

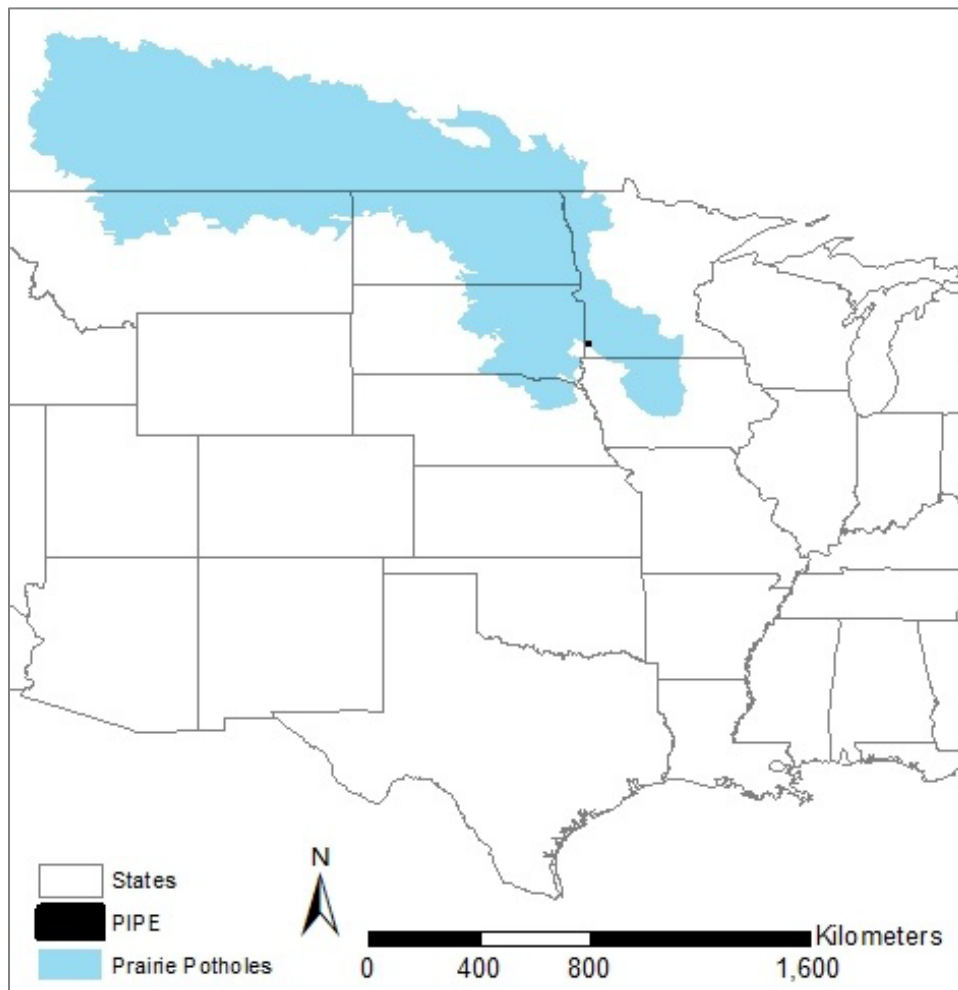


Figure 1. Location of Pipestone National Monument (PIPE), Minnesota, within the Prairie Potholes Bird Conservation Region.

The Prairie Potholes Bird Conservation Region is a glaciated area of mixed-grass prairie in the west and tallgrass prairie in the east (NABCI 2024). This is the most important waterfowl production area on the North American continent despite extensive wetland drainage and tillage of native grasslands. The region contains the core of the breeding range of most 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 the area 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 (USGS) annual North American Breeding Bird Surveys (BBS) between 2009 and 2019 indicate that 11 potential breeding bird species occurring at Pipestone National Monument show evidence of population decline (Sauer et al. 2020), with species such as the Western Kingbird (*Tyrannus verticalis*), Grasshopper Sparrow (*Ammodramus savannarum*), and Ring-necked Pheasant (*Phasianus colchicus*) declining at alarming rates.

Long-term trends in community composition and abundance of breeding bird populations provide one measure for assessing the ecological integrity in a system and detecting changes. We use trends in the composition and abundance of bird populations as long-term indicators of ecosystem integrity at Pipestone National Monument. *Ecosystem integrity* 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. 1993; Mallory et al. 2006; Wood et al. 2006). Therefore, changes in the number of individuals and species composition of bird communities may reflect the effectiveness of management actions implemented to restore and maintain 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 14 years (2009–2022) of monitoring.

Methods

Site Selection

Permanent monitoring locations or “plots” were selected by overlaying a systematic grid of 100 m 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 others) the number of plots sampled annually ranged from 17 to 68 (Table 1).

During bird surveys in 2009, monitoring plots were located using navigation waypoints (Peitz 2010) in a Trimble Geo XT GNSS unit and temporarily marked with 36-inch 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, 2017, and 2022 the habitat assessment crews worked independently from the bird surveyor, and monitoring plots were located using a GNSS unit but not marked with pin flags. During bird surveys in 2010 to 2012, 2014 to 2016, 2018, and 2021, years when habitat assessments were not conducted, monitoring plots were located using a GNSS unit and plots were not marked with pin flags.

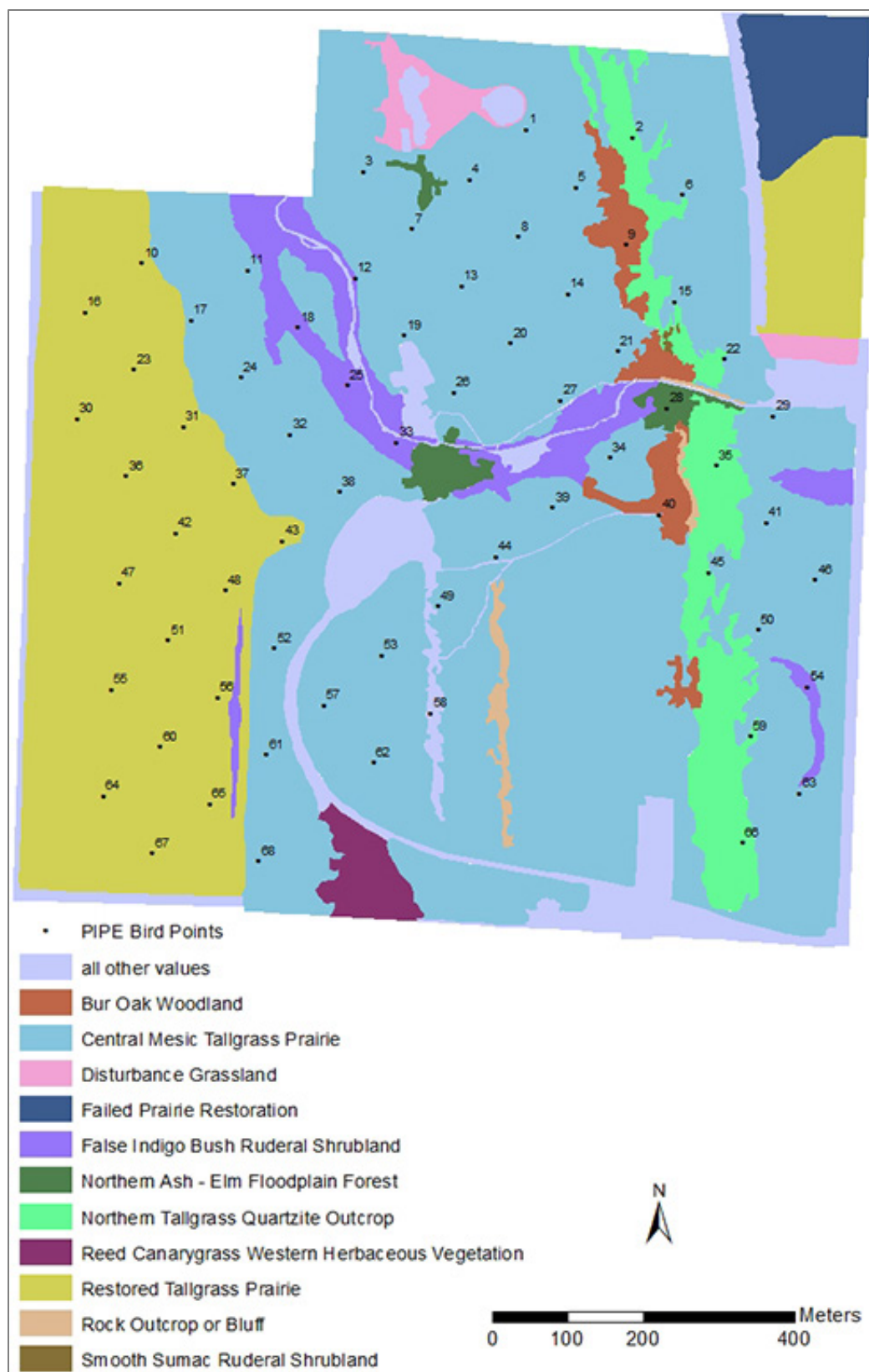


Figure 2. Bird plot locations on Pipestone National Monument (PIPE), Minnesota. Vegetation mapping and classification provided by Diamond et al. (2014).

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 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 ^A	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 ^A	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 ^A and D. W. Marcum ^A	Yes
2018	June 1	17	S. B. Hendrix, C. D. Langland, L. H. Blacik	No
2021	May 28–June 21	68	S. B. Hendrix, G. L. Yellowhawk, R. C. Schroyer, J. K. Borden, and N. R. Chiapperi	No
2022	May 14–May 15	68	D. G. Peitz ^A and D. W. Marcum ^A	Yes

^A Heartland Inventory and Monitoring Network staff.

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-minute 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 rather than 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 GNSS 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 from the time it was light enough to observe birds to four hours after sunrise.

Variable circular plot counts were conducted 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-minute survey are included.

Habitat Assessment

The collection of habitat data followed methods outlined in the bird monitoring protocol by Peitz et al. (2008) and summarized in this report. Habitat data were collected in 2009, 2013, 2017, and 2022. During years when habitat assessments occurred, plots were visited in generally the same order they were surveyed for birds to avoid disturbing birds on a plot prior to sampling. Once the habitat crew arrived at a plot, they set up a 5 m radius subplot, a nested 1.78 m radius sample plot, and a larger 50 m radius plot.

Slope, slope variability, aspect, aspect variability, and topographic position of each 50 m radius plot were recorded during the first visit to a plot and not remeasured in subsequent years. The amount of various vegetation types (drainage, old field/prairie, shrub, riparian woodland/woodland, etc.) and road and water cover on each 50 m plot were recorded. As 5 m subplots were sampled, horizontal vegetation cover was estimated in 0.25 m intervals from 0.0 to 2.0 m above ground surface using a 0.15 m wide cover board. Area of the cover board obscured by vegetation was estimated at 15 m north of plot center. Using a graduated measuring rod, vertical vegetation structure was measured in 1 m increments up to 7.5 m in height at four locations around the perimeter of the subplot. Locations were in the four cardinal directions. Vertical structure was recorded for deciduous, coniferous, and herbaceous vegetation. Trees were tallied by species and diameter size class (<1.0 cm, 1.1–2.5 cm, 2.6–8.0 cm, 8.1–15.0 cm, 15.1–23.0 cm, 23.1–38.0 cm, or >38.0 cm) on subplots. Lastly, at a 1.78 m sample plot nested within the subplot, ground and foliar cover were estimated. Ground cover classes included deciduous and grass litter, bare soil, rock, woody debris (>2.5 cm diameter), and unvegetated. Foliar cover was estimated for six plant guilds, including warm-season and cool-season grasses, forbs, mosses and lichens, shrubs and vines, tree seedlings, and total foliar cover (<1.5 m tall).

Data Analysis

Prior to summary analysis, the residency status (migrant, outside normal range, permanent resident, summer resident, and winter resident) was determined for each bird species detected. Identifying the residency of each species helps to exclude species outside their normal range, migrants, and winter residents from analyses 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 Appendix B and Appendix C.

For species with greater than 60 observations (15 species), Distance software (Distance 6.0 Release 2) was used to determine the park-wide abundance of each (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 (half-normal + cosine, hazard-rate + cosine, half-normal + hermite polynomial, and hazard-rate + simple polynomial) and two without series expansion (half-normal, and hazard-rate) were considered in determining the detection function of each species. The most robust models were selected by Distance based on the lowest Akaike Information Criteria (AIC) values.

The hazard-rate function was selected for six species: Bobolink (*Dolichonyx oryzivorus*), Grasshopper Sparrow, Red-winged Blackbird (*Agelaius phoeniceus*), Ring-necked Pheasant, Song

Sparrow (*Melospiza melodia*), and Yellow Warbler (*Setophaga petechia*). The hazard-rate + simple polynomial function was selected for four species: American Robin (*Turdus migratorius*), Canada Goose (*Branta canadensis*), Common Grackle (*Quiscalus quiscula*), and Dickcissel (*Spiza americana*). The half-normal + cosine function was selected for four species: American Goldfinch (*Spinus tristis*), Brown-headed Cowbird (*Molothrus ater*), Clay-colored Sparrow (*Spizella pallida*), and Common Yellowthroat (*Geothlypis trichas*). The hazard-rate + cosine function was selected for one species: Eastern Kingbird (*Tyrannus tyrannus*). 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 the statistical package “rtrim” (built under R version 3.6.3) and reported in Appendix D. Rtrim is the R version of the statistical software package “TRIM,” a program developed for the analysis of count data obtained from wildlife population monitoring (Pannekoek and van Strien 2005). It 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 accounted for 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 periods between 2009 and 2019 (Appendix E; Sauer et al. 2020). It is possible to determine trends for many bird species, and many regions of interest for periods ranging from 1966 to 2019 by using the interactive calculator available at the [BBS Regional Trend Analysis Form website](https://www.pwrc.usgs.gov/MBR/bbs/trend/tf15.html) (<https://www.pwrc.usgs.gov/MBR/bbs/trend/tf15.html>). However, we chose the last eleven-year period of available data to maximize the accuracy of regional trend results without going beyond the sampling period at Pipestone National Monument. We compared regional trends with those from the park that were calculated using TRIM. 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 interpretation of BBS results should be made with caution.

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 and graphing the results. Prior to trend analysis, bird community diversity values were calculated annually using the Shannon Diversity Index (H'):

$$H' = -\sum_{i=1}^s \left(\frac{n_i}{N} \right) \cdot \ln \left(\frac{n_i}{N} \right)$$

where n_i/N is the proportion of the total number of individuals in a population consisting of the i th species (Shannon 1949). Species richness values were determined as the total number of bird taxa recorded annually in each habitat type. Species distribution evenness values were calculated using Pielou's evenness index (J'):

$$J' = \frac{H'}{H_{max}}$$

where H' is the Shannon Diversity Index and H_{max} is the maximum possible diversity for a given number of species if all species are present in equal numbers ($\ln(\text{annual species richness})$). 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).

Location and permanent abiotic measures on each plot were reported by Peitz (2010). Annual averages ($\pm$ std dev) for semi-permanent plot data, including road and water cover, were calculated from plot estimates (Appendix F). Averages ($\pm$ std dev) for horizontal vegetation cover at each of the vegetation profile heights (0–0.25 m, 0.25–0.50 m, 0.50–0.75 m, 0.75–1.00 m, 1.00–1.25 m, 1.25–1.50 m, 1.50–1.75 m, and 1.75–2.00 m) were calculated and reported. Average ($\pm$ std dev) annual vertical structural diversity was estimated and reported as well. Vertical structural diversity was calculated as follows:

$$\text{Structural Diversity Index} = \frac{\left(\left(\sum_{i=1}^8 \frac{p_i}{8} \right) + a \right) \cdot 100}{2}$$

where p_i is the observed frequency for vegetation in the i th interval touching a measuring rod out of twelve measuring events, and a is the percent of intervals with recorded vegetation in eight height increments. Vertical structural diversity values are weighted equally to represent both the vertical height of vegetation and how dense the vegetation is within each height increment.

Within each plot, ground cover, including deciduous and grass litter, bare soil, rock, woody debris (>2.5 cm DBH), and unvegetated, were averaged ($\pm$ std dev) across plots and reported (Appendix F). Foliar cover, by guild of warm-season and cool-season grasses, forbs, mosses and lichens, shrubs and vines, tree seedlings and total foliar cover (<1.5 m tall), were averaged ($\pm$ std dev) across plots as well (Appendix F). Trees were identified to family and size class before summing stems per hectare for the park (Appendix F).

Results

Bird Surveys

Between 2009 and 2022, 559 cumulative plots were surveyed, and 109 different bird species were recorded, 92 of which are species with the potential to breed within the park (Table 2; Janssen et al. 2003). Seven of the breeding species recorded are considered species of regional concern for the Prairie Potholes Bird Conservation Region (USFWS 2008): Black Tern (*Chlidonias niger*), Dickcissel, Grasshopper Sparrow, Least Bittern (*Ixobrychus exilis*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Swainson's Hawk (*Buteo swainsoni*), and Upland Sandpiper (*Bartramia longicauda*).

Table 2. Bird species recorded during breeding bird surveys at Pipestone National Monument, Minnesota, 2009–2022. 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 web site (ITIS 2023).

Common Name	Scientific Name	AOU Code	Residency ^A
American Crow	<i>Corvus brachyrhynchos</i>	AMCR	R
American Goldfinch	<i>Spinus tristis</i>	AMGO	R
American Kestrel	<i>Falco sparverius</i>	AMKE	R
American Redstart	<i>Setophaga ruticilla</i>	AMRE	SR
American Robin	<i>Turdus migratorius</i>	AMRO	R
Bald Eagle ^B	<i>Haliaeetus leucocephalus</i>	BAEA	M
Baltimore Oriole	<i>Icterus galbula</i>	BAOR	SR
Bank Swallow	<i>Riparia riparia</i>	BANS	SR
Barn Swallow	<i>Hirundo rustica</i>	BARS	SR
Belted Kingfisher	<i>Megaceryle alcyon</i>	BEKI	SR
Black and White Warbler	<i>Mniotilta varia</i>	BAWW	SR
Black-capped Chickadee	<i>Poecile atricapillus</i>	BCCH	R
Blackpoll Warbler	<i>Setophaga striata</i>	BLPW	M
Black Tern ^B	<i>Chlidonias niger</i>	BLTE	SR
Blue Jay	<i>Cyanocitta cristata</i>	BLJA	R
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	BGGN	SR
Blue Grosbeak	<i>Passerina caerulea</i>	BLGR	SR
Blue-headed Vireo	<i>Vireo solitarius</i>	BHVI	M
Blue-winged Teal	<i>Anas discors</i>	BWTE	SR
Bobolink	<i>Dolichonyx oryzivorus</i>	BOBO	SR

^A Residency status: SR = summer resident; R = year-round resident; WR = winter resident; M = late season migrant; O = outside of normal range (Janssen et al. 2003).

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

^C Resident species recorded only while traveling between survey plots or at other times outside of 5-minute survey periods.

Table 2 (continued). Bird species recorded during breeding bird surveys at Pipestone National Monument, Minnesota, 2009–2022. 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 web site (ITIS 2023).

Common Name	Scientific Name	AOU Code	Residency ^A
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	BRBL	O
Brown-headed Cowbird	<i>Molothrus ater</i>	BHCO	SR
Brown Thrasher	<i>Toxostoma rufum</i>	BRTH	SR
Canada Goose	<i>Branta canadensis</i>	CANG	SR
Cedar Waxwing	<i>Bombycilla cedrorum</i>	CEDW	R
Cerulean Warbler	<i>Setophaga cerulea</i>	CERW	M
Chimney Swift	<i>Chaetura pelagica</i>	CHSW	SR
Chipping Sparrow	<i>Spizella passerina</i>	CHSP	SR
Clay-colored Sparrow	<i>Spizella pallida</i>	CCSP	SR
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	CLSW	SR
Common Grackle	<i>Quiscalus quiscula</i>	COGR	SR
Common Nighthawk	<i>Chordeiles minor</i>	CONI	SR
Common Yellowthroat	<i>Geothlypis trichas</i>	COYE	SR
Cooper's Hawk	<i>Accipiter cooperii</i>	COHA	R
Dickcissel ^B	<i>Spiza americana</i>	DICK	SR
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	DCCO	SR
Downy Woodpecker	<i>Picoides pubescens</i>	DOWO	R
Eastern Bluebird	<i>Sialia sialis</i>	EABL	SR
Eastern Kingbird	<i>Tyrannus tyrannus</i>	EAKI	SR
Eastern Meadowlark	<i>Sturnella magna</i>	EAME	SR
Eastern Phoebe	<i>Sayornis phoebe</i>	EAPH	SR
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	EATO	SR
European Starling	<i>Sturnus vulgaris</i>	EUST	R
Field Sparrow	<i>Spizella pusilla</i>	FISP	SR
Grasshopper Sparrow ^B	<i>Ammodramus savannarum</i>	GRSP	SR
Gray Catbird	<i>Dumetella carolinensis</i>	GRCA	SR
Great Blue Heron	<i>Ardea herodias</i>	GBHE	SR
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	GCFL	SR
Great Egret ^C	<i>Ardea alba</i>	GREG	SR
Great Horned Owl	<i>Bubo virginianus</i>	GHOW	R

^A Residency status: SR = summer resident; R = year-round resident; WR = winter resident; M = late season migrant; O = outside of normal range (Janssen et al. 2003).

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

^C Resident species recorded only while traveling between survey plots or at other times outside of 5-minute survey periods.

Table 2 (continued). Bird species recorded during breeding bird surveys at Pipestone National Monument, Minnesota, 2009–2022. 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 web site (ITIS 2023).

Common Name	Scientific Name	AOU Code	Residency ^A
Green Heron	<i>Butorides virescens</i>	GRHE	SR
Hairy Woodpecker	<i>Picoides villosus</i>	HAWO	R
Henslow's Sparrow ^C	<i>Ammodramus henslowii</i>	HESP	SR
Horned Lark	<i>Eremophila alpestris</i>	HOLA	R
House Finch	<i>Haemorhous mexicanus</i>	HOFI	R
House Sparrow	<i>Passer domesticus</i>	HOSP	SR
House Wren	<i>Troglodytes aedon</i>	HOWR	SR
Killdeer	<i>Charadrius vociferus</i>	KILL	SR
Lapland Longspur	<i>Calcarius lapponicus</i>	LALO	WR
Least Bittern ^B	<i>Ixobrychus exilis</i>	LEBI	SR
Least Flycatcher	<i>Empidonax minimus</i>	LEFL	SR
Mallard	<i>Anas platyrhynchos</i>	MALL	R
Marsh Wren	<i>Cistothorus palustris</i>	MAWR	SR
Mourning Dove	<i>Zenaida macroura</i>	MODO	R
Nashville Warbler	<i>Leiothlypis ruficapilla</i>	NAWA	M
Northern Flicker	<i>Colaptes auratus</i>	NOFL	R
Northern Harrier	<i>Circus cyaneus</i>	NOHA	R
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	NRWS	SR
Northern Shoveler	<i>Anas clypeata</i>	NSHO	SR
Orchard Oriole	<i>Icterus spurius</i>	OROR	SR
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	RBWO	R
Redhead	<i>Aythya americana</i>	REDH	SR
Red-headed Woodpecker ^B	<i>Melanerpes erythrocephalus</i>	RHWO	SR
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RTHA	R
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	RWBL	SR
Ring-billed Gull	<i>Larus delawarensis</i>	RBGU	M
Ring-necked Pheasant	<i>Phasianus colchicus</i>	RNEP	R
Rock Dove	<i>Columba livia</i>	ROPI	R
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	RTHU	M
Ruby-crowned Kinglet	<i>Regulus calendula</i>	RCKI	M

^A Residency status: SR = summer resident; R = year-round resident; WR = winter resident; M = late season migrant; O = outside of normal range (Janssen et al. 2003).

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

^C Resident species recorded only while traveling between survey plots or at other times outside of 5-minute survey periods.

Table 2 (continued). Bird species recorded during breeding bird surveys at Pipestone National Monument, Minnesota, 2009–2022. 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 web site (ITIS 2023).

Common Name	Scientific Name	AOU Code	Residency ^A
Rusty Blackbird	<i>Euphagus carolinus</i>	RUBL	M
Savannah Sparrow	<i>Passerculus sandwichensis</i>	SAVS	SR
Sedge Wren	<i>Cistothorus platensis</i>	SEWR	SR
Semipalmated Sandpiper	<i>Calidris pusilla</i>	SESA	M
Solitary Sandpiper ^B	<i>Tringa solitaria</i>	SOSA	M
Song Sparrow	<i>Melospiza melodia</i>	SOSP	R
Sora	<i>Porzana carolina</i>	SORA	SR
Swainson's Hawk ^B	<i>Buteo swainsoni</i>	SWHA	SR
Swamp Sparrow	<i>Melospiza georgiana</i>	SWSP	SR
Tennessee Warbler	<i>Leiothlypis peregrina</i>	TEWA	M
Tree Swallow	<i>Tachycineta bicolor</i>	TRES	SR
Turkey Vulture	<i>Cathartes aura</i>	TUVU	SR
Upland Sandpiper ^B	<i>Bartramia longicauda</i>	UPSA	SR
Vesper Sparrow	<i>Pooecetes gramineus</i>	VESP	SR
Warbling Vireo	<i>Vireo gilvus</i>	WAVI	SR
Western Kingbird	<i>Tyrannus verticalis</i>	WEKI	SR
Western Meadowlark	<i>Sturnella neglecta</i>	WEME	SR
White-breasted Nuthatch	<i>Sitta carolinensis</i>	WBNU	R
White-crowned Sparrow ^C	<i>Zonotrichia leucophrys</i>	WCSP	SR
White-throated Sparrow	<i>Zonotrichia albicollis</i>	WTSP	M
Wild Turkey	<i>Meleagris gallopavo</i>	WITU	R
Willow Flycatcher	<i>Empidonax traillii</i>	WIFL	SR
Wilson's Warbler	<i>Cardellina pusilla</i>	WIWA	M
Wood Duck	<i>Aix sponsa</i>	WODU	SR
Yellow-breasted Chat	<i>Icteria virens</i>	YBCH	O
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	YHBL	SR
Yellow-rumped Warbler	<i>Setophaga coronata</i>	YRWA	SR
Yellow-throated Vireo ^C	<i>Vireo flavifrons</i>	YTVI	SR
Yellow Warbler	<i>Setophaga petechia</i>	YEWA	SR

^A Residency status: SR = summer resident; R = year-round resident; WR = winter resident; M = late season migrant; O = outside of normal range (Janssen et al. 2003).

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

^C Resident species recorded only while traveling between survey plots or at other times outside of 5-minute survey periods.

Fifteen breeding species were observed during the survey period in sufficient numbers to calculate annual abundances with some degree of confidence (Appendix B). Of these fifteen species, Bobolink, American Robin, and Red-winged Blackbird were the most abundant and widespread species on Pipestone National Monument. The Common Yellowthroat is the only species observed in sufficient numbers to calculate annual abundance that had a detectible trend in population size, a moderate increase (Figure 3; Appendix D). Of the remaining fourteen species observed in sufficient numbers to calculate annual abundances, we were unable to detect with certainty positive or negative population trends. Regional bird data (2009–2019) reported by Sauer et al. (2020; Figure 3 and Appendix E) for the Prairie Potholes Bird Conservation Region showed increasing trends for American Robin, Dickcissel, and Yellow Warbler; declining trends for Bobolink, Clay-colored Sparrow, Eastern Kingbird, Grasshopper Sparrow, and Ring-necked Pheasant; and uncertain trends for the remaining seven species.

Diversity ($P = 0.07$), richness ($P = 0.23$), and evenness in distribution of individuals across species ($P = 0.33$) in the breeding bird community on Pipestone National Monument were unchanged over the fourteen monitoring years since 2009 (Figure 4). For the bird community on the park, richness averaged 43 species annually.

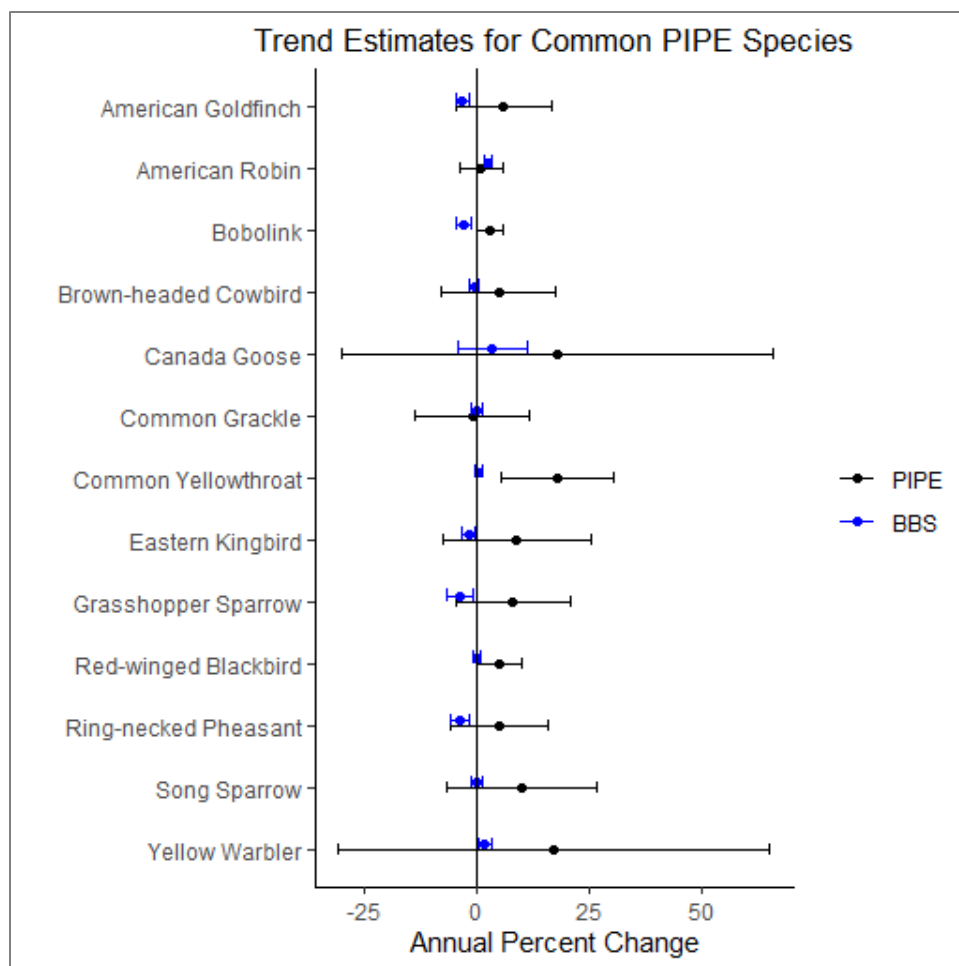


Figure 3. Comparison of bird population trends from Pipestone National Monument (PIPE), Minnesota (2009–2022), with those of the larger Prairie Potholes Bird Conservation Region (2009–2019) from the USGS Breeding Bird Surveys (BBS). Error bars represent 95% confidence intervals. For graphing aesthetics, Clay-colored Sparrow (*Spizella pallida*) and Dickcissel (*Spiza americana*) were excluded from the figure because of their large confidence intervals.

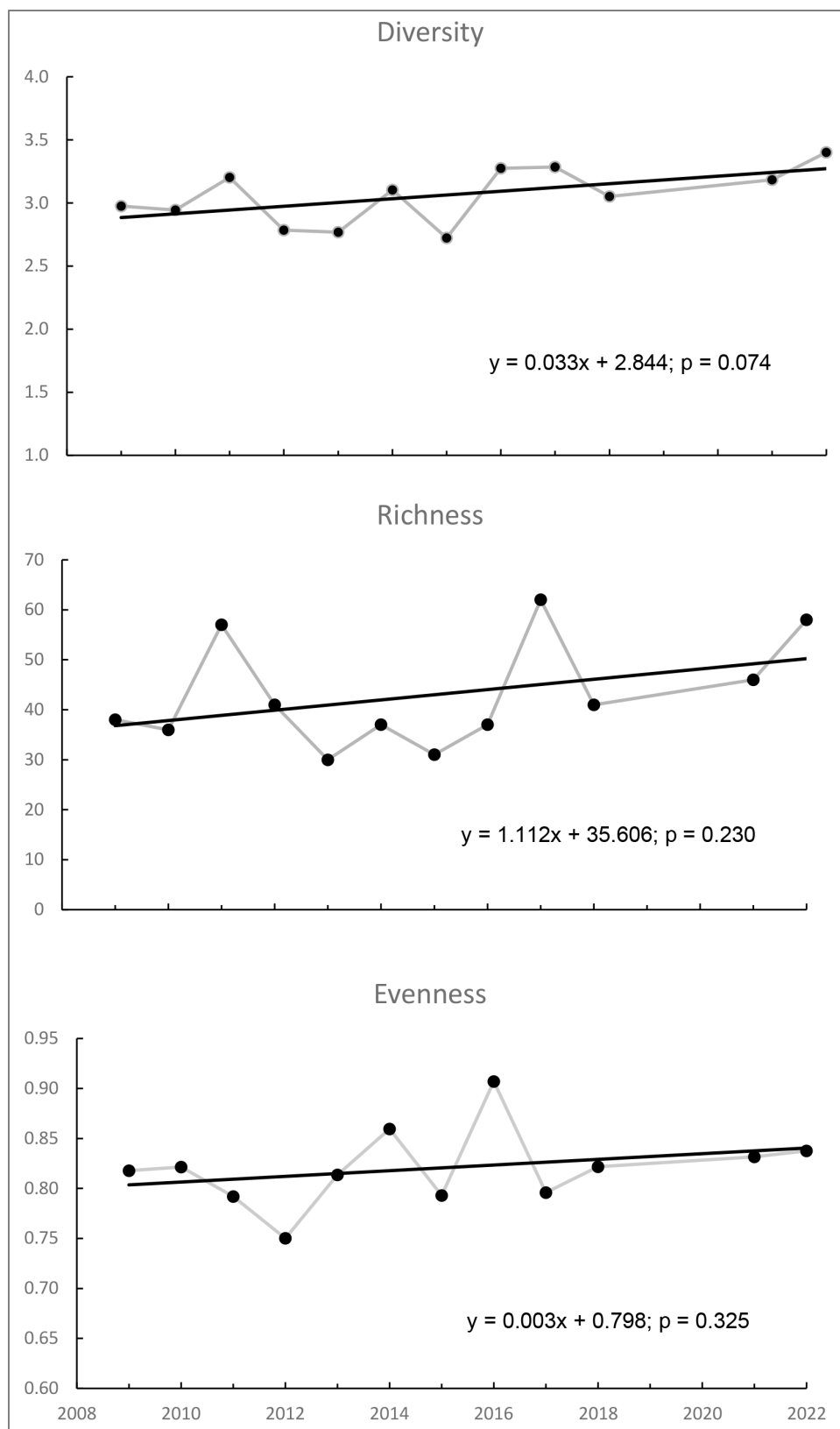


Figure 4. Trends in bird community diversity, richness, and species distribution evenness on Pipestone National Monument, Minnesota, 2009–2022.

Habitat Assessment

When sampled, habitats on the plots at Pipestone National Monument consisted primarily of the old field/prairie (80–84%) type, with far lesser amounts of other types present (Appendix F). Canopy cover averaged 5 to 7% on plots (Appendix F), with cover provided exclusively by hardwood trees. Basal area of hardwood trees averaged between 1 and 2 m²/ha, and canopy height averaged 1 to 3 m. Tree species from 10 different families contributed to the canopy cover and basal area of plots (Appendix F).

Across all plots, the densest vegetation measures at the time of assessment (mid-May to mid-June) occurred in horizontal profile heights below 0.50 m (Appendix F). However, vegetation was measured in all height classes to 2.0 m. Average vertical structure diversity estimates across years ranged from 4 to 13% on plots.

When sampled, plots were primarily unvegetated (71–88% cover) at ground level, with grass litter (26–63% cover) common, and rock (5–13% cover) and bare soil (1–13% cover) exposed (Appendix F). Deciduous litter (1–3% cover) and woody debris (1–2% cover) were also recorded on plots. Total foliar cover (22–53% cover) on plots consisted primarily of cool season grasses (16–41% cover), shrubs and vines (3–4% cover), and forbs (1–8% cover), with lesser amounts of warm season grasses (0–5% cover), moss and lichens (<1–2% cover), and tree seedlings (<1% cover) present.

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 14 years of monitoring, 109 bird species have been recorded, 92 of which are permanent or summer residents to the area (Janssen et al. 2003). Data collected for these species are valuable for characterizing the park's breeding bird community and the habitat they rely on. The seven breeding species of concern for the Prairie Potholes Bird Conservation Region should be given additional consideration in the management of natural resources on the park: Black Tern, Dickcissel, Grasshopper Sparrow, Least Bittern, Red-headed Woodpecker, Swainson's Hawk, and Upland Sandpiper. Two of these species that were recorded in sufficient numbers to calculate population trends—Dickcissel and Grasshopper Sparrow—require open prairie and or weedy field habitat, the primary habitat types on the park. If it is not feasible to manage habitat for the five remaining species of conservation concern directly, then habitat should at least be managed in a way that does not conflict with their needs. Habitat requirements of 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 whole. The Black Tern and Least Bittern require wet meadows, marshes with dense vegetation, and pond habitat, requirements that are quite different from the requirements of the other species of conservation concern, making management for them more complex. Red-headed Woodpecker favor open grasslands and prairie habitat with scattered trees, a habitat combination found on the park.

Fifteen breeding species were observed during the survey period in sufficient numbers to calculate annual abundances and trends with some degree of confidence. The Bobolink, American Robin, and Red-winged Blackbird were the most abundant and widespread species on Pipestone National Monument, and their habitat preferences provide the best characterization of habitat currently present at the park. The Bobolink utilizes grasslands, American Robin is a habitat generalist, and Red-winged Blackbird occupies marshy areas and meadows (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 widespread 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 differing microhabitat requirements.

A comparison of population trends on Pipestone National Monument with regional trends for the Prairie Potholes Bird Conservation Region was inconclusive. We were unable to detect with certainty either positive or negative population trends for 14 of the 15 species reported on the park. The Common Yellowthroat population moderately increased on the park over the 14 years of monitoring. Regionally, data reported by Sauer et al. (2020; Figure 3; Appendix E) for the Prairie Potholes Bird Conservation Region from 2009 to 2019 showed increasing trends for American Robin, Dickcissel, and Yellow Warbler. However, the Bobolink, Clay-colored Sparrow, Eastern Kingbird, Grasshopper Sparrow, and Ring-necked Pheasant had declining population trends in the region. The seven remaining species had uncertain population trends in the Prairie Potholes Bird Conservation Region.

Over the 14 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. However, this stable species community structure could be altered if significant portions of the park's prairies and grasslands were converted to woodlands or invaded by shrubby vegetation.

A word of caution is needed here; since we have a limited number of survey years within Pipestone National Monument, trends and indices may change as more years of data are collected. However, our reported data provide baseline information for understanding bird populations at Pipestone National Monument in the context of those seen in the larger Prairie Potholes Bird Conservation Region and should help the park make more 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 3. Plots sampled on Pipestone National Monument, Minnesota, between 2009 and 2022 and gross habitat type. “Yes” indicates plot was sampled in that year; “No” indicates it was not sampled. Number of plots sampled each year listed in parentheses.

Plot	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)	Plot Type
1	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
2	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
3^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
4	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
5^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
6	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
7	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
8	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
9	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Woodland/Shrubland
10	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
11^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
12	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
13^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
14	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
15^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
16	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
17	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
18	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Woodland/Shrubland
19	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
20	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
21	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie

^A Plots that were included in analysis of individual bird species trends (also in bold).

Table 3 (continued). Plots sampled on Pipestone National Monument, Minnesota, between 2009 and 2022 and gross habitat type. “Yes” indicates plot was sampled in that year; “No” indicates it was not sampled. Number of plots sampled each year listed in parentheses.

Plot	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)	Plot Type
22	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
23^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
24	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
25^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Woodland/Shrubland
26	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
27^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
28	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Woodland/Shrubland
29^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
30	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
31	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
32	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
33	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Woodland/Shrubland
34	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
35	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
36	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
37^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
38	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
39	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
40^A	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Woodland/Shrubland
41	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
42	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
43	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
44	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie

^A Plots that were included in analysis of individual bird species trends (also in bold).

Table 3 (continued). Plots sampled on Pipestone National Monument, Minnesota, between 2009 and 2022 and gross habitat type. “Yes” indicates plot was sampled in that year; “No” indicates it was not sampled. Number of plots sampled each year listed in parentheses.

Plot	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)	Plot Type
45	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
46	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
47^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
48	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
49	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
50^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
51	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
52	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
53	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
54	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Woodland/Shrubland
55	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
56^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
57	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
58^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
59	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
60	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
61	Yes	Yes	Yes	No	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
62	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
63	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
64^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
65	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
66^A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Grassland/Prairie
67	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie
68	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Grassland/Prairie

^A Plots that were included in analysis of individual bird species trends (also in bold).

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

Table 4. Annual proportion of plots occupied by each breeding bird species and estimated abundance (determined using Distance software; shown in parentheses) of each species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance using Distance does not. “–” denotes when an annual abundance value could not be calculated because the species was present but distance measures from observers could not be determined.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
American Goldfinch	0.24 (187)	0.37 (214)	0.63 (153)	0.42 (211)	0.06 (140)	0.59 (168)	0.41 (140)	0.65 (140)	0.59 (187)	0.71 (–)	0.60 (292)	0.32 (176)
American Robin	0.29 (222)	0.43 (142)	0.56 (130)	0.46 (135)	0.29 (179)	0.76 (137)	0.47 (199)	0.41 (199)	0.66 (131)	0.12 (–)	0.44 (186)	0.38 (163)
Bobolink	0.46 (157)	0.49 (136)	0.75 (136)	0.66 (140)	0.71 (172)	0.41 (217)	0.71 (155)	0.65 (145)	0.47 (117)	0.82 (94)	0.53 (131)	0.57 (169)
Brown-headed Cowbird	0.26 (236)	0.10 (421)	0.26 (223)	0.19 (327)	0.24 (519)	0.53 (433)	0.24 (346)	0.29 (173)	0.41 (156)	0.47 (173)	0.25 (346)	0.41 (295)
Canada Goose	0.18 (53)	0.01 (–)	0.21 (45)	0.00 (0)	0.41 (47)	0.00 (0)	0.00 (0)	0.29 (30)	0.31 (89)	0.18 (–)	0.31 (45)	0.28 (78)
Clay-colored Sparrow	0.19 (179)	0.00 (0)	0.03 (311)	0.19 (167)	0.06 (155)	0.71 (233)	0.76 (376)	0.65 (155)	0.44 (212)	0.41 (–)	0.46 (155)	0.51 (240)
Common Grackle	0.49 (146)	0.67 (190)	0.78 (297)	0.76 (199)	0.29 (–)	0.71 (531)	0.76 (814)	0.71 (531)	0.46 (106)	0.35 (–)	0.60 (197)	0.26 (212)
Common Yellowthroat	0.01 (108)	0.04 (108)	0.40 (108)	0.33 (118)	0.06 (108)	0.35 (–)	0.65 (177)	0.53 (108)	0.50 (122)	0.65 (108)	0.49 (108)	0.47 (135)
Dickcissel^A	0.03 (175)	0.00 (0)	0.19 (175)	0.64 (222)	0.06 (–)	0.00 (0)	0.24 (219)	0.12 (175)	0.03 (175)	0.94 (219)	0.62 (332)	0.24 (186)

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 4 (continued). Annual proportion of plots occupied by each breeding bird species and estimated abundance (determined using Distance software; shown in parentheses) of each species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n=number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance using Distance does not. “–” denotes when an annual abundance value could not be calculated because the species was present but distance measures from observers could not be determined.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
Eastern Kingbird	0.03 (–)	0.07 (142)	0.15 (189)	0.07 (199)	0.00 (0)	0.18 (189)	0.41 (260)	0.12 (213)	0.09 (114)	0.18 (237)	0.18 (227)	0.24 (175)
Grasshopper Sparrow^A	0.19 (170)	0.34 (170)	0.63 (195)	0.18 (170)	0.24 (255)	0.18 (340)	0.47 (170)	0.53 (–)	0.15 (189)	0.65 (170)	0.38 (227)	0.12 (277)
Red-winged Blackbird	0.22 (189)	0.28 (100)	0.57 (154)	0.40 (112)	0.24 (47)	0.76 (121)	0.53 (71)	0.59 (118)	0.51 (110)	0.65 (110)	0.53 (173)	0.41 (159)
Ring-necked Pheasant	0.25 (37)	0.10 (36)	0.40 (28)	0.52 (28)	0.53 (41)	0.82 (28)	0.59 (28)	0.82 (28)	0.54 (37)	0.76 (–)	0.51 (51)	0.34 (32)
Song Sparrow	0.01 (72)	0.13 (72)	0.18 (72)	0.06 (72)	0.00 (0)	0.29 (217)	0.47 (120)	0.47 (96)	0.51 (74)	0.12 (–)	0.13 (72)	0.19 (89)
Yellow Warbler	0.01 (261)	0.00 (0)	0.09 (131)	0.01 (392)	0.18 (131)	0.35 (–)	0.18 (196)	0.18 (131)	0.21 (149)	0.18 (–)	0.12 (163)	0.29 (189)

^A Species of conservation 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 5. Annual proportion of plots occupied by and estimated abundance (determined using birds within 50 m of plot center) of breeding bird species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. “–” denotes when an annual abundance value could not be calculated because the species was present, but distance measures from observers could not be determined or the species was outside of 50 m from the plot center.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
American Crow	0.04 (–)	0.09 (–)	0.37 (4)	0.04 (–)	0.12 (–)	0.18 (–)	0.29 (–)	0.18 (–)	0.18 (–)	0.29 (–)	0.19 (–)	0.15 (2)
American Kestrel	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)
American Redstart	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)
Baltimore Oriole	0.00 (0)	0.04 (2)	0.04 (4)	0.13 (7)	0.12 (9)	0.06 (–)	0.00 (0)	0.00 (0)	0.04 (–)	0.06 (–)	0.06 (–)	0.06 (6)
Bank Swallow	0.04 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (–)	0.12 (–)	0.00 (0)	0.12 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.12 (–)
Barn Swallow	0.03 (–)	0.21 (11)	0.21 (9)	0.15 (–)	0.06 (–)	0.24 (–)	0.41 (–)	0.18 (–)	0.18 (–)	0.18 (–)	0.25 (2)	0.12 (6)
Belted Kingfisher	0.01 (–)	0.03 (–)	0.03 (–)	0.01 (–)	0.00 (0)	0.06 (–)	0.00 (0)	0.12 (–)	0.01 (–)	0.00 (0)	0.04 (2)	0.09 (–)
Black and White Warbler	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (2)	0.00 (0)	0.00 (0)	0.00 (0)
Black-capped Chickadee	0.00 (0)	0.00 (0)	0.00 (0)	0.04 (7)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)	0.01 (–)	0.06 (–)	0.01 (–)	0.00 (0)

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 5 (continued). Annual proportion of plots occupied by and estimated abundance (determined using birds within 50 m of plot center) of breeding bird species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. “–” denotes when an annual abundance value could not be calculated because the species was present, but distance measures from observers could not be determined or the species was outside of 50 m from the plot center.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
Black Tern ^A	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.01 (–)
Blue Jay	0.00 (0)	0.00 (0)	0.07 (–)	0.03 (4)	0.00 (0)	0.00 (0)	0.00 (0)	0.12 (9)	0.00 (0)	0.00 (0)	0.10 (–)	0.01 (–)
Blue-gray Gnatcatcher	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (2)	0.00 (0)	0.00 (0)	0.01 (2)
Blue Grosbeak	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.03 (2)	0.00 (0)	0.00 (0)	0.00 (0)
Blue-winged Teal	0.00 (0)	0.00 (0)	0.03 (–)	0.03 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.03 (–)	0.06 (–)	0.01 (–)	0.06 (2)
Brown Thrasher	0.06 (2)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (9)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (4)	0.00 (0)
Cedar Waxwing	0.01 (–)	0.00 (0)	0.06 (–)	0.03 (26)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)	0.06 (–)	0.06 (30)	0.00 (0)
Chimney Swift	0.00 (0)	0.00 (0)	0.09 (2)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
Chipping Sparrow	0.00 (0)	0.01 (4)	0.31 (4)	0.03 (4)	0.06 (8)	0.24 (–)	0.06 (–)	0.00 (0)	0.04 (–)	0.06 (–)	0.00 (0)	0.04 (6)
Cliff Swallow	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.04 (–)
Common Nighthawk	0.00 (0)	0.09 (4)	0.26 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (9)	0.06 (9)	0.03 (–)	0.06 (–)	0.03 (2)	0.07 (–)

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 5 (continued). Annual proportion of plots occupied by and estimated abundance (determined using birds within 50 m of plot center) of breeding bird species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. “–” denotes when an annual abundance value could not be calculated because the species was present, but distance measures from observers could not be determined or the species was outside of 50 m from the plot center.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
Cooper's Hawk	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)
Double-crested Cormorant	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)
Downy Woodpecker	0.00 (0)	0.04 (7)	0.04 (–)	0.00 (0)	0.00 (0)	0.06 (17)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (–)	0.01 (2)	0.01 (–)
Eastern Bluebird	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.03 (–)
Eastern Meadowlark	0.03 (–)	0.01 (2)	0.07 (–)	0.03 (–)	0.12 (9)	0.00 (0)	0.12 (–)	0.12 (–)	0.19 (2)	0.18 (–)	0.00 (0)	0.03 (–)
Eastern Phoebe	0.00 (0)	0.00 (0)	0.04 (2)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (9)	0.06 (–)	0.06 (–)	0.00 (0)	0.07 (4)
Eastern Towhee	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (9)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
European Starling	0.00 (0)	0.01 (2)	0.16 (2)	0.06 (4)	0.00 (0)	0.06 (–)	0.00 (0)	0.12 (–)	0.03 (4)	0.00 (0)	0.04 (–)	0.01 (–)
Field Sparrow	0.16 (17)	0.19 (11)	0.31 (15)	0.10 (7)	0.06 (–)	0.00 (0)	0.24 (–)	0.24 (9)	0.10 (4)	0.06 (–)	0.10 (9)	0.03 (2)
Gray Catbird	0.03 (2)	0.04 (4)	0.06 (2)	0.00 (0)	0.00 (0)	0.06 (–)	0.06 (–)	0.06 (–)	0.04 (4)	0.06 (–)	0.03 (–)	0.09 (13)
Great Blue Heron	0.01 (–)	0.01 (2)	0.00 (0)	0.01 (–)	0.00 (0)	0.06 (–)	0.00 (0)	0.12 (–)	0.09 (–)	0.06 (–)	0.04 (2)	0.03 (–)

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 5 (continued). Annual proportion of plots occupied by and estimated abundance (determined using birds within 50 m of plot center) of breeding bird species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. “–” denotes when an annual abundance value could not be calculated because the species was present, but distance measures from observers could not be determined or the species was outside of 50 m from the plot center.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
Great Crested Flycatcher	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
Great Horned Owl	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.03 (–)	0.01 (–)
Green Heron	0.00 (0)	0.00 (0)	0.01 (–)	0.03 (–)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)
Hairy Woodpecker	0.00 (0)	0.00 (0)	0.03 (–)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
Double-crested Cormorant	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)
Horned Lark	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (2)	0.00 (0)	0.00 (0)	0.00 (0)
House Finch	0.00 (0)	0.01 (–)	0.01 (2)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)
House Sparrow	0.00 (0)	0.01 (–)	0.01 (–)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
House Wren	0.03 (–)	0.09 (–)	0.31 (–)	0.06 (–)	0.06 (–)	0.12 (–)	0.12 (–)	0.18 (–)	0.06 (–)	0.18 (–)	0.12 (–)	0.13 (–)
Killdeer	0.03 (2)	0.01 (9)	0.12 (–)	0.07 (2)	0.18 (–)	0.41 (26)	0.00 (0)	0.18 (–)	0.04 (–)	0.12 (–)	0.04 (4)	0.12 (2)
Least Bittern^A	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 5 (continued). Annual proportion of plots occupied by and estimated abundance (determined using birds within 50 m of plot center) of breeding bird species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. “–” denotes when an annual abundance value could not be calculated because the species was present, but distance measures from observers could not be determined or the species was outside of 50 m from the plot center.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
Least Flycatcher	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.03 (4)	0.00 (0)	0.00 (0)	0.01 (2)
Mallard	0.03 (–)	0.10 (–)	0.07 (2)	0.03 (–)	0.00 (0)	0.12 (–)	0.00 (0)	0.24 (9)	0.18 (–)	0.00 (0)	0.16 (–)	0.09 (–)
Marsh Wren	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.24 (9)	0.00 (0)	0.00 (0)	0.00 (0)	0.03 (2)	0.00 (0)	0.00 (0)	0.00 (0)
Mourning Dove	0.09 (–)	0.25 (–)	0.35 (2)	0.12 (7)	0.06 (–)	0.12 (–)	0.24 (9)	0.24 (–)	0.12 (–)	0.24 (–)	0.25 (2)	0.15 (4)
Northern Flicker	0.00 (0)	0.06 (2)	0.03 (–)	0.04 (2)	0.00 (0)	0.06 (–)	0.12 (–)	0.00 (0)	0.03 (–)	0.06 (–)	0.00 (0)	0.01 (2)
Northern Harrier	0.01 (–)	0.01 (2)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.04 (–)	0.00 (0)	0.00 (0)	0.00 (0)
Northern Rough-winged Swallow	0.06 (–)	0.00 (0)	0.12 (2)	0.04 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.06 (–)	0.06 (2)
Northern Shoveler	0.06 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)
Orchard Oriole	0.00 (0)	0.00 (0)	0.10 (9)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (2)	0.00 (0)	0.00 (0)	0.04 (–)
Red-bellied Woodpecker	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)
Redhead	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 5 (continued). Annual proportion of plots occupied by and estimated abundance (determined using birds within 50 m of plot center) of breeding bird species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. “–” denotes when an annual abundance value could not be calculated because the species was present, but distance measures from observers could not be determined or the species was outside of 50 m from the plot center.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
Red-headed Woodpecker^A	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (2)
Red-tailed Hawk	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.03 (–)	0.00 (0)	0.00 (0)	0.01 (–)
Rock Dove	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
Savannah Sparrow	0.00 (0)	0.06 (7)	0.01 (2)	0.03 (4)	0.59 (51)	0.12 (9)	0.18 (–)	0.24 (17)	0.01 (–)	0.18 (–)	0.10 (2)	0.01 (2)
Sedge Wren	0.03 (6)	0.00 (0)	0.01 (2)	0.22 (22)	0.00 (0)	0.24 (9)	0.12 (–)	0.29 (9)	0.25 (26)	0.24 (–)	0.06 (4)	0.10 (9)
Sora	0.00 (0)	0.00 (0)	0.03 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
Swainson’s Hawk^A	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
Swamp Sparrow	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)
Tree Swallow	0.09 (–)	0.18 (4)	0.28 (4)	0.15 (4)	0.06 (–)	0.18 (–)	0.00 (0)	0.29 (9)	0.03 (–)	0.06 (–)	0.07 (–)	0.10 (–)
Turkey Vulture	0.00 (0)	0.01 (–)	0.07 (–)	0.00 (0)	0.00 (0)	0.06 (–)	0.00 (0)	0.18 (–)	0.09 (–)	0.12 (–)	0.06 (–)	0.01 (–)
Upland Sandpiper^A	0.01 (–)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 5 (continued). Annual proportion of plots occupied by and estimated abundance (determined using birds within 50 m of plot center) of breeding bird species at Pipestone National Monument, Minnesota, during the 2009 to 2022 spring bird surveys (n = number of plots sampled). Note that the proportion of plots occupied includes flyovers, whereas estimated abundance does not. “–” denotes when an annual abundance value could not be calculated because the species was present, but distance measures from observers could not be determined or the species was outside of 50 m from the plot center.

Common Name	Proportion of Plots Occupied (Abundance)											
	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)	2018 (n=17)	2021 (n=68)	2022 (n=68)
Vesper Sparrow	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.09 (–)	0.00 (0)
Warbling Vireo	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (2)	0.00 (0)	0.00 (0)	0.06 (6)
Western Kingbird	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
Western Meadowlark	0.04 (2)	0.24 (15)	0.00 (0)	0.13 (–)	0.00 (0)	0.29 (–)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.04 (–)	0.44 (–)
White-breasted Nuthatch	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)
Wild Turkey	0.00 (0)	0.00 (0)	0.06 (–)	0.04 (–)	0.00 (0)	0.24 (26)	0.00 (0)	0.12 (–)	0.03 (–)	0.06 (–)	0.03 (–)	0.00 (0)
Willow Flycatcher	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)	0.00 (0)	0.00 (0)	0.00 (0)
Wood Duck	0.00 (0)	0.00 (0)	0.03 (–)	0.00 (0)	0.06 (–)	0.00 (0)	0.00 (0)	0.06 (–)	0.03 (–)	0.06 (–)	0.01 (–)	0.04 (–)
Yellow-headed Blackbird	0.00 (0)	0.00 (0)	0.03 (–)	0.01 (4)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.01 (–)
Yellow-rumped Warbler	0.01 (2)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Appendix D. Pipestone National Monument Trends

Table 6. Trends, annual change in abundance (individuals), of breeding birds recorded on Pipestone National Monument, Minnesota, 2009–2022.

Common Name	Trend ^A	SE of Slope	Trend Classification ^B
American Goldfinch	1.06	0.06	Uncertain
American Robin	1.01	0.03	Uncertain
Bobolink	1.03	0.02	Uncertain
Brown-headed Cowbird	1.05	0.07	Uncertain
Canada Goose	1.18	0.25	Uncertain
Clay-colored Sparrow	1.25	0.46	Uncertain
Common Grackle	0.99	0.07	Uncertain
Common Yellowthroat	1.18	0.07	Moderate Increase
Dickcissel ^C	1.30	0.96	Uncertain
Eastern Kingbird	1.09	0.09	Uncertain
Grasshopper Sparrow ^C	1.08	0.07	Uncertain
Red-winged Blackbird	1.05	0.03	Uncertain
Ring-necked Pheasant	1.05	0.06	Uncertain
Song Sparrow	1.10	0.09	Uncertain
Yellow Warbler	1.17	0.25	Uncertain

^A Trends were determined using the statistical software package 'rtrim' built under R version 3.6.3.

^B Trend classification types depend on statistical significance and magnitude (Pannekoek and van Strien 2005; van Strien et al. 2001) and follow 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 $\pm$ 1.96 times the standard error of the slope). Strong increase: increase significantly more than 5% per year; criterion is lower limit of confidence interval > 1.05. Moderate increase: significant increase, but not significantly more than 5% per year; criterion is 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 is 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 is 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 is 0.95 < upper limit of confidence interval < 1.00. Steep decline: decline significantly more than 5% per year; criterion is upper limit of confidence interval < 0.95.

^C Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Appendix E. Regional Trends

Table 7. Regional trends (Prairie Potholes Bird Conservation Region) in breeding birds recorded on Pipestone National Monument, Minnesota, from 2009 through 2019. Regional trend data are from the USGS Breeding Bird Surveys (BBS) Program (Sauer et al. 2020). Trend is defined as an interval-specific geometric mean of proportional changes in population size (Link and Sauer 1998), expressed as a percentage. NA signifies that few observations of the species were made, so calculations of trends could not be made.

Common Name	Annual Percent Change in Population Size	Lower End of 95% Confidence Interval	Upper End of 95% Confidence Interval
American Crow	-3.17	-4.76	-1.60
American Goldfinch	0.70	-0.81	2.25
American Kestrel	-3.15	-5.59	-0.78
American Redstart	NA	NA	NA
American Robin	2.62	1.71	3.55
Baltimore Oriole	-2.02	-3.97	0.04
Bank Swallow	3.44	-1.88	10.45
Barn Swallow	-0.97	-2.22	0.29
Belted Kingfisher	-0.98	-3.76	1.92
Black and White Warbler	-1.44	-7.90	4.54
Black-capped Chickadee	-1.88	-4.71	1.06
Black Tern ^A	5.25	-1.70	12.65
Blue Jay	-0.17	-2.18	1.96
Blue-gray Gnatcatcher	NA	NA	NA
Blue Grosbeak	9.01	3.79	15.20
Blue-winged Teal	-3.17	-7.20	1.22
Bobolink	-2.89	-4.43	-1.39
Brown-headed Cowbird	-0.42	-1.51	0.65
Brown Thrasher	-1.07	-2.52	0.45
Canada Goose	3.29	-3.93	11.46
Cedar Waxwing	-3.80	-8.18	0.50
Chimney Swift	-0.63	-3.86	2.73
Chipping Sparrow	1.51	0.02	3.14
Clay-colored Sparrow	-2.03	-3.49	-0.54
Cliff Swallow	0.72	-2.15	3.68
Common Grackle	0.04	-1.29	1.34
Common Nighthawk	2.30	-1.69	6.98
Common Yellowthroat	0.28	-0.56	1.14

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 7 (continued). Regional trends (Prairie Potholes Bird Conservation Region) in breeding birds recorded on Pipestone National Monument, Minnesota, from 2009 through 2019. Regional trend data are from the USGS Breeding Bird Surveys (BBS) Program (Sauer et al. 2020). Trend is defined as an interval-specific geometric mean of proportional changes in population size (Link and Sauer 1998), expressed as a percentage. NA signifies that few observations of the species were made, so calculations of trends could not be made.

Common Name	Annual Percent Change in Population Size	Lower End of 95% Confidence Interval	Upper End of 95% Confidence Interval
Cooper's Hawk	1.52	-3.66	7.08
Dickcissel^A	5.27	2.16	8.57
Double-crested Cormorant	-0.23	-6.06	5.86
Downy Woodpecker	NA	NA	NA
Eastern Bluebird	-3.00	-6.71	0.53
Eastern Kingbird	-1.81	-3.11	-0.52
Eastern Meadowlark	5.11	-0.52	11.72
Eastern Phoebe	-0.29	-3.66	3.10
Eastern Towhee	0.24	-4.68	6.08
European Starling	-1.27	-3.30	0.81
Field Sparrow	0.87	-3.23	4.94
Grasshopper Sparrow^A	-3.65	-6.53	-0.86
Gray Catbird	1.49	-0.21	3.25
Great Blue Heron	-0.02	-3.63	3.74
Great Crested Flycatcher	-0.80	-3.06	1.50
Great Egret	-2.07	-10.63	6.32
Great Horned Owl	1.02	-2.48	4.79
Green Heron	-0.76	-5.24	3.81
Hairy Woodpecker	0.37	-2.31	3.19
Henslow's Sparrow	-4.91	-21.08	13.44
Horned Lark	-1.74	-3.51	0.08
House Finch	1.76	-4.31	8.04
House Sparrow	0.57	-1.11	2.28
House Wren	1.47	0.20	2.67
Killdeer	-1.58	-2.75	-0.39
Least Bittern^A	1.76	-6.04	12.05
Least Flycatcher	2.52	0.58	4.60
Mallard	0.32	-2.70	3.43
Marsh Wren	3.61	0.36	6.98
Mourning Dove	-1.02	-2.04	-0.03
Northern Flicker	NA	NA	NA

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 7 (continued). Regional trends (Prairie Potholes Bird Conservation Region) in breeding birds recorded on Pipestone National Monument, Minnesota, from 2009 through 2019. Regional trend data are from the USGS Breeding Bird Surveys (BBS) Program (Sauer et al. 2020). Trend is defined as an interval-specific geometric mean of proportional changes in population size (Link and Sauer 1998), expressed as a percentage. NA signifies that few observations of the species were made, so calculations of trends could not be made.

Common Name	Annual Percent Change in Population Size	Lower End of 95% Confidence Interval	Upper End of 95% Confidence Interval
Northern Harrier	-2.35	-5.14	0.09
Northern Rough-winged Swallow	0.23	-3.96	6.21
Northern Shoveler	-1.25	-6.81	4.61
Orchard Oriole	0.12	-1.71	1.91
Red-bellied Woodpecker	6.19	1.93	11.33
Redhead	-1.68	-8.57	5.44
Red-headed Woodpecker^A	2.38	-1.30	6.19
Red-tailed Hawk	1.86	0.01	3.80
Red-winged Blackbird	0.12	-0.76	1.01
Ring-necked Pheasant	-3.65	-5.78	-1.59
Rock Dove	-0.23	-3.36	2.76
Savannah Sparrow	-2.67	-4.21	-1.02
Sedge Wren	4.14	0.77	7.77
Song Sparrow	0.04	-1.04	1.11
Sora	4.03	-0.28	8.60
Swainson's Hawk^A	0.18	-2.85	3.25
Swamp Sparrow	7.02	2.61	12.02
Tree Swallow	-2.05	-4.43	0.31
Turkey Vulture	12.63	5.10	20.43
Upland Sandpiper^A	-1.43	-3.32	0.53
Vesper Sparrow	-0.55	-1.86	0.76
Warbling Vireo	-0.35	-1.91	1.26
Western Kingbird	-5.56	-7.54	-3.61
Western Meadowlark	-0.17	-1.12	0.77
White-breasted Nuthatch	0.05	-3.53	3.77
White-crowned Sparrow	NA	NA	NA
Wild Turkey	-2.48	-9.96	4.98
Willow Flycatcher	NA	NA	NA
Wood Duck	0.80	-3.01	4.76
Yellow-headed Blackbird	1.11	-1.81	4.26
Yellow-rumped Warbler	0.34	-7.78	8.31

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Table 7 (continued). Regional trends (Prairie Potholes Bird Conservation Region) in breeding birds recorded on Pipestone National Monument, Minnesota, from 2009 through 2019. Regional trend data are from the USGS Breeding Bird Surveys (BBS) Program (Sauer et al. 2020). Trend is defined as an interval-specific geometric mean of proportional changes in population size (Link and Sauer 1998), expressed as a percentage. NA signifies that few observations of the species were made, so calculations of trends could not be made.

Common Name	Annual Percent Change in Population Size	Lower End of 95% Confidence Interval	Upper End of 95% Confidence Interval
Yellow-throated Vireo	2.01	-2.47	6.83
Yellow Warbler	1.74	0.28	3.24

^A Species of conservation concern for the Prairie Potholes Bird Conservation Region (USFWS 2008; also in bold).

Appendix F. Habitat Parameters

Habitat parameter averages in three different plot sizes are shown in Tables 8 through 10. Table 11 shows stem densities of trees by size class.

Table 8. Average percent cover ($\pm$ standard deviation) of each habitat type in 50 m plots at Pipestone National Monument, Minnesota, during bird breeding seasons from 2009 through 2022 (n = number of plots sampled). Total percent cover across habitat types may not sum to 100% as values are averaged over mid-point values of cover classes (i.e., class 1 = 0.5%, class 2 = 3.0%, class 3 = 15.0%, class 4 = 37.5%, class 5 = 62.5%, class 6 = 85.0%, and class 7 = 97.5%).

Habitat Parameter	2009 (n = 68)	2013 (n = 17)	2017 (n = 68)	2022 (n = 68)
Old Field/Prairie (%)	83.49 ($\pm$ 26.42)	84.26 ($\pm$ 22.32)	83.53 ($\pm$ 23.14)	79.93 ($\pm$ 25.70)
Floodplain/Wetland (%)	4.88 ($\pm$ 19.79)	0.00	2.47 ($\pm$ 12.79)	2.49 ($\pm$ 13.94)
Lawn (%)	1.57 ($\pm$ 10.44)	0.00	0.40 ($\pm$ 1.93)	0.27 ($\pm$ 1.85)
Paved Road (%)	2.17 ($\pm$ 5.10)	0.00	1.70 ($\pm$ 3.95)	0.49 ($\pm$ 1.95)
Riparian Woodland/Woodland (%)	6.89 ($\pm$ 16.26)	2.38 ($\pm$ 9.08)	4.79 ($\pm$ 2.74)	5.30 ($\pm$ 13.34)
River Terraces (%)	0.22 ($\pm$ 1.82)	0.00	0.22 ($\pm$ 1.82)	0.22 ($\pm$ 1.82)
Shrub (%)	1.52 ($\pm$ 8.78)	0.00	2.94 ($\pm$ 9.40)	5.28 ($\pm$ 12.37)
Stream/Pond (%)	1.57 ($\pm$ 5.69)	2.15 ($\pm$ 4.94)	1.91 ($\pm$ 4.57)	2.51 ($\pm$ 6.27)
Pasture Road/Trail (%)	0.79 ($\pm$ 3.14)	1.24 ($\pm$ 3.68)	0.66 ($\pm$ 2.06)	0.95 ($\pm$ 3.16)

Table 9. Average ($\pm$ standard deviation) canopy cover, canopy height, basal area, percent cover of vegetation at various horizontal height increments to 2.0 m, and vertical structural diversity in 5 m subplots at Pipestone National Monument, Minnesota, during bird breeding seasons from 2009 through 2022 (n = number of subplots sampled). For percent cover data, total percent cover may not sum to 100% as values are averaged over mid-point values of cover classes (i.e., class 1 = 0.5%, class 2 = 3.0%, class 3 = 15.0%, class 4 = 37.5%, class 5 = 62.5%, class 6 = 85.0%, and class 7 = 97.5%).

Habitat Parameter	Subcategory	2009 (n = 68)	2013 (n = 17)	2017 (n = 68)	2022 (n = 68)
Canopy Cover	Hardwood (%)	7.25 ($\pm$ 23.18)	5.57 ($\pm$ 12.68)	5.01 ($\pm$ 17.66)	5.33 ($\pm$ 15.93)
	Total Cover (%)	7.25 ($\pm$ 23.18)	5.57 ($\pm$ 12.68)	5.01 ($\pm$ 17.66)	5.33 ($\pm$ 15.93)
Canopy Height	Hardwood (m)	1.37 ($\pm$ 3.49)	1.71 ($\pm$ 3.83)	1.62 ($\pm$ 3.99)	2.61 ($\pm$ 4.94)
Basal Area	Hardwood (m ² /ha)	1.51 ($\pm$ 5.31)	1.18 ($\pm$ 2.67)	1.47 ($\pm$ 4.76)	1.99 ($\pm$ 7.43)
	Total (m ² /ha)	1.51 ($\pm$ 5.31)	1.18 ($\pm$ 2.67)	1.47 ($\pm$ 4.76)	1.99 ($\pm$ 7.43)
Horizontal Vegetation Profile—measured at 15 m north of plot center (percent cover at different height increments)	0.00–0.25 m (%)	82.07 ($\pm$ 28.80)	91.18 ($\pm$ 20.06)	93.57 ($\pm$ 12.71)	92.76 ($\pm$ 11.77)
	0.25–0.50 m (%)	49.10 ($\pm$ 39.61)	55.35 ($\pm$ 36.55)	70.68 ($\pm$ 31.67)	57.40 ($\pm$ 38.21)
	0.50–0.75 m (%)	7.33 ($\pm$ 15.56)	20.56 ($\pm$ 33.46)	15.79 ($\pm$ 27.33)	13.27 ($\pm$ 28.33)
	0.75–1.00 m (%)	4.02 ($\pm$ 13.50)	9.12 ($\pm$ 16.96)	6.55 ($\pm$ 18.08)	9.29 ($\pm$ 25.98)
	1.00–1.25 m (%)	2.66 ($\pm$ 12.76)	0.97 ($\pm$ 3.62)	5.47 ($\pm$ 18.95)	5.63 ($\pm$ 19.85)
	1.25–1.50 m (%)	2.43 ($\pm$ 13.94)	2.24 ($\pm$ 9.09)	4.06 ($\pm$ 17.62)	4.88 ($\pm$ 17.75)
	1.50–1.75 m (%)	2.71 ($\pm$ 15.56)	2.21 ($\pm$ 9.10)	3.29 ($\pm$ 16.12)	3.48 ($\pm$ 13.15)
	1.75–2.00 m (%)	3.79 ($\pm$ 18.10)	0.88 ($\pm$ 3.64)	2.21 ($\pm$ 12.70)	3.60 ($\pm$ 16.17)
Vertical Structure Diversity (%)	n/a	9.52 ($\pm$ 6.49)	3.89 ($\pm$ 9.69)	12.01 ($\pm$ 8.10)	12.52 ($\pm$ 9.50)

Table 10. Average percent ($\pm$ standard deviation) of soil substrate cover and plant guild cover in 1.78 m subplots at Pipestone National Monument, Minnesota, during bird breeding seasons from 2009 through 2022 (n = number of subplots sampled). Total percent cover may not necessarily sum to 100% as values are averaged over mid-point values of cover classes (i.e., class 1 = 0.5%, class 2 = 3.0%, class 3 = 15.0%, class 4 = 37.5%, class 5 = 62.5%, class 6 = 85.0%, and class 7 = 97.5%).

Habitat Parameter	2009 (n = 68)	2013 (n = 17)	2017 (n = 68)	2022 (n = 68)
Deciduous Litter (%)	3.30 ($\pm$ 6.48)	0.50 ($\pm$ 0.97)	0.63 ($\pm$ 2.58)	1.31 ($\pm$ 3.91)
Grass Litter (%)	44.23 ($\pm$ 27.26)	54.03 ($\pm$ 33.88)	25.65 ($\pm$ 26.80)	62.53 ($\pm$ 27.48)
Bare Soil (%)	5.54 ($\pm$ 8.53)	1.18 ($\pm$ 3.64)	10.13 ($\pm$ 14.31)	13.05 ($\pm$ 16.90)
Rock (%)	9.96 ($\pm$ 21.96)	13.32 ($\pm$ 30.76)	4.60 ($\pm$ 11.65)	6.44 ($\pm$ 15.40)
Woody Debris (%)	2.35 ($\pm$ 4.78)	0.50 ($\pm$ 0.97)	0.73 ($\pm$ 2.02)	0.53 ($\pm$ 1.92)
Unvegetated (%)	87.72 ($\pm$ 8.60)	70.88 ($\pm$ 26.32)	75.88 ($\pm$ 26.33)	72.61 ($\pm$ 25.22)
Warm-season Grass (%)	0.00	0.44 ($\pm$ 0.70)	3.96 ($\pm$ 8.50)	5.43 ($\pm$ 11.85)
Cool-season Grass (%)	40.88 ($\pm$ 28.07)	15.82 ($\pm$ 21.19)	31.87 ($\pm$ 24.02)	40.44 ($\pm$ 26.83)
Forb (%)	7.61 ($\pm$ 8.91)	0.53 ($\pm$ 0.67)	6.58 ($\pm$ 8.60)	2.91 ($\pm$ 5.91)
Moss and Lichen (%)	1.66 ($\pm$ 5.50)	0.26 ($\pm$ 0.73)	1.60 ($\pm$ 5.44)	1.19 ($\pm$ 3.56)
Shrubs and Vines (%)	4.15 ($\pm$ 8.77)	2.68 ($\pm$ 4.78)	3.84 ($\pm$ 7.69)	3.23 ($\pm$ 7.32)
Tree Seedling (%)	0.01 ($\pm$ 0.06)	0.06 ($\pm$ 0.17)	0.06 ($\pm$ 0.37)	0.11 ($\pm$ 0.52)
Total Foliar (%)	47.52 ($\pm$ 27.45)	22.18 ($\pm$ 22.48)	52.83 ($\pm$ 22.46)	53.49 ($\pm$ 25.29)

Table 11. Stems per hectare for trees found at Pipestone National Monument, Minnesota, by size class, during the 2009 to 2022 bird breeding seasons (n = number of plots sampled). Tree stems per hectare are reported by family.

Stem Size Class	Family	2009 (n = 68)	2013 (n = 17)	2017 (n = 68)	2022 (n = 68)
<1.0 cm	Aceraceae	0	30	2	0
	Anacardiaceae	0	457	0	0
	Caprifoliaceae	0	37	0	0
	Fabaceae	0	0	251	0
	Rhamnaceae	4	0	9	0
	Rosaceae	26	97	17	0
	Ulmaceae	2	0	0	0
1.1–2.85 cm	Aceraceae	2	30	0	2
	Cornaceae	0	0	0	2
	Oleaceae	0	0	0	2
	Rhamnaceae	0	0	4	0
	Rosaceae	86	135	6	6
	Snag	7	0	7	6
2.6–8.0 cm	Aceraceae	7	7	2	4
	Fagaceae	0	7	0	0
	Oleaceae	0	0	0	2
	Rosaceae	21	210	6	9
	Snag	0	7	7	6
8.1–15.0 cm	Aceraceae	0	15	0	0
	Fagaceae	6	15	6	6
	Rosaceae	0	0	0	2
	Snag	4	0	0	0
15.1–23.0 cm	Aceraceae	7	0	2	0
	Fagaceae	7	0	6	6
	Oleaceae	2	0	0	0
	Rosaceae	0	0	2	0
	Ulmaceae	0	0	2	0
	Snag	0	0	2	0
23.1–38.0 cm	Aceraceae	7	30	6	6
	Fagaceae	9	0	9	11
	Snag	2	0	0	0
>38.0 cm	Aceraceae	0	0	4	4

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