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Natural Resource Stewardship and Science

# Bird Monitoring at Homestead National Monument of America, Nebraska

## *Status Report 2009–2017*

Natural Resource Report NPS/HTLN/NRR—2019/1937

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

# Bird Monitoring at Homestead National Monument of America, Nebraska

## *Status Report 20009–2017*

Natural Resource Report NPS/HTLN/NRR—2019/1937

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# Executive Summary

In 2009, the Heartland Inventory Monitoring Network initiated breeding bird surveys on Homestead National Monument of America, Nebraska, 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) Central Mixed Grass Prairie 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 the Homestead national Monument of America.

Eighty-six species of birds were recorded during May and June site visits in the nine years since initiating monitoring. Seventy-four of the species are considered breeding species because they are permanent or summer residents. Two of the breeding species recorded on Homestead National Monument of America are species of concern for the Central Mixed Grass Prairie Bird Conservation Region. Thirteen species were observed during the survey period in sufficient numbers to calculate annual abundances and trends with some degree of confidence.

The American Goldfinch (*Spinus tristis*), Dickcissel (*Spiza americana*), House Wren (*Troglodytes aedon*), and Red-winged Blackbird (*Agelaius phoeniceus*) were the most abundant and widespread species on Homestead National Monument of America. Comparing population trends of the thirteen most recorded species on the park with regional trends for the Central Mixed Grass Prairie Bird Conservation Region were inconclusive, but suggest that trends in populations on the park were similar to trends in populations found region-wide for most species present. However, some differences in population trends were observed between the park and the region.

This report provides current regional and local trends for breeding birds for future comparisons with bird data collected as part of the long-term monitoring efforts at Homestead National Monument of America. 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 Homestead National Monument of America, Nebraska, for allowing us access to the park during our site visit. We would also like to thank park staff and volunteers who assisted with bird surveys on the park: Jesse M. Bolli, Gordon Grover, Sarah E. Rehme, Kellie L. DeJong, Shin-Ping C. Lao, Kelly A. Manktelow, Chelsea N. Schrage, Brittani Salvatore, and Miles W. Lampo.

# 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.

Homestead National Monument of America, Nebraska, is located in the north-east section of the Central Mixed Grass Prairie 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 Central Mixed Grass Prairie extends from the edge of shortgrass prairie on its west side to the beginning of the tallgrass prairie and savanna-like habitat on its east side (NABCI 2012). Large areas in the center of this region have been converted to agriculture. However, extensive areas of high-quality grassland remain in the Nebraska Sandhills and the

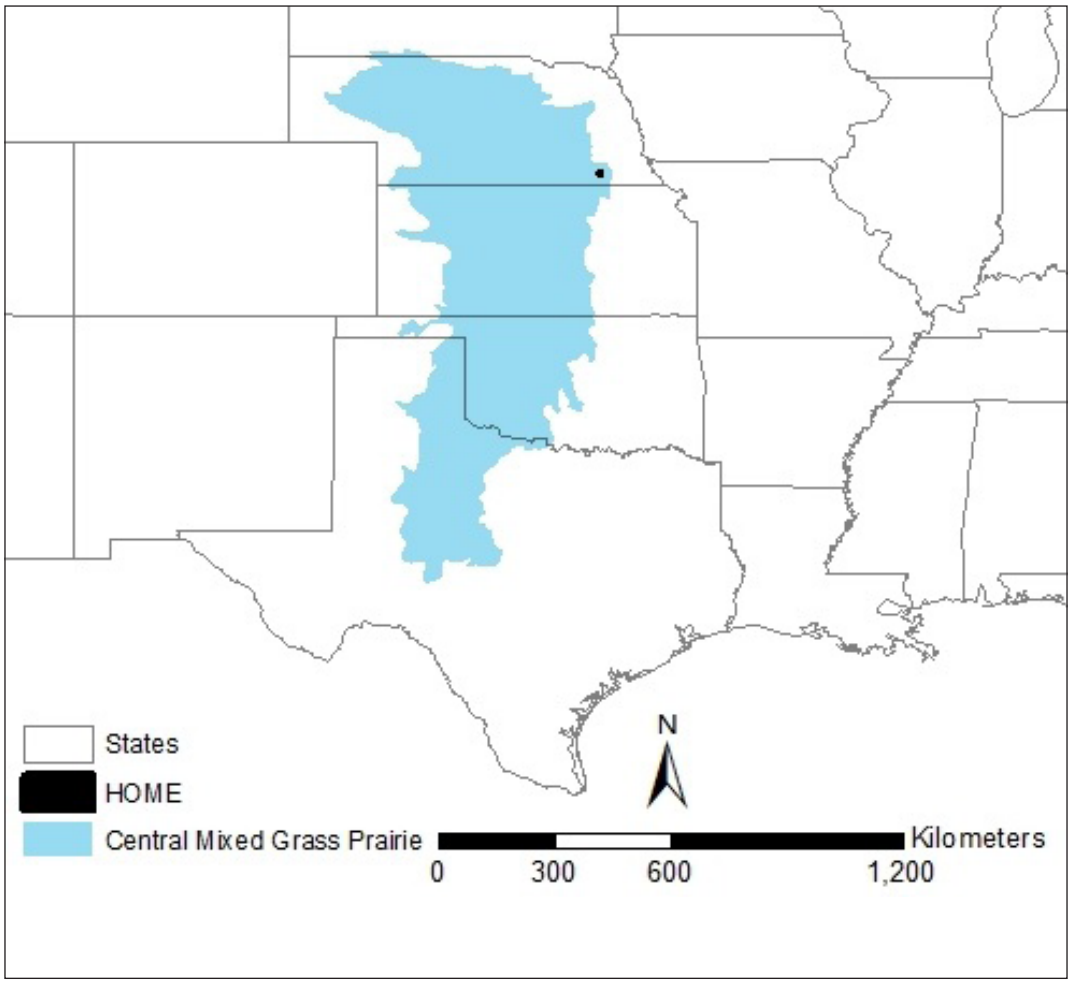


**Figure 1.** Location of Homestead National Monument of America (HOME), Nebraska, within the Central Mixed Grass Prairie Bird Conservation Region.

shrublands in Texas. Approximately 125 species of breeding birds can be found in the mixed grass prairie habitat of the area around Homestead National Monument of America (Sharpe et al. 2001).

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 (46) of potential breeding bird species occurring at Homestead National Monument of America show evidence of population decline (Sauer et al. 2017). In fact, 38% of the bird species in the Central Mixed Grass Prairie 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 Loggerhead Shrike (*Lanius ludovicianus*) and Northern Pintail (*Anas acuta*) declining at alarming rates.

Long-term trends in community composition and abundance of breeding bird populations provide one measure for assessing the ecological integrity and sustainability of this system. We will use trends in the composition and abundance of bird populations as long-term indicators of ecosystem stability in bird habitat found at Homestead National Monument of America. *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 Homestead National Monument of America.

There are two primary objectives for monitoring breeding birds at Homestead National Monument of America:

- 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 48 permanent plots (Figure 2). Eighteen are located in woodland habitat and 30 are in grassland/open habitat (Appendix A). However, due to various reasons (i.e. several plots falling in Cub Creek and volunteer availability) the number of plots sampled annually ranged from eight to 47 (Table 1).

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. In 2010 to 2012 and 2014 to 2016, habitat assessments were not conducted. Bird monitoring plots in these years were located using a GPS unit and plots were not marked with pin flags.

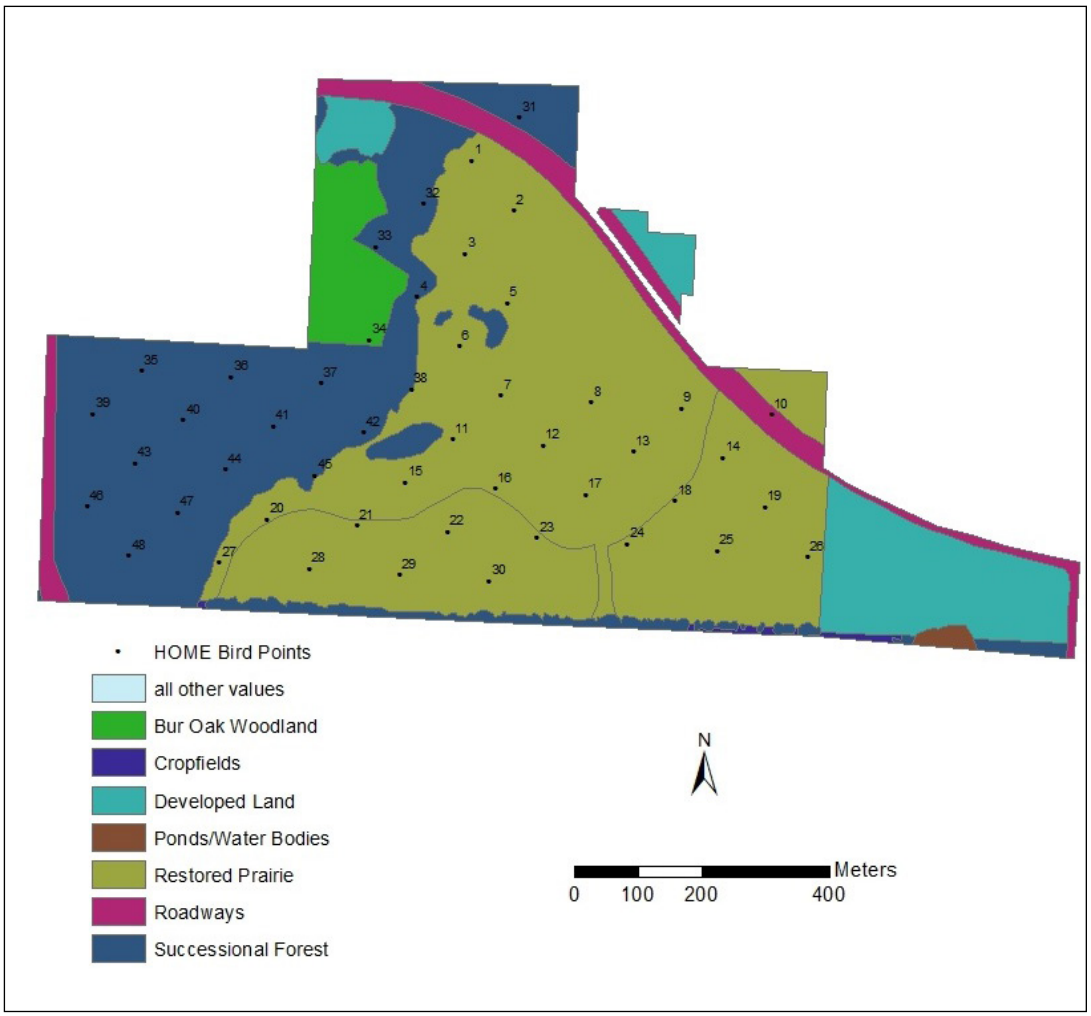


**Figure 2.** Bird plot locations on Homestead National Monument of America (HOME), Nebraska. Vegetation mapping and classification provided by Diamond et al. (2014).

**Table 1.** Number of plots sampled and sampling dates for breeding bird surveys conducted at Homestead National Monument of America, Nebraska, 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 12 – May 13 | 44 | D. G. Peitz* | Yes |
| 2010 | May 18 – June 5 | 47 | J. M. Bolli, G. Grover, and S. E. Rehme | No |
| 2011 | June 2 – June 16 | 44 | J. M. Bolli, K. L. DeJong, and S. C. Lao | No |
| 2012 | June 5 – June 15 | 43 | J. M. Bolli, K. A. Manktelow, and C. N. Schrage | No |
| 2013 | May 14 – May 14 | 9 | J. M. Bolli and D. G. Peitz* | Yes |
| 2014 | May 31 – May 31 | 9 | J. M. Bolli | No |
| 2015 | June 10 - June 10 | 9 | J. M. Bolli and B. Salvatore | No |
| 2016 | June 10 – June10 | 8 | J. M. Bolli and M. W. Lampo | No |
| 2017 | May 16 – May 17 | 44 | D. G. Peitz* and D. W. Marcum* | Yes |

* Heartland I&M 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-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, permanent resident, summer resident, transient, and winter resident) of each recorded bird species was determined. Identifying the residency of each species helps to exclude migrants, transients, and winter residents from analysis of breeding birds within Homestead National Monument of America. 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 (13 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 were selected for eleven species: American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Baltimore Oriole (*Icterus galbula*), Brown-headed Cowbird (*Molothrus ater*), Common Yellowthroat (*Geothlypis trichas*), Dickcissel (*Spiza americana*), Gray Catbird (*Dumetella carolinensis*), House Wren (*Troglodytes aedon*), Red-bellied Woodpecker (*Melanerpes carolinus*), Red-winged Blackbird (*Agelaius phoeniceus*), and Ring-necked Pheasant (*Phasianus colchicus*). The uniform + cosine function was selected for Mourning Dove (*Zenaida macroura*), and the half-normal + cosine function was selected for Northern Bobwhite (*Colinus virginianus*). 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 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 nine plots that were surveyed in most years (Appendix A). By doing this we analyzed a consistent ratio of woodland and grassland/open plots across years.

American Robin (*Turdus migratorius*). NPS

We also obtained regional breeding bird trends for the Central Mixed Grass Prairie during the period from 2005 to 2015 from the Breeding Bird Survey (BBS) website of the USGS Patuxent Wildlife Research Center (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 Homestead National Monument of America.

We compared regional trends with those calculated using TRIM for Homestead National Monument of America 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 the park 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.

Eastern Kingbirds (*Tyrannus tyrannus*). NPS

# Results

## Bird Surveys

Between 2009 and 2017, 257 cumulative plots were surveyed and 86 different bird species were recorded, 74 of which are species with the potential to breed within Homestead National Monument of America (Table 2; Sharpe et al. 2001). Two breeding species, American Woodcock (*Scolopax minor*) and Northern Shoveler (*Anas clypeata*), were only observed outside 5-min survey periods. Two of the breeding species recorded, Bell's Vireo (*Vireo bellii*) and Red-headed Woodpecker (*Melanerpes erythrocephalus*), are considered species of regional concern for the Central Mixed Grass Prairie Bird Conservation Region (USFWS 2008).

**Table 2.** Bird species recorded during breeding bird surveys at Homestead National Monument of America 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 Redstart | *Setophaga ruticilla* | AMRE | SR |
| American Robin | *Turdus migratorius* | AMRO | R |
| American Woodcock[B] | *Scolopax minor* | AMWO | SR |
| Baltimore Oriole | *Icterus galbula* | BAOR | SR |
| Bank Swallow | *Riparia riparia* | BANS | SR |
| Barn Swallow | *Hirundo rustica* | BARS | SR |
| Barred Owl | *Strix varia* | BDOW | R |
| **Bell's Vireo[C]** | ***Vireo bellii*** | **BEVI** | **SR** |
| Belted Kingfisher | *Megaceryle alcyon* | BEKI | R |
| Blackburnian Warbler[B] | *Setophaga fusca* | BLBW | M |
| Black-capped Chickadee | *Poecile atricapillus* | BCCH | R |
| Blue Jay | *Cyanocitta cristata* | BLJA | R |
| Blue-gray Gnatcatcher | *Polioptila caerulea* | BGGN | SR |
| Blue-headed Vireo | *Vireo solitarius* | BHVI | M |
| Brown Creeper | *Certhia americana* | BRCR | R |
| Brown Thrasher | *Toxostoma rufum* | BRTH | R |
| Brown-headed Cowbird | *Molothrus ater* | BHCO | R |
| Canada Goose | *Branta canadensis* | CAGO | R |
| Carolina Wren | *Thryothorus ludovicianus* | CARW | 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 Central Mixed Grass Prairie Bird Conservation Region (USFWS 2008; also in bold).

**Table 2 (continued).** Bird species recorded during breeding bird surveys at Homestead National Monument of America 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] |
|---|---|---|---|
| Cedar Waxwing | *Bombycilla cedrorum* | CEDW | R |
| Chestnut-sided Warbler | *Setophaga pensylvanica* | CSWA | M |
| Chimney Swift | *Chaetura pelagica* | CHSW | SR |
| Chipping Sparrow | *Spizella passerina* | CHSP | SR |
| Clay-colored Sparrow | *Spizella pallida* | CCSP | M |
| Cliff Swallow | *Petrochelidon pyrrhonota* | CLSW | SR |
| Common Grackle | *Quiscalus quiscula* | COGR | R |
| Common Yellowthroat | *Geothlypis trichas* | COYE | SR |
| Cooper's Hawk | *Accipiter cooperii* | COHA | R |
| Dickcissel | *Spiza americana* | DICK | SR |
| Downy Woodpecker | *Picoides pubescens* | DOWO | R |
| Eastern Bluebird | *Sialia sialis* | EABL | R |
| Eastern Kingbird | *Tyrannus tyrannus* | EAKI | SR |
| Eastern Meadowlark | *Sturnella magna* | EAME | R |
| Eastern Phoebe | *Sayornis phoebe* | EAPH | SR |
| Eastern Towhee | *Pipilo erythrophthalmus* | EATO | R |
| Eastern Wood-pewee | *Contopus virens* | EAWP | SR |
| European Starling | *Sturnus vulgaris* | EUST | R |
| Field Sparrow | *Spizella pusilla* | FISP | R |
| Grasshopper Sparrow | *Ammodramus savannarum* | GRSP | SR |
| Gray Catbird | *Dumetella carolinensis* | GRCA | SR |
| Great Blue Heron | *Ardea herodias* | GBHE | SR |
| Great Crested Flycatcher | *Myiarchus crinitus* | GCFL | SR |
| Hairy Woodpecker | *Picoides villosus* | HAWO | R |
| Hermit Thrush[B] | *Catharus guttatus* | HETH | M |
| House Sparrow | *Passer domesticus* | HOSP | R |
| House Wren | *Troglodytes aedon* | HOWR | SR |
| Indigo Bunting | *Passerina cyanea* | INBU | SR |
| Killdeer[B] | *Charadrius vociferus* | KILL | SR |
| Lark Sparrow | *Chondestes grammacus* | LASP | SR |
| Least Flycatcher | *Empidonax minimus* | LEFL | M |

[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 Central Mixed Grass Prairie Bird Conservation Region (USFWS 2008; also in bold).

**Table 2 (continued).** Bird species recorded during breeding bird surveys at Homestead National Monument of America 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] |
|---|---|---|---|
| Mourning Dove | *Zenaida macroura* | MODO | R |
| Northern Bobwhite | *Colinus virginianus* | NOBO | R |
| Northern Cardinal | *Cardinalis cardinalus* | NOCA | R |
| Northern Flicker | *Colaptes auratus* | YSFL | R |
| Northern Rough-winged Swallow | *Stelgidopteryx serripennis* | NRWS | SR |
| Northern Shoveler[B] | *Anas clypeata* | NSHO | SR |
| Orchard Oriole | *Icterus spurius* | OROR | SR |
| Red-bellied Woodpecker | *Melanerpes carolinus* | RBWO | R |
| Red-eyed Vireo | *Vireo olivaceus* | REVI | SR |
| **Red-headed Woodpecker[C]** | ***Melanerpes erythocephalus*** | **RHWO** | **R** |
| Red-tailed Hawk | *Buteo jamaicensis* | RTHA | R |
| Red-winged Blackbird | *Agelaius phoeniceus* | RWBL | R |
| Ring-necked Pheasant | *Phasianus colchicus* | RPHE | R |
| Rose-breasted Grosbeak | *Pheucticus ludovicianus* | RBGR | SR |
| Ruby-throated Hummingbird | *Archilochus colubris* | RTHU | SR |
| Savannah Sparrow | *Passerculus sandwichensis* | SAVS | SR |
| Song Sparrow | *Melospiza melodia* | SOSP | R |
| Spotted Rowhee | *Pipilo maculatus* | SPTO | R |
| Summer Tanager | *Piranga rubra* | SUTA | SR |
| Swainson's Thrush | *Catharus ustulatus* | SWTH | M |
| Tennessee Warbler[B] | *Leiothlypis peregrina* | TEWA | M |
| Tufted Titmouse | *Baeolophus bicolor* | ETTI | R |
| Turkey Vulture | *Cathartes aura* | TUVU | SR |
| Warbling Vireo | *Vireo gilvus* | WAVI | SR |
| White-breasted Nuthatch | *Sitta carolinensis* | WBNU | R |
| White-winged Dove | *Zenaida asiatica* | WWDO | T |
| Wild Turkey | *Meleagris gallopavo* | WITU | R |
| Wilson's Warbler | *Cardellina pusilla* | WIWA | M |
| Wood Duck | *Aix sponsa* | WODU | SR |
| Worm-eating Warbler | *Helmitheros vermivorum* | WEWA | M |
| Yellow Warbler | *Setophaga petechia* | YWAR | 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 Central Mixed Grass Prairie Bird Conservation Region (USFWS 2008; also in bold).

**Table 2 (continued).** Bird species recorded during breeding bird surveys at Homestead National Monument of America 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] |
|---|---|---|---|
| Yellow-bellied Sapsucker | *Sphyrapicus varius* | YBSA | WR |
| Yellow-billed Cuckoo | *Coccyzus americanus* | YBCU | 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 Central Mixed Grass Prairie Bird Conservation Region (USFWS 2008; also in bold).

Thirteen breeding species were observed during the survey period in sufficient numbers to calculate annual abundances with some degree of confidence (Appendix B). Of these thirteen species, American Goldfinch (*Spinus tristis*), Dickcissel (*Spiza Americana*), House Wren (*Troglodytes aedon*), and Red-winged Blackbird (*Agelaitus phoeniceus*) were the most abundant and widespread species on Homestead National Monument of America. However, of these four species, only American Goldfinch had a change in population size (decline) over the nine years of monitoring (Figure 3; Appendix D). Brown-headed Cowbird (*Molothrus ater*), a species that was not as abundant or widespread on the park as the four previously mentioned species, had a population in steep decline. American Robin (*Turdus migratorius*) and Baltimore Oriole (*Icterus galbula*) had unreliable trend estimates. We were unable to detect with certainty either positive or negative population trends for the Common Yellowthroat (*Geothlypis trichas*), Dickcissel, Gray Catbird (*Dumetella carolinensis*), House Wren, Mourning Dove (*Zenaida macroura*), Northern Bobwhite (*Colinus virginianus*), Red-bellied Woodpecker (*Melanerpes carolinus*), Red-winged Blackbird, and Ring-necked Pheasant (*Phasianus colchicus*).

Regional trends (2005–2015) reported by Sauer et al. (2017; Appendix E) for the Central Mixed Grass Prairie Bird Conservation Region were uncertain for eight of the thirteen species, including the American Goldfinch and Brown-headed Cowbird. The American Robin and Red-bellied Woodpecker had regional populations that increased, while the Northern Bobwhite, Red-winged Blackbird, and Ring-necked Pheasant had populations that declined.

Diversity ($p = 0.14$), richness ($p = 0.12$), and evenness ($p = 0.34$) in distribution of individuals across species in the breeding bird community on Homestead National Monument of America were unchanged over the nine monitoring years since 2009 (Figure 4). Bird richness averaged 40 species annually on the park. Average estimated species richness was 50 by the ACE estimator and 52 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 these metrics.

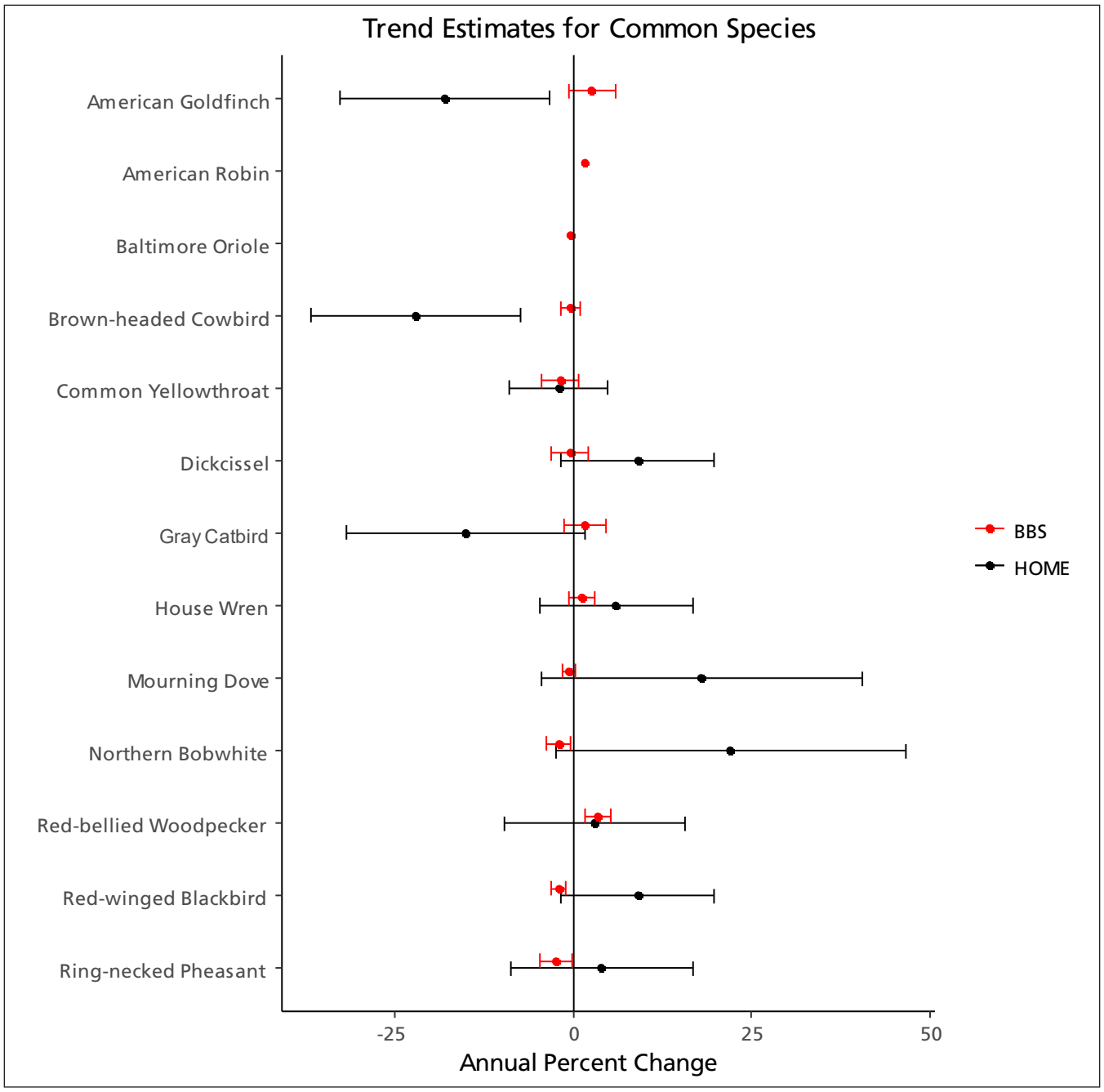


**Figure 3.** Comparison of bird population trends from Homestead National Monument of America (HOME), Nebraska, (2009 through 2017, excluding 2007) with those of the larger Central Mixed Grass Prairie Bird Conservation Region (2005 through 2015) from the Breeding Bird Surveys (BBS). Error bars represent 95% confidence intervals.

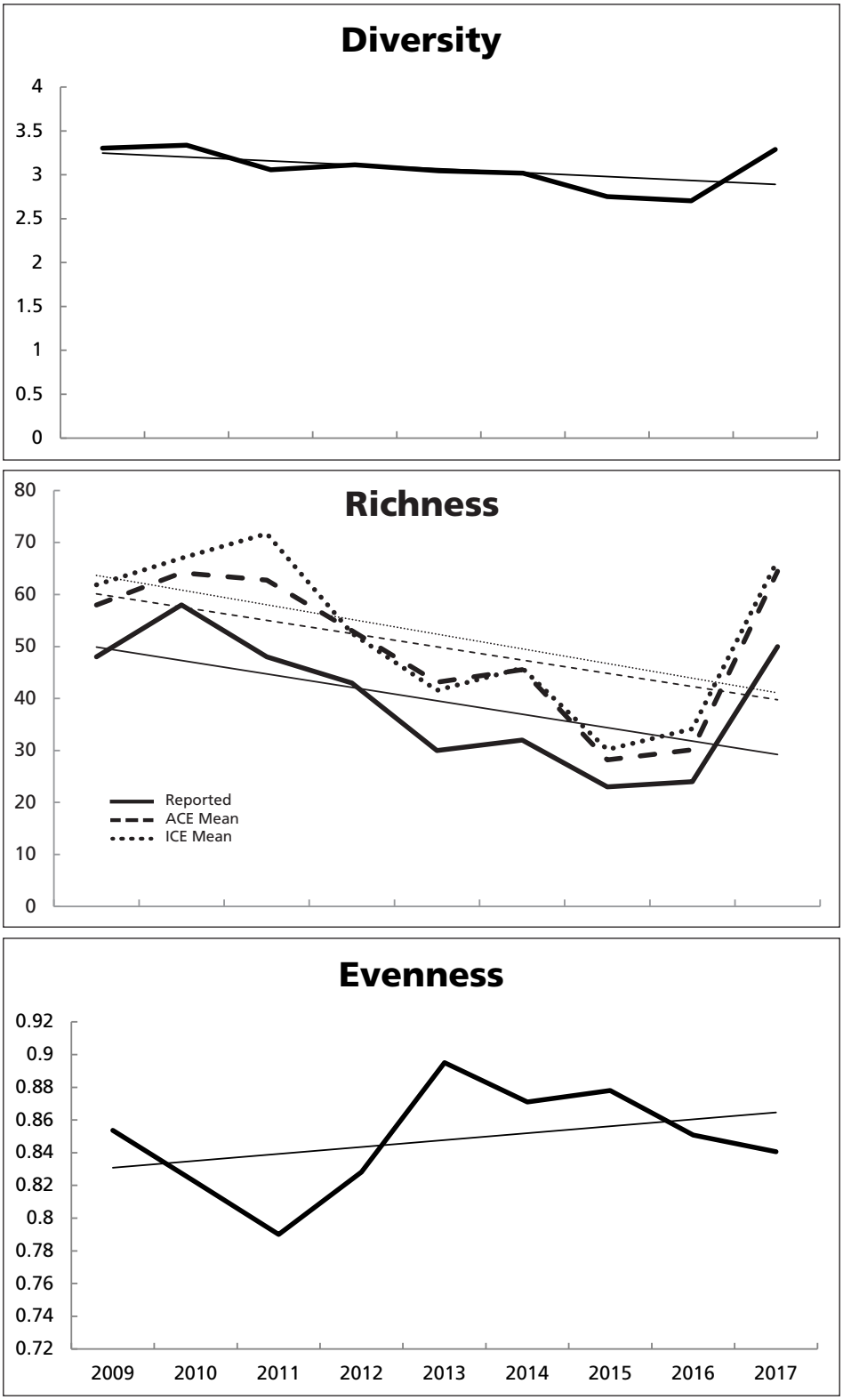


**Figure 4.** Trends in bird community diversity, richness, and species distribution evenness on Homestead National Monument of America, Nebraska, from 2009 through 2017, excluding 2007.

# Discussion

Breeding bird surveys were initiated at Homestead National Monument of America in 2009 to assist the park in assessing the integrity of their woodland and grassland areas through time. During the nine years of monitoring, 86 bird species have been recorded. Seventy-four are permanent or summer residents to the area (Sharpe et al. 2001). Therefore, these 74 species have some value in characterizing the park's breeding bird community and their habitat.

The two breeding species of concern for the Central Mixed Grass Prairie Bird Conservation Region should be given additional consideration when managing natural resources on the park: Bell's Vireo (*Vireo bellii*) and Red-headed Woodpecker (*Melanerpes erythocephalus*). If it is not feasible to manage habitat for the species of conservation concern directly, then at least habitat should be managed in a way that does not conflict with their needs. For example, conversion of the parks shrubby grassland prairie to mature woodland would be detrimental to the Bell's Vireo, and removal of mature trees would be detrimental to the Red-headed Woodpecker.

Thirteen breeding species were observed during the survey period in sufficient numbers to calculate annual abundances and trends with some degree of confidence. American Goldfinch (*Spinus tristis*), Dickcissel (*Spiza Americana*), House Wren (*Troglodytes aedon*), and Red-winged Blackbird (*Agelaitus phoeniceus*) were the most abundant and widespread species on Homestead National Monument of America and provide for the best characterization of habitat currently present. American Goldfinches utilize open areas with some shrubs and trees, farms, suburban yards and gardens; House Wrens are found in wood edges in rural and suburban areas; Dickcissels use prairies and weedy fields; and Red-winged Blackbirds occupy marshy areas and meadows (Stokes and Stokes 1996). Habitat on the park is a mix of developed areas, restored prairie, successional forest, and Bur Oak woodlands (Kindscher et al. 2011), habitat that is well suited for the four common and wide spread species.

The mix of habitat (structural composition) on the park is important for the species of regional concern as well because their microhabitat requirements vary (Pashley and Barrow 1993). For example, Bell's Vireos utilize riparian brush and thorny thickets, while Red-headed Woodpeckers prefer farmlands, open woodlands, orchards, and urban/suburban forest (Stokes and Stokes 1996).

Comparing population trends on Homestead National Monument of America with regional trends for the Central Mixed Grass Prairie Bird Conservation Region were inconclusive, but suggest that many of the park's bird populations are faring similar to populations found region-wide. However, we were unable to detect with certainty any positive or negative population trends for eleven of the species reported (Figure 3).Within the region, five of these species had uncertain population trends as well. Three species with uncertain population trends on the park, Northern Bobwhite (*Colinus virginianus*), Red-winged Blackbird, and Ring-necked Pheasant (*Phasianus colchicus*), have populations declining region-wide, suggesting that the park's populations could be faring better than populations in the region as a whole. However, regional population trends for two species, American Robin (*Turdus migratorius*) and Red-bellied Woodpecker (*Melanerpes carolinus*),

Ring-necked Pheasant (*Phasianus colchicus*). NPS

were positive, but on the park they were unreliable or uncertain, respectively, suggesting that region-wide populations may be faring better than those on the park. The American Goldfinch and Brown-headed Cowbird (*Molothrus ater*) had uncertain population trends region-wide but declining trends on the park, suggesting that region-wide populations may be faring better than those on the park.

Over the nine years of bird monitoring on Homestead National Monument of America, the unchanging diversity, richness, and evenness in distribution of individuals across species values suggest habitat on the park has remained similar across years (Figure 4), and provides for an array of breeding species (average of 40 species annually). However, this stable species community structure could be altered if significant portions of the parks grasslands were converted to woodlands or vice versa.

Our reported data are a baseline for placing bird populations at the park into the context of those seen in the larger Central Mixed Grass Prairie 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 Homestead National Monument of America, Nebraska, between 2009 and 2017 and gross habitat type. "Yes" indicates plot was sampled; "No" indicates it was not sampled.

| | Year sampled | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Plot** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **Plot type** |
| HOME1 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME2 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| **HOME3*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Open** |
| HOME4 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME5 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME6 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME7 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME8 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME9 | Yes | Yes | Yes | No | No | No | No | No | Yes | Grassland/Open |
| HOME10 | Yes | Yes | Yes | No | No | No | No | No | Yes | Grassland/Open |
| **HOME11*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Open** |
| HOME12 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| **HOME13*** | **Yes** | **Yes** | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Open** |
| HOME14 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME15 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME16 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME17 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME18 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME19 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME20 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| **HOME21*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Open** |
| HOME22 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| **HOME23*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Open** |
| HOME24 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |

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

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

| Plot | Year sampled | | | | | | | | | Plot type |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | |
| **HOME25*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Grassland/Open** |
| HOME26 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME27 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME28 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME29 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME30 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Grassland/Open |
| HOME31 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland |
| HOME32 | Yes | Yes | Yes | No | No | No | No | No | Yes | Woodland |
| HOME33 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland |
| HOME34 | No | Yes | Yes | Yes | No | No | No | No | No | Woodland |
| HOME35 | Yes | Yes | No | Yes | No | No | No | No | Yes | Woodland |
| HOME36 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland |
| **HOME37*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Woodland** |
| HOME38 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland |
| **HOME39*** | **Yes** | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Woodland** |
| HOME40 | Yes | No | No | Yes | No | No | No | No | Yes | Woodland |
| HOME41 | No | Yes | Yes | Yes | No | No | No | No | No | Woodland |
| HOME42 | No | Yes | Yes | Yes | No | No | No | No | No | Woodland |
| HOME43 | Yes | Yes | No | Yes | No | No | No | No | Yes | Woodland |
| HOME44 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland |
| HOME45 | Yes | Yes | Yes | Yes | No | No | No | No | Yes | Woodland |
| HOME46 | Yes | Yes | No | Yes | No | No | No | No | Yes | Woodland |
| **HOME47*** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **No** | **Yes** | **Woodland** |
| HOME48 | No | Yes | No | No | No | No | No | No | No | Woodland |

*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 Homestead National Monument of America, Nebraska, during the 2009-2017 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 | 0.25 (58) | 0.60 (185) | 0.45 (135) | 0.42 (161) | 0.44 (110) | 0.44 (198) | 0.22 (66) | 0.13 (49) | 0.27 (36) |
| American Robin | 0.20 (15) | 0.30 (24) | 0.27 (10) | 0.37 (33) | 0.11 (0) | 0.22 (16) | 0.44 (32) | 0.88 (89) | 0.11 (6) |
| Baltimore Oriole | 0.14 (59) | 0.36 (165) | 0.27 (156) | 0.09 (60) | 0.22 (48) | 0 (0) | 0 (0) | 0.13 (54) | 0.36 (205) |
| Brown-headed Cowbird | 0.46 (66) | 0.60 (176) | 0.30 (66) | 0.26 (64) | 0.33 (16) | 0.22 (32) | 0.11 (16) | 0.38 (55) | 0.23 (26) |
| Common Yellowthroat | 0.41 (70) | 0.66 (175) | 0.32 (35) | 0.44 (65) | 0.44 (77) | 0.67 (124) | 0.33 (77) | 0.63 (87) | 0.68 (136) |
| Dickcissel | 0.30 (43) | 0.64 (136) | 0.75 (150) | 0.67 (144) | 0.33 (73) | 0.67 (178) | 0.67 (188) | 0.50 (223) | 0.55 (122) |
| Gray Catbird | 0.09 (18) | 0.51 (95) | 0.27 (40) | 0.49 (89) | 0.11 (18) | 0.44 (71) | 0.11 (18) | 0.13 (20) | 0.25 (47) |
| House Wren | 0.20 (87) | 0.55 (272) | 0.32 (143) | 0.42 (297) | 0.22 (50) | 0.33 (125) | 0.33 (224) | 0.25 (224) | 0.36 (112) |
| Mourning Dove | 0.09 (1) | 0.47 (4) | 0.27 (2) | 0.27 (3) | 0 (0) | 0.67 (6) | 0.11 (1) | 0.63 (8) | 0.27 (3) |
| Northern Bobwhite | 0.07 (1) | 0.13 (0) | 0.18 (2) | 0.54 (8) | 0.11 (2) | 0.56 (13) | 0.44 (13) | 0.75 (15) | 0.21 (5) |
| Red-bellied Woodpecker | 0.07 (9) | 0.45 (49) | 0.27 (25) | 0.28 (57) | 0.33 (45) | 0.67 (105) | 0.33 (75) | 0.38 (51) | 0.25 (40) |
| Red-winged Blackbird | 0.23 (69) | 0.60 (173) | 0.48 (127) | 0.56 (248) | 0.56 (207) | 0.22 (38) | 0.44 (264) | 0.63 (382) | 0.41 (173) |
| Ring-necked Pheasant | 0.11 (5) | 0.72 (15) | 0.82 (24) | 0.42 (23) | 0.22 (14) | 0.78 (47) | 0.33 (24) | 0.63 (85) | 0.20 (14) |

*Species considered of regional concern for the Eastern Tallgrass Prairie 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 Homestead National Monument of America, Nebraska, 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=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 Crow | 0.03 (–) | 0.47 (7) | 0.25 (7) | 0.47 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.05 (–) |
| American Redstart | 0.02 (2) | 0 (0) | 0 (0) | 0 (0) | 0.11 (12) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Bank Swallow | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Barn Swallow | 0 (0) | 0.06 (0) | 0.07 (2) | 0.14 (13) | 0 (0) | 0 (0) | 0.11 (24) | 0 (0) | 0 (0) |
| Barred Owl | 0.05 (5) | 0 (0) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **Bell's Vireo*** | **0 (0)** | **0.15 (9)** | **0.02 (2)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** | **0 (0)** |
| Belted Kingfisher | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| Black-capped Chickadee | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.22 (–) | 0 (0) | 0 (0) | 0 (0) |
| Blue Jay | 0.02 (–) | 0.21 (7) | 0.16 (2) | 0.23 (30) | 0.33 (–) | 0.33 (36) | 0.44 (12) | 0.38 (27) | 0.14 (7) |
| Blue-gray Gnatcatcher | 0 (0) | 0.02 (2) | 0 (0) | 0 (0) | 0.33 (36) | 0 (0) | 0 (0) | 0 (0) | 0.14 (7) |
| Brown Creeper | 0 (0) | 0 (0) | 0 (0) | 0.02 (3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Brown Thrasher | 0.20 (10) | 0.13 (2) | 0.14 (5) | 0.09 (8) | 0.11 (–) | 0.11 (12) | 0.11 (–) | 0.25 (14) | 0 (0) |
| Canada Goose | 0 (0) | 0.04 (–) | 0 (0) | 0 (0) | 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 Homestead National Monument of America, Nebraska, 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=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** |
| Carolina Wren | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.05 (–) |
| Cedar Waxwing | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Chimney Swift | 0 (0) | 0.02 (–) | 0 (0) | 0 (0) | 0.11 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Chipping Sparrow | 0 (0) | 0.02 (–) | 0.02 (–) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Cliff Swallow | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.11 (36) | 0 (0) | 0 (0) | 0 (0) |
| Common Grackle | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.11 (–) | 0.11 (12) | 0.38 (68) | 0 (0) |
| Cooper's Hawk | 0 (0) | 0.02 (2) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Downy Woodpecker | 0.05 (2) | 0.04 (2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| Eastern Bluebird | 0 (0) | 0.04 (9) | 0.02 (–) | 0 (0) | 0 (0) | 0.11 (12) | 0 (0) | 0 (0) | 0.05 (2) |
| Eastern Kingbird | 0.05 (–) | 0.06 (7) | 0.05 (0) | 0.12 (13) | 0 (0) | 0.22 (12) | 0.22 (24) | 0.13 (–) | 0.11 (–) |
| Eastern Meadowlark | 0 (0) | 0.09 (–) | 0.02 (–) | 0.05 (5) | 0.22 (–) | 0.22 (–) | 0.22 (24) | 0 (0) | 0.11 (2) |
| Eastern Phoebe | 0 (0) | 0.04 (–) | 0.05 (2) | 0.09 (5) | 0 (0) | 0.11 (–) | 0 (0) | 0 (0) | 0.02 (–) |
| Eastern Towhee | 0.09 (7) | 0.15 (7) | 0.16 (2) | 0.21 (25) | 0 (0) | 0.22 (–) | 0 (0) | 0 (0) | 0.14 (5) |
| Eastern Wood-pewee | 0 (0) | 0.21 (5) | 0.11 (2) | 0.19 (18) | 0.11 (–) | 0.33 (60) | 0.11 (12) | 0 (0) | 0.23 (12) |
| European Starling | 0 (0) | 0.13 (2) | 0.07 (2) | 0 (0) | 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 Homestead National Monument of America, Nebraska, 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=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** |
| Field Sparrow | 0.05 (0) | 0.38 (–) | 0.02 (0) | 0.23 (23) | 0.11 (–) | 0.11 (–) | 0.33 (12) | 0.25 (27) | 0.02 (0) |
| Grasshopper Sparrow | 0.02 (–) | 0.13 (16) | 0 (0) | 0.05 (5) | 0.56 (73) | 0.11 (0) | 0 (0) | 0 (0) | 0.05 (5) |
| Great Blue Heron | 0 (0) | 0.04 (–) | 0.02 (–) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (–) |
| Great Crested Flycatcher | 0.09 (2) | 0.02 (–) | 0 (0) | 0.02 (3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.16 (2) |
| Hairy Woodpecker | 0 (0) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| House Sparrow | 0 (0) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Indigo Bunting | 0.09 (10) | 0.04 (2) | 0.02 (2) | 0.05 (5) | 0.11 (12) | 0 (0) | 0 (0) | 0.13 (14) | 0.14 (5) |
| Killdeer | 0.02 (–) | 0.02 (–) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Lark Sparrow | 0 (0) | 0 (0) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Northern Cardinal | 0.09 (5) | 0.17 (9) | 0.11 (–) | 0.26 (15) | 0.22 (12) | 0.11 (–) | 0.56 (24) | 0.13 (14) | 0.21 (12) |
| Northern Flicker | 0.07 (–) | 0.11 (5) | 0.02 (–) | 0.07 (8) | 0.11 (12) | 0.11 (12) | 0 (0) | 0 (0) | 0.07 (2) |
| Northern Rough-winged Swallow | 0 (0) | 0.04 (2) | 0 (0) | 0.02 (0) | 0 (0) | 0 (0) | 0 (0) | 0.13 (14) | 0 (0) |
| Orchard Oriole | 0 (0) | 0.04 (5) | 0.02 (2) | 0 (0) | 0.22 (48) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| Red-eyed Vireo | 0.02 (2) | 0.04 (2) | 0 (0) | 0.02 (3) | 0.11 (–) | 0 (0) | 0 (0) | 0 (0) | 0.09 (7) |
| **Red-headed Woodpecker*** | **0.16 (10)** | **0.09 (–)** | **0.09 (2)** | **0.02 (–)** | **0.22 (12)** | **0 (0)** | **0.11 (24)** | **0 (0)** | **0.25 (15)** |

*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 Homestead National Monument of America, Nebraska, 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=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** |
| Red-tailed Hawk | 0.05 (–) | 0 (0) | 0.02 (–) | 0 (0) | 0 (0) | 0.11 (–) | 0 (0) | 0.13 (14) | 0.02 (–) |
| Rose-breasted Grosbeak | 0.09 (15) | 0.38 (32) | 0.09 (7) | 0.19 (15) | 0 (0) | 0 (0) | 0 (0) | 0.13 (27) | 0.30 (35) |
| Ruby-throated Hummingbird | 0 (0) | 0 (0) | 0 (0) | 0.02 (3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Savannah Sparrow | 0 (0) | 0 (0) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Song Sparrow | 0.05 (5) | 0.40 (21) | 0.07 (–) | 0.05 (3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (2) |
| Spotted Towhee | 0 (0) | 0 (0) | 0 (0) | 0.05 (3) | 0 (0) | 0.11 (–) | 0 (0) | 0 (0) | 0 (0) |
| Summer Tanager | 0.05 (5) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Tufted Titmouse | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Turkey Vulture | 0.05 (–) | 0.02 (–) | 0.02 (–) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (–) |
| Warbling Vireo | 0 (0) | 0.19 (9) | 0.05 (–) | 0.07 (5) | 0 (0) | 0 (0) | 0.11 (–) | 0 (0) | 0.09 (5) |
| White-breasted Nuthatch | 0.02 (2) | 0.13 (5) | 0.14 (2) | 0.12 (10) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.07 (2) |
| Wild Turkey | 0.02 (–) | 0.06 (–) | 0.05 (10) | 0 (0) | 0.11 (12) | 0.33 (–) | 0 (0) | 0 (0) | 0 (0) |
| Wood Duck | 0.05 (–) | 0.09 (–) | 0.02 (2) | 0.02 (–) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.02 (–) |
| Yellow Warbler | 0.21 (15) | 0.47 (21) | 0.02 (5) | 0.07 (5) | 0.44 (24) | 0 (0) | 0 (0) | 0 (0) | 0.05 (7) |
| Yellow-billed Cuckoo | 0 (0) | 0.02 (–) | 0.05 (–) | 0 (0) | 0.11 (–) | 0.11 (–) | 0 (0) | 0.13 (–) | 0 (0) |
| Yellow-throated Vireo | 0.02 (2) | 0 (0) | 0 (0) | 0 (0) | 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).

# Appendix D. Homestead National Monument of America Trends

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

| Common name | Trend[A] | SE of slope | Trend Classification[B] |
|---|---|---|---|
| American Goldfinch | 0.82 | 0.08 | Moderate Decline |
| American Robin | – | – | – |
| Baltimore Oriole | – | – | – |
| Brown-headed Cowbird | 0.78 | 0.08 | Steep Decline |
| Common Yellowthroat | 0.98 | 0.04 | Uncertain |
| Dickcissel | 1.09 | 0.06 | Uncertain |
| Gray Catbird | 0.85 | 0.09 | Uncertain |
| House Wren | 1.06 | 0.06 | Uncertain |
| Mourning Dove | 1.18 | 0.12 | Uncertain |
| Northern Bobwhite | 1.22 | 0.13 | Uncertain |
| Red-bellied Woodpecker | 1.03 | 0.07 | Uncertain |
| Red-winged Blackbird | 1.09 | 0.06 | Uncertain |
| Ring-necked Pheasant | 1.04 | 0.07 | Uncertain |

[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 (Central Mixed Grass Prairie Bird Conservation Region) in breeding birds recorded on Homestead National Monument of America, Nebraska, 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 | -0.47 | -2.41 | 1.47 |
| American Goldfinch | 2.62 | -0.71 | 5.97 |
| American Redstart | NA | NA | NA |
| American Robin | 1.63 | 0.28 | 3.03 |
| American Woodcock[A] | NA | NA | NA |
| Baltimore Oriole | -0.27 | -1.61 | 0.99 |
| Bank Swallow | 0.78 | -12.37 | 17.92 |
| Barn Swallow | -0.62 | -1.89 | 0.61 |
| Barred Owl | 4.91 | -1.79 | 9.83 |
| **Bell's Vireo[B]** | **7.13** | **3.63** | **11.69** |
| Belted Kingfisher | -1.84 | -7.21 | 3.07 |
| Black-capped Chickadee | -1.05 | -5.65 | 3.99 |
| Blue Jay | 0.79 | -1.07 | 2.71 |
| Blue-gray Gnatcatcher | -0.21 | -4.42 | 3.70 |
| Brown Creeper | NA | NA | NA |
| Brown Thrasher | -1.08 | -2.26 | -0.03 |
| Brown-headed Cowbird | -0.42 | -1.71 | 0.88 |
| Canada Goose | 15.22 | 4.60 | 27.95 |
| Carolina Wren | 9.68 | 4.36 | 15.54 |
| Cedar Waxwing | 28.74 | 12.55 | 50.24 |
| Chimney Swift | -3.40 | -6.10 | -0.69 |
| Chipping Sparrow | 4.01 | -0.16 | 7.26 |
| Cliff Swallow | 3.88 | -0.10 | 7.46 |
| Common Grackle | -2.63 | -4.18 | -1.21 |
| Common Yellowthroat | -1.63 | -4.39 | 0.77 |
| Cooper's Hawk | 3.92 | -6.55 | 11.58 |
| Dickcissel | -0.48 | -3.07 | 2.13 |
| Downy Woodpecker | -0.07 | -2.94 | 2.66 |
| Eastern Bluebird | 2.94 | 0.20 | 5.89 |
| Eastern Kingbird | -1.41 | -2.83 | -0.08 |
| Eastern Meadowlark | -3.24 | -5.44 | -0.99 |
| Eastern Phoebe | 1.34 | -1.27 | 3.93 |
| Eastern Towhee | 3.64 | -6.28 | 12.45 |

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

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

**Table E1 (continued).** Regional trends (Central Mixed Grass Prairie Bird Conservation Region) in breeding birds recorded on Homestead National Monument of America, Nebraska, 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** |
| Eastern Wood-pewee | 2.86 | -0.24 | 7.00 |
| European Starling | -3.41 | -6.02 | -0.90 |
| Field Sparrow | 0.10 | -1.96 | 2.21 |
| Grasshopper Sparrow | -1.51 | -3.54 | 0.56 |
| Gray Catbird | 1.62 | -1.18 | 4.54 |
| Great Blue Heron | 0.33 | -2.64 | 3.09 |
| Great Crested Flycatcher | 1.00 | -0.99 | 2.97 |
| Hairy Woodpecker | 1.62 | -4.03 | 8.25 |
| House Sparrow | -2.37 | -4.10 | -0.50 |
| House Wren | 1.18 | -0.63 | 3.04 |
| Indigo Bunting | 0.68 | -1.96 | 3.33 |
| Killdeer | -0.33 | -1.85 | 1.11 |
| Lark Sparrow | 0.02 | -1.58 | 1.83 |
| Mourning Dove | -0.56 | -1.53 | 0.41 |
| Northern Bobwhite | -2.06 | -3.70 | -0.40 |
| Northern Cardinal | 0.77 | -0.49 | 1.98 |
| Northern Flicker | -1.75 | -3.91 | 0.39 |
| Northern Rough-winged Swallow | -1.20 | -4.65 | 2.03 |
| Northern Shoveler[A] | -4.65 | -15.37 | 5.90 |
| Orchard Oriole | 2.97 | 0.66 | 5.21 |
| Red-bellied Woodpecker | 3.48 | 1.68 | 5.21 |
| Red-eyed Vireo | 6.14 | 3.22 | 8.97 |
| **Red-headed Woodpecker[B]** | **-0.03** | **-1.61** | **1.83** |
| Red-tailed Hawk | 1.80 | 0.34 | 3.30 |
| Red-winged Blackbird | -2.02 | -3.17 | -0.94 |
| Ring-necked Pheasant | -2.40 | -4.66 | -0.21 |
| Rose-breasted Grosbeak | 3.38 | -0.39 | 8.94 |
| Ruby-throated Hummingbird | -0.33 | -13.59 | 8.39 |
| Savannah Sparrow | NA | NA | NA |
| Song Sparrow | 1.45 | -3.84 | 7.33 |
| Spotted Towhee | 4.41 | -0.35 | 9.97 |
| Summer Tanager | 5.30 | 0.71 | 15.15 |
| Tufted Titmouse | -1.02 | -4.31 | 2.02 |
| Turkey Vulture | 2.90 | 1.10 | 4.85 |

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

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

**Table E1 (continued).** Regional trends (Central Mixed Grass Prairie Bird Conservation Region) in breeding birds recorded on Homestead National Monument of America, Nebraska, 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** |
| Warbling Vireo | 1.43 | -0.69 | 3.24 |
| White-breasted Nuthatch | 4.60 | 1.76 | 7.35 |
| Wild Turkey | 6.70 | 1.59 | 11.16 |
| Wood Duck | 6.19 | -1.21 | 14.32 |
| Yellow Warbler | 5.11 | 2.38 | 8.61 |
| Yellow-billed Cuckoo | -1.64 | -3.90 | 0.62 |
| Yellow-throated Vireo | NA | NA | NA |

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

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

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