



Bird Community Monitoring at Hopewell Culture National Historical Park, Ohio

Status Report

Natural Resource Data Series NPS/HTLN/NRDS—2015/998



ON THE COVER

Landscape at Hopewell Culture National Historical Park
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Natural Resource Data Series NPS/HTLN/NRDS—2015/998

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Abstract

Breeding bird surveys were initiated on Hopewell Culture National Historical Park (HOCU), Ohio in 2005 to assess temporal changes in the species composition and abundance of birds on the park, and to improve our understanding of breeding bird – habitat relationships and the effects of management actions such as invasive plant species control on bird populations. Birds were sampled using point counts with 27 variable circular plots located on a systematic grid of 400 x 400 meter cells (originating from a random start point). All birds seen or heard on a plot during a 5-min sampling period were recorded. In the 11 years since initiating our breeding bird survey, birds have been surveyed on the 27 variable circular plots annually resulting in 289 plot visits. Surveys have yielded records for 100 different bird species. Ninety-five of the species recorded are classified as permanent or summer residents to the area, four are classified as migrants through the area, and one as a winter resident in the area. Twelve species recorded are considered species of conservation concern for the Eastern Tallgrass Prairie and/or Appalachian Mountain Bird Conservation Regions, the bird conservation regions HOCU is located within. Thirteen of the 95 resident species were recorded on HOCU every year of the surveys.

Acknowledgment

We would like to thank the staff of Hopewell Culture National Historical Park (HOCU), Ohio for allowing us access to the park during our breeding bird surveys and for assisting with bird surveys. We would especially like to thank Dafna Reiner for her coordination of surveys with volunteers and park staff, and for assisting with many of the surveys. A debt of thanks is owed volunteer birder David Hess who has conducted surveys for many years on the park.

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, intended to preserve habitat for bird populations, such as for neotropical migrants, can have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991, Maurer 1993). Additionally, the National Park Service plays a role in bird conservation, as it complies with the requirements of the Migratory Bird Treaty Act of 1918 (as amended) and the Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. 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. Bird monitoring is also critical as widespread habitat loss to agriculture and urban and industrial development threaten the integrity of the region for birds.

Hopewell Culture National Historical Park (HOCU), Ohio is located on the boarder of the Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions (Figure 1). The Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions are two 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 2015).

The Eastern Tallgrass Prairie Bird Conservation Region historically consists of the tallest and lushest grasslands of the Great Plains (NABCI 2015). However, forests dominate the region in the east creating an oak-savanna ecotone between the eastern woodlands and the western prairie. The Appalachian Mountain Bird Conservation Region has a rugged terrain dominated by oak-hickory and other deciduous forest types at lower elevations and by various combinations of pine, hemlock, spruce, and fir in higher areas. Flatter portions are used for agriculture; however, the majority of this region is forested. High priority birds common to both regions include Peregrine Falcon (*Falco peregrinus*), Upland Sandpiper (*Bartramia longicauda*), Whip-poor-will (*Caprimulgus vociferus*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Loggerhead Shrike (*Lanius ludovicianus*), Bewick's Wren (*Thryomanes bewickii*), Wood Thrush (*Hylocichla mustelina*), Blue-winged Warbler (*Vermivora pinus*), Cerulean Warbler (*Dendroica cerulea*), Kentucky Warbler (*Oporornis formosus*), and Henslow's Sparrow (*Ammodramus henslowii*; U.S. Fish and Wildlife Service 2008). Approximately 126 species of breeding birds can be found in the habitats of the Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions around HOCU (Peterjohn 2001).

Data collected during the U.S. Geological Survey's annual North American Breeding Bird Surveys (BBS) between 1966 and 2013 indicate that a number of bird species breeding at HOCU show evidence of long-term population decline (Sauer et al. 2014). In fact, between 41% (Eastern Tallgrass Prairie Bird Conservation Region) and 58% (Appalachian Mountain Bird Conservation Region) of the species have populations reported to be in decline, with species such as the Grasshopper Sparrow (*Ammodramus savannarum*), Northern Bobwhite (*Colinus virginianus*), and Ring-necked Pheasant (*Phasianus colchicus*) declining at alarming rates in both regions.

Long-term trends in community composition and abundance of breeding bird populations provide one measure for assessing the ecological integrity and sustainability of a system. We will use trends in the composition and abundance of bird populations as long-term indicators of ecosystem integrity at HOCU. *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 (Karr and Dudley 1981). 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 result of management actions taken to restore and maintain the cultural landscape at HOCU.

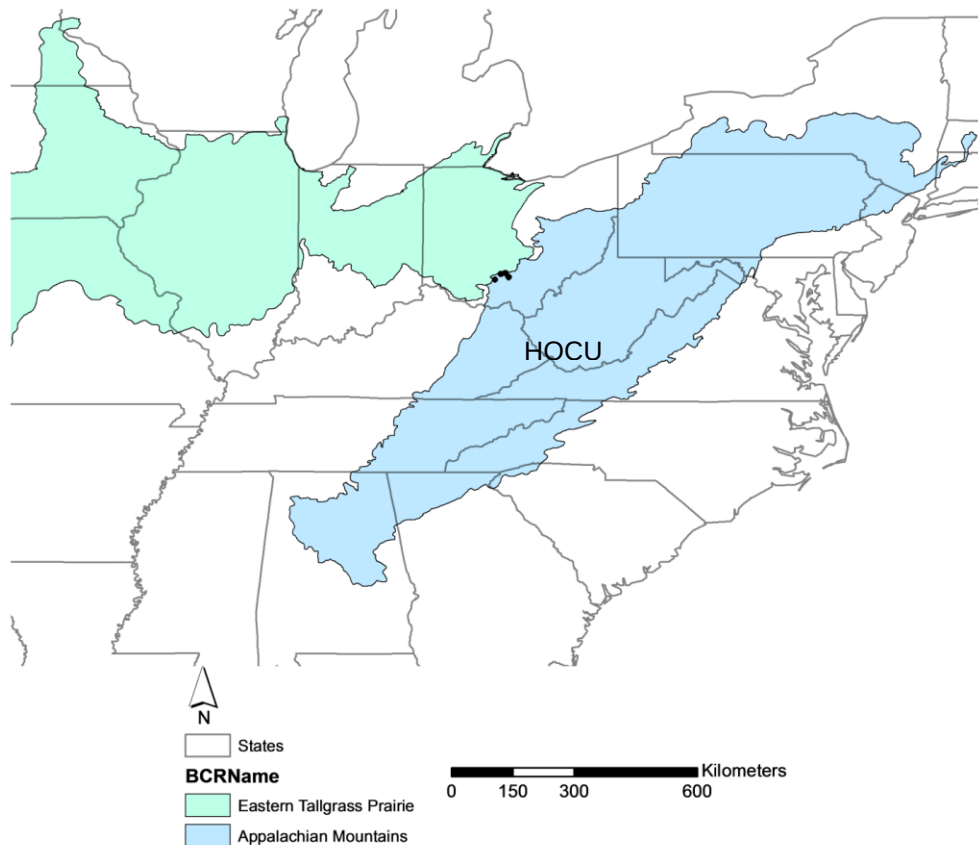


Figure 1. Location of Hopewell Culture National Historical Park (HOCU), Ohio within the Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions.

Objectives

There are three primary objectives for monitoring breeding birds at Hopewell Culture National Historical Park:

- Identify significant temporal changes in the species composition and abundance of bird communities that occur at HOCU during the breeding season.
- Improve our understanding of breeding bird – habitat relationships and the effects of management actions such as invasive plant species control and native grass restoration on bird populations, by correlating changes in bird community composition and abundance with changes in specific habitat variables (e.g., vegetation structure, ground cover).
- Make bird monitoring datasets for HOCU available to the avian conservation community and to the general public through the Avian Knowledge Network (AKN) and Data.Gov through the NPS Integrated Resource Management Applications (IRMA)

As a first step in meeting monitoring objectives, this report summarizes species composition and abundances for birds recorded during the eleven years of monitoring.

Methods

Site Selection

Permanent monitoring locations or 'plots' were selected by overlaying a systematic grid of 400 x 400 meter 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 27 permanent and one temporary plot on HOCU for monitoring bird population sizes and community composition (Figure 2). Monitoring occurred on 26 to 28 sites annually depending on year (Table 1).

Starting in 2008 breeding bird monitoring was conducted by volunteers and HOCU staff three out of every four years, allowing annual data to be collected and HTLN to implement their modified sampling schedule for visiting the park once every fourth year.

Table 1. Number of plots sampled, and sampling dates for breeding bird surveys conducted at Hopewell Culture National Historical Park, Ohio, by year. Also listed are observer(s) who conducted the surveys.

Year	Sampling Dates	Number of Plots Sampled	Observer(s)
2005	June 1 – June 3	27	D.G. Peitz*
2006	May 31 – June 2	27	D.G. Peitz*
2007	June 12 – June 13	27	D.G. Peitz*
2008	May 9 – June 2	27	D.L. Hess, C.L. Jones, J. Foor, D. Bostic, W. Bostic
2009	May 23 – June 12	27	D.L. Hess, D. Reiner, C.L. Jones
2010	May 15 – June 7	27	D.L. Hess, D. Reiner, J.T. Nelson
2011	May 22 – May 24	26	D.G. Peitz*
2012	May 19 – June 1	27	D.L. Hess, D. Reiner, A.L. Molloy, J. Hutcherson
2013	May 24 – May 30	28**	D.L. Hess, D. Reiner, B.J. Lombardo
2014	May 28 – June 6	28**	D.L. Hess, D. Reiner, J.S. Sisler, S.R. Roethle
2015	May 12 – May 14	27	D.G. Peitz*

*Heartland I&M Network staff.

**Park staff added an additional non-random plot for reasons unrelated to the HTLN long-term monitoring efforts.

During bird surveys in 2005, 2006, 2007, 2011 and 2015, monitoring plots were located using navigation waypoints (Peitz et al. 2008) in a GPS 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. During bird surveys in other years when habitat assessments were not conducted, monitoring plots were located using a GPS unit. However, plot locations were not marked with pin flags.

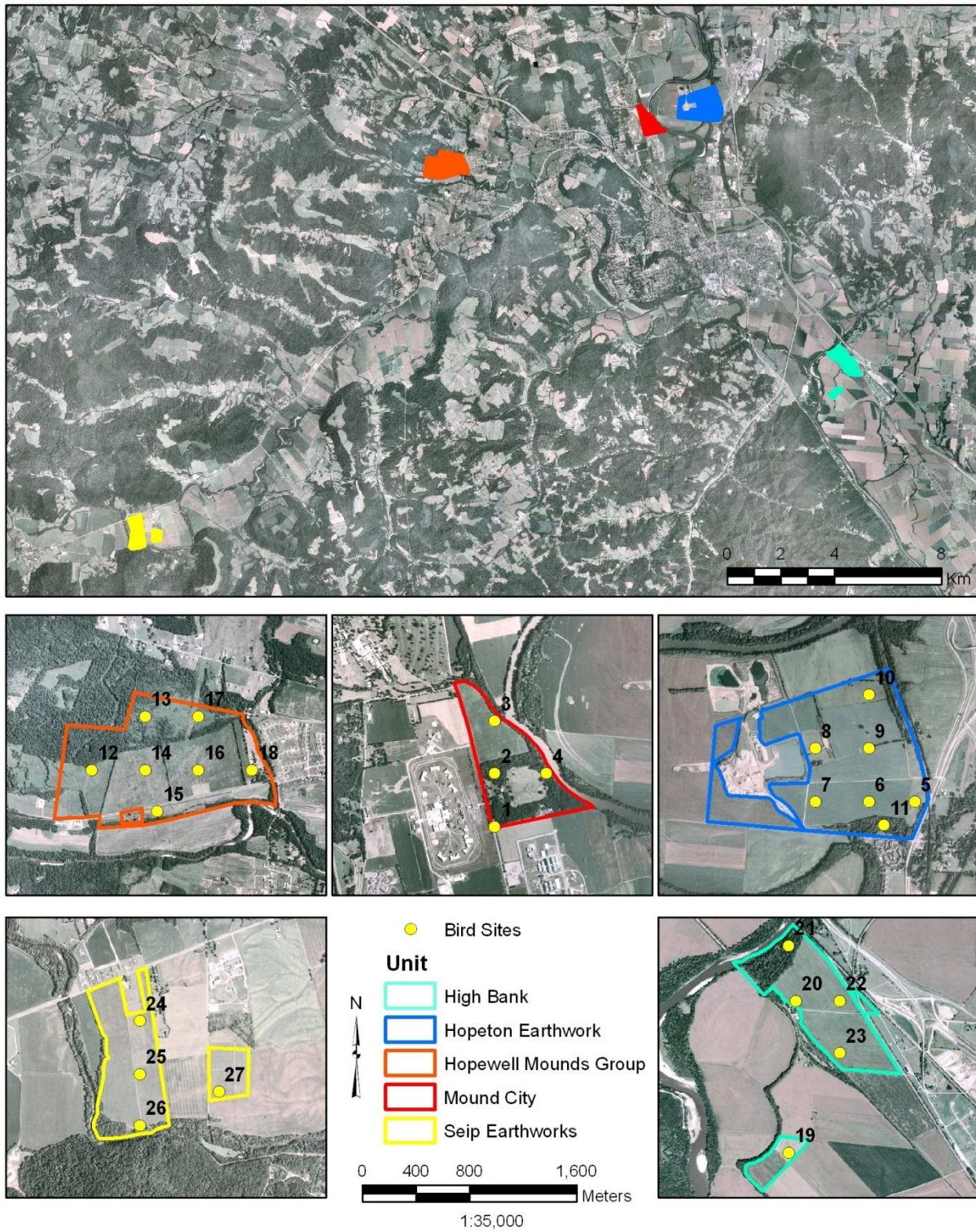


Figure 2. Bird plot locations on Hopewell Culture National Historical Park, Ohio.

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 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 during a period 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 survey are included.

Data Analysis

Prior to summary analysis, the residency status (migrant, permanent resident, summer resident, and winter resident) of each bird species recorded was determined. Identifying the residency of each species helps to exclude migrants and winter residents from analysis of breeding birds within HOCU. Proportion of plots occupied by each bird species was calculated (total number of plots occupied by a species/plots surveyed) and reported in Appendix A. Park-wide abundances for each species are reported in Appendix A as well. Park-wide abundance was calculated by first deriving a species density from observations recorded within a 100-m radius (3.14 ha) around each plot center, and then calculating abundance based on the densities found within the area surveyed.

For this report we also obtained regional breeding bird trends for the Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions during the period 2005 through 2013 (Sauer et al. 2014), and reported these values for HOCU in Appendix B for comparison with populations on the park. The period between 2005 and 2013 roughly coincides with our breeding bird monitoring efforts.

Results

Bird Surveys

Since initiating breeding bird survey in 2005 on HOCU, as many of the 27 variable circular plots as possible were sampled resulting in a total of 289 plot visits (Table 1). One hundred different bird species have been recorded during surveys (Table 2). Ninety-five of the 100 species recorded are classified as permanent or summer residents to the area (Peterjohn 2001). Four species-- Blackpoll Warbler (*Setophaga striata*), Black-throated Blue Warbler (*Setophaga caerulescens*), Tennessee Warbler (*Leiothlypis peregrina*), and Yellow-rumped Warbler (*Setophaga coronata*)--are classified as migrants through the area, and one species-- Golden-crowned Kinglet (*Regulus satrapa*)-- as a winter residents to the area.

On HOCU, 12 species recorded--Bald Eagle (*Haliaeetus leucocephalus*), Bewick's Wren, Blue-winged Warbler, Dickcissel (*Spiza americana*), Field Sparrow (*Spizella pusilla*), Grasshopper Sparrow (*Ammodramus savannarum*), Henslow's Sparrow, Northern Flicker (*Colaptes auratus*), Prairie Warbler (*Setophaga discolor*), Prothonotary Warbler (*Protonotaria citrea*), Sedge Wren (*Cistothorus platensis*), and Wood Thrush--are considered species of conservation concern for the Eastern Tallgrass Prairie and/or Appalachian Mountain Bird Conservation Regions (U.S. Fish and Wildlife Service 2008). Eastern Meadowlark (*Sturnella magna*), Field Sparrow (*Spizella pusilla*), Grasshopper Sparrow, and Red-winged Blackbird (*Agelaius phoeniceus*) are the most commonly encountered and widely distributed species on HOCU, annually (Appendix A). These four species offer the best opportunities for monitoring the influence of changing habitats on bird species. For breeding species recorded on HOCU their trends within the larger Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions are reported in Appendix B for the period roughly coinciding with the surveys on HOCU.

Table 2. Bird species recorded during breeding bird surveys at Hopewell Culture National Historical Park, Ohio in 2005 – 2015. Residency status of each species is given.

Common name	Species name	AOU code	Residency ¹
Acadian Flycatcher	<i>Empidonax virens</i>	ACFL	SR
American Crow	<i>Corvus brachyrhynchos</i>	AMCR	R
American Goldfinch	<i>Carduelis tristis</i>	AMGO	R
American Redstart	<i>Setophaga ruticilla</i>	AMRE	SR
American Robin	<i>Turdus migratorius</i>	AMRO	R
American Woodcock*	<i>Scolopax minor</i>	AMWO	SR
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BAEA	SR
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>Megasceryle alcyon</i>	BEKI	R
Bewick's Wren	<i>Thryomanes bewickii</i>	BEWR	SR
Blackpoll Warbler	<i>Setophaga striata</i>	BLPW	M
Black-throated Blue Warbler	<i>Setophaga caerulescens</i>	BTBW	M
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	BGGN	SR
Blue Grosbeak	<i>Passerina caerulea</i>	BLGR	SR
Blue Jay	<i>Cyanocitta cristata</i>	BLJA	R
Blue-winged Warbler	<i>Vermivora cyanoptera</i>	BWWA	SR
Bobolink	<i>Dolichonyx oryzivorus</i>	BOBO	SR
Brown-headed Cowbird	<i>Molothrus ater</i>	BHCO	R
Brown Thrasher	<i>Toxostoma rufum</i>	BRTH	SR
Canada Goose	<i>Branta canadensis</i>	CAGO	R
Carolina Chickadee	<i>Poecile carolinensis</i>	CACH	R
Carolina Wren	<i>Thryothorus ludovicianus</i>	CARW	R
Cedar Waxwing	<i>Bombycilla cedrorum</i>	CEDW	R
Chimney Swift	<i>Chaetura pelagica</i>	CHSW	SR
Chipping Sparrow	<i>Spizella passerina</i>	CHSP	SR
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	CLSW	SR
Common Grackle	<i>Quiscalus quiscula</i>	COGR	R
Common Yellowthroat	<i>Geothlypis trichas</i>	COYE	SR
Cooper's Hawk	<i>Accipiter cooperii</i>	COHA	R
Dickcissel	<i>Spiza americana</i>	DICK	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	R
Eastern Phoebe	<i>Sayornis phoebe</i>	EAPH	SR
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	EATO	R
Eastern Wood-pewee	<i>Contopus virens</i>	EAWP	SR
European Starling	<i>Sturnus vulgaris</i>	EUST	R
Field Sparrow	<i>Spizella pusilla</i>	FISP	R
Golden-crowned Kinglet	<i>Regulus satrapa</i>	GCKI	WR
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	GRSP	SR

Table 2. Bird species recorded during breeding bird surveys at Hopewell Culture National Historical Park, Ohio in 2005 – 2015. Residency status of each species is given.

Common name	Species name	AOU code	Residency ¹
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
Green Heron	<i>Butorides virescens</i>	GRHE	SR
Henslow's Sparrow	<i>Ammodramus henslowii</i>	HESP	SR
Horned Lark	<i>Eremophila alpestris</i>	HOLA	R
House Finch	<i>Carpodacus mexicanus</i>	HOFI	R
House Sparrow*	<i>Passer domesticus</i>	HOSP	R
House Wren	<i>Troglodytes aedon</i>	HOWR	SR
Indigo Bunting	<i>Passerina cyanea</i>	INBU	SR
Killdeer	<i>Charadrius vociferous</i>	KILL	SR
Least Flycatcher	<i>Empidonax minimus</i>	LEFL	SR
Mallard	<i>Anas platyrhynchos</i>	MALL	SR
Mourning Dove	<i>Zenaida macroura</i>	MODO	R
Northern Bobwhite	<i>Colinus virginianus</i>	NOBO	R
Northern Cardinal	<i>Cardinalis cardinalis</i>	NOCA	R
Northern Flicker	<i>Colaptes auratus</i>	YSFL	R
Northern Harrier	<i>Circus cyaneus</i>	NOHA	SR
Northern Mockingbird	<i>Minus polyglottos</i>	NOMO	R
Northern Parula	<i>Setophaga americana</i>	NOPA	SR
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	NRWS	SR
Orchard Oriole	<i>Icterus spurius</i>	OROR	SR
Pileated Woodpecker	<i>Dryocopus pileatus</i>	PIWO	R
Prairie Warbler	<i>Setophaga discolor</i>	PRAW	SR
Prothonotary Warbler	<i>Protonotaria citrea</i>	PROW	SR
Purple Martin	<i>Progne subis</i>	PUMA	SR
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	RBWO	R
Red-eyed Vireo	<i>Vireo olivaceus</i>	REVI	SR
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RTHA	R
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	RWBL	R
Ring-necked Pheasant	<i>Phasianus colchicus</i>	RPHE	R
Rock Dove	<i>Columba livia</i>	RODO	R
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	RBGR	SR
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	RTHU	SR
Savannah Sparrow	<i>Passerculus sandwichensis</i>	SAVS	SR
Scarlet Tanager	<i>Piranga olivacea</i>	SCTA	SR
Sedge Wren	<i>Cistothorus platensis</i>	SEWR	SR
Song Sparrow	<i>Melospiza melodia</i>	SOSP	R
Summer Tanager	<i>Piranga rubra</i>	SUTA	SR
Tennessee Warbler	<i>Leiothlypis peregrina</i>	TEWA	M
Tree Swallow	<i>Tachycineta bicolor</i>	TRES	SR
Tufted titmouse	<i>Baeolophus bicolor</i>	TUTI	R

Table 2. Bird species recorded during breeding bird surveys at Hopewell Culture National Historical Park, Ohio in 2005 – 2015. Residency status of each species is given.

Common name	Species name	AOU code	Residency ¹
Turkey Vulture	<i>Cathartes aura</i>	TUVU	SR
Vesper Sparrow*	<i>Poocetes gramineus</i>	VESP	SR
Warbling Vireo	<i>Vireo gilvus</i>	WAVI	SR
White-breasted Nuthatch	<i>Sitta carolinensis</i>	WBNU	R
White-eyed Vireo	<i>Vireo griseus</i>	WEVI	SR
Willow Flycatcher	<i>Empidonax traillii</i>	WIFL	SR
Wild Turkey*	<i>Meleagris gallopavo</i>	WITU	R
Wood Duck	<i>Aix sponsa</i>	WODU	SR
Wood Thrush	<i>Hylocichla mustelina</i>	WOTH	SR
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	YBCU	SR
Yellow-breasted Chat	<i>Icteria virens</i>	YBCH	SR
Yellow-rumped Warbler	<i>Setophaga coronata</i>	MYWA	M
Yellow-throated Vireo	<i>Vireo flavifrons</i>	YTVI	SR
Yellow-throated Warbler	<i>Setophaga dominica</i>	YTWA	SR
Yellow Warbler	<i>Setophaga petechia</i>	YEWA	SR

* Species recorded while traveling between point transects or at other times outside of 5-min survey periods.

¹ Residency: M = migrant; SR = summer resident; R = year around resident; WR = winter resident; According to Peterjohn (2001).

Species names are valid and verified names taken from ITIS (Integrated Taxonomic Information System). <http://www.itis.usda.gov/>.

Bolded species names are those species considered of conservation concern for either or both the Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions (U.S. Fish and Wildlife Service 2008).

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Appendix A.

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
Acadian Flycatcher	0	0	0.04	0	0.04	0.04	0	0	0.07	0.07	0
	0	0	5	0	*--	--	0	0	--	--	0
American Crow	0.07	0.07	0.04	0.15	0.33	0.15	0.04	0.37	0.29	0.39	0.11
	--	--	--	--	--	--	--	--	--	--	--
American Goldfinch	0.04	0.11	0.15	0.19	0.19	0.48	0	0.30	0.46	0.29	0.07
	16	32	5	--	16	--	0	11	31	5	--
American Redstart	0	0	0	0.04	0	0.04	0	0	0.04	0	0.04
	0	0	0	--	0	--	0	0	--	0	5
American Robin	0.22	0.19	0.22	0.19	0.37	0.59	0.15	0.44	0.29	0.50	0.30
	11	37	32	--	--	11	22	--	5	5	21
Bald Eagle	0	0	0	0	0.04	0	0	0	0	0	0
	0	0	0	0	--	0	0	0	0	0	0
Baltimore Oriole	0.04	0	0.07	0.11	0.11	0.30	0	0.07	0.14	0.11	0.07

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
	5	0	5	--	--	--	0	--	--	5	11
Bank Swallow	0	0.04	0	0	0.04	0.15	0	0.15	0.07	0.14	0
	0	--	0	0	--	--	0	11	--	--	0
Barn Swallow	0	0.04	0	0.22	0.07	0.22	0.08	0.11	0.11	0.43	0.19
	0	--	0	--	--	--	--	--	--	--	--
Belted Kingfisher	0.04	0.04	0	0	0	0	0	0	0	0	0
	5	--	0	0	0	0	0	0	0	0	0
Bewick's Wren	0	0.15	0	0	0	0	0	0	0	0	0
	0	27	0	0	0	0	0	0	0	0	0
Blue-gray Gnatcatcher	0.04	0	0.04	0.11	0.11	0.11	0	0.07	0.07	0.21	0.11
	5	0	5	5	--	--	0	--	--	--	16
Blue Grosbeak	0	0.04	0.04	0	0.04	0.04	0	0	0.07	0.04	0
	0	21	--	0	--	--	0	0	5	--	0
Blue Jay	0.04	0.07	0.07	0.26	0.15	0.26	0.08	0.15	0.14	0.18	0
	5	5	11	--	--	11	--	--	--	--	0

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
Blue-winged Warbler	0	0.04	0	0.04	0	0	0	0.07	0.04	0	0.04
	0	5	0	--	0	0	0	--	--	0	11
Bobolink	0	0	0	0.04	0	0	0	0	0	0	0
	0	0	0	--	0	0	0	0	0	0	0
Brown-headed Cowbird	0.04	0.04	0	0.07	0.19	0.15	0.04	0.15	0.11	0.25	0.11
	--	--	0	--	--	--	6	11	5	5	5
Brown Thrasher	0	0.11	0.11	0.19	0.11	0.15	0.12	0.11	0.25	0.25	0.04
	0	--	--	5	--	--	6	--	--	--	5
Canada Goose	0	0.04	0	0.07	0.04	0.11	0	0.07	0.04	0	0.07
	0	--	0	--	--	--	0	--	--	0	--
Carolina Chickadee	0	0	0.07	0	0	0.07	0	0.07	0.07	0	0
	0	0	5	0	0	5	0	5	--	0	0
Carolina Wren	0.26	0.11	0.11	0.15	0.15	0.15	0	0.33	0.46	0.04	0.04
	27	11	11	--	--	--	0	--	--	--	5
Cedar Waxwing	0	0	0	0.07	0.04	0.15	0	0.11	0.21	0.18	0

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
	0	0	0	--	--	--	0	--	--	5	0
Chimney Swift	0	0	0	0.04	0.22	0.11	0.04	0.11	0.07	0	0.07
	0	0	0	--	--	--	--	--	--	0	--
Chipping Sparrow	0	0	0	0	0.04	0.04	0.04	0	0	0	0
	0	0	0	0	--	--	6	0	0	0	0
Cliff Swallow	0	0	0	0	0	0.04	0	0.04	0	0	0
	0	0	0	0	0	--	0	--	0	0	0
Common Grackle	0	0	0.07	0.48	0.52	0.78	0	0.78	0.50	0.54	0.11
	0	0	--	11	27	16	0	5	10	41	11
Common Yellowthroat	0.15	0.11	0.30	0.63	0.52	0.55	0.39	0.63	0.54	0.50	0.19
	21	16	16	--	11	--	28	11	--	5	11
Cooper's Hawk	0	0	0	0.04	0	0	0.04	0.04	0	0	0
	0	0	0	--	0	0	--	--	0	0	0
Dickcissel	0.22	0.11	0.19	0.07	0.15	0.07	0	0.19	0.25	0.39	0.11
	43	27	27	16	21	--	0	16	15	--	11

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
Downy Woodpecker	0	0	0.04	0.04	0.11	0.15	0	0.11	0	0.11	0
	0	0	5	--	--	5	0	--	0	--	0
Eastern Bluebird	0	0.07	0	0.15	0.07	0	0	0.22	0.07	0.21	0.15
	0	16	0	11	5	0	0	--	10	--	21
Eastern Kingbird	0	0.04	0	0.19	0.07	0.07	0	0.11	0.07	0.11	0.04
	0	--	0	11	5	--	0	16	--	--	5
Eastern Meadowlark	0.33	0.19	0.11	0.44	0.56	0.56	0.15	0.41	0.43	0.43	0.33
	21	16	5	32	11	5	5	5	31	10	48
Eastern Phoebe	0.04	0	0	0	0	0.04	0	0.07	0.04	0	0
	5	0	0	0	0	--	0	5	--	0	0
Eastern Towhee	0.11	0.07	0.19	0.37	0.15	0.30	0.08	0.15	0.29	0.25	0.26
	5	5	11	--	--	--	5	--	--	--	27
Eastern Wood-pewee	0.04	0.19	0.07	0.15	0.11	0.11	0	0.07	0.07	0.25	0.07
	5	21	--	--	--	--	--	--	--	--	11
European Starling	0.04	0.04	0.22	0.33	0.37	0.44	0.04	0.59	0.43	0.50	0.07

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
	--	--	5	5	--	11	--	--	31	5	5
Field Sparrow	0.26	0.22	0.33	0.59	0.44	0.37	0.23	0.41	0.61	0.64	0.33
	16	21	64	5	5	5	33	5	15	5	21
Grasshopper Sparrow	0.19	0.26	0.15	0.19	0.19	0.30	0.19	0.19	0.32	0.25	0.33
	5	53	5	5	5	5	39	--	15	5	64
Gray Catbird	0	0.04	0.04	0.22	0.22	0.22	0.04	0.11	0.25	0.11	0.07
	0	5	--	--	--	5	5	--	5	--	11
Great Blue Heron	0.07	0.07	0	0.07	0.11	0.11	0.04	0.15	0.14	0.04	0
	--	--	0	--	--	--	--	--	--	--	0
Great Crested Flycatcher	0	0	0	0.04	0.04	0	0.04	0.11	0	0.04	0
	0	0	0	--	--	0	6	--	0	--	0
Green Heron	0	0	0	0	0	0	0.04	0.04	0	0	0
	0	0	0	0	0	0	--	--	0	0	0
Henslow's Sparrow	0.04	0.04	0.04	0	0.07	0.19	0	0.11	0.18	0.11	0.07
	11	11	16	0	--	--	0	--	--	--	11

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
Horned Lark	0	0	0	0	0	0	0	0.04	0	0	0.04
	0	0	0	0	0	0	0	--	0	0	5
House Finch	0.04	0	0	0	0.04	0.04	0	0.04	0.11	0	0
	5	0	0	0	--	--	0	--	--	0	0
House Wren	0.04	0	0.11	0.22	0.19	0.30	0.04	0.07	0.21	0.21	0.11
	5	0	--	5	--	--	--	--	--	--	16
Indigo Bunting	0.19	0.15	0.41	0.30	0.37	0.48	0.19	0.44	0.43	0.64	0.26
	27	16	43	5	--	11	22	--	--	21	37
Killdeer	0	0	0	0	0.04	0.04	0	0	0	0	0.04
	0	0	0	0	--	--	0	0	0	0	--
Least Flycatcher	0	0	0	0	0.04	0	0	0	0	0	0
	0	0	0	0	--	0	0	0	0	0	0
Mallard	0	0	0	0	0.04	0	0.04	0	0	0.04	0
	0	0	0	0	--	0	--	0	0	--	0
Mourning Dove	0.04	0.11	0.07	0.37	0.33	0.30	0.04	0.37	0.29	0.32	0.19

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
	--	5	--	5	5	--	6	27	--	--	16
Northern Bobwhite	0.11	0.04	0.04	0	0	0	0	0	0	0.04	0.11
	--	--	--	0	0	0	0	0	0	--	5
Northern Cardinal	0.22	0.19	0.37	0.37	0.48	0.41	0.15	0.56	0.39	0.05	0.15
	11	11	43	5	--	5	11	5	--	--	21
Northern Flicker	0	0	0.04	0	0.15	0.11	0	0.11	0.07	0.14	0
	0	0	--	0	5	--	0	--	--	--	0
Northern Harrier	0	0	0	0	0	0	0	0	0	0	0.04
	0	0	0	0	0	0	0	0	0	0	5
Northern Mockingbird	0	0	0.07	0	0.07	0.04	0.04	0.04	0.04	0.04	0.07
	0	0	5	0	--	--	--	--	--	5	5
Northern Parula	0	0	0	0	0	0	0	0.04	0	0.04	0
	0	0	0	0	0	0	0	--	0	--	0
Northern Rough-winged Swallow	0	0	0.04	0.07	0.19	0.15	0	0.22	0.25	0.32	0

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
	0	0	--	5	11	11	0	5	--	51	0
Orchard Oriole	0	0	0.07	0.19	0.15	0.15	0	0.11	0.07	0.18	0.04
	0	0	--	5	--	--	0	11	--	--	11
Pileated Woodpecker	0	0	0	0	0	0	0	0	0	0	0.04
	0	0	0	0	0	0	0	0	0	0	5
Prairie Warbler	0	0	0	0	0.15	0	0	0	0.04	0.07	0
	0	0	0	0	11	0	0	0	--	--	0
Prothonotary Warbler	0	0	0	0	0	0	0	0	0	0.04	0
	0	0	0	0	0	0	0	0	0	--	0
Purple Martin	0	0	0	0	0.04	0.04	0	0	0	0	0
	0	0	0	0	--	--	0	0	0	0	0
Red-bellied Woodpecker	0	0	0.04	0.07	0.15	0.19	0.04	0.11	0.07	0.29	0.04
	0	0	--	--	--	5	5	--	--	--	5
Red-eyed Vireo	0.04	0.07	0.04	0.07	0.26	0.15	0	0.15	0.14	0.21	0.04
	--	5	5	--	--	--	--	--	--	--	5

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
Red-tailed Hawk	0.04	0.04	0.07	0.04	0	0.11	0	0.07	0.04	0	0.04
	--	--	--	--	0	--	0	--	--	0	--
Red-winged Blackbird	0.67	0.67	0.67	0.82	0.78	0.78	0.81	0.59	0.75	0.75	0.52
	272	240	165	139	123	192	161	101	134	170	107
Ring-necked Pheasant	0.22	0.04	0.04	0.04	0.19	0.04	0	0.07	0.04	0.04	0.04
	--	--	--	--	--	--	0	--	--	--	--
Rock Dove	0.04	0	0	0	0.07	0.04	0	0.07	0	0.04	0
	11	0	0	0	11	--	0	--	0	--	0
Rose-breasted Grosbeak	0	0	0	0	0	0	0	0	0	0.07	0
	0	0	0	0	0	0	0	0	0	--	0
Ruby-throated Hummingbird	0	0	0	0.04	0.04	0.04	0	0	0	0	0
	0	0	0	--	--	--	0	0	0	0	0
Savannah Sparrow	0	0	0	0.04	0	0	0.04	0	0	0	0
	0	0	0	--	0	0	6	0	0	0	0
Scarlet Tanager	0	0	0	0.07	0.04	0	0	0.04	0.11	0.07	0

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
	0	0	0	--	--	0	0	--	5	--	0
Sedge Wren	0	0	0.04	0	0	0	0	0	0	0	0
	0	0	--	0	0	0	0	0	0	0	0
Song Sparrow	0.26	0.04	0.30	0.70	0.52	0.63	0.15	0.56	0.43	0.57	0.07
	21	21	32	16	16	5	33	--	5	5	--
Summer Tanager	0	0	0	0	0	0	0	0	0	0	0.04
	0	0	0	0	0	0	0	0	0	0	11
Tree Swallow	0.26	0.07	0.07	0.22	0.19	0.19	0.23	0.26	0.14	0.11	0.26
	48	--	16	5	11	16	11	11	10	5	11
Tufted titmouse	0.11	0.07	0	0.26	0.15	0.19	0	0.19	0.29	0.25	0.15
	11	5	0	--	--	--	0	--	--	--	16
Turkey Vulture	0.04	0	0	0.11	0.07	0	0	0.11	0.21	0.14	0.07
	--	0	0	--	--	0	0	--	--	5	--
Warbling Vireo	0	0	0.04	0	0.11	0.15	0	0.19	0.14	0.21	0
	0	0	--	0	--	--	0	5	--	--	0

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
White-breasted Nuthatch	0	0	0	0	0.04	0.04	0	0.04	0	0.04	0
	0	0	0	0	--	--	0	--	0	--	0
White-eyed Vireo	0	0	0.04	0.37	0.15	0.07	0	0.04	0.11	0.07	0
	0	0	--	--	--	--	0	--	--	--	0
Willow Flycatcher	0	0	0.15	0.04	0.30	0.22	0	0.07	0.04	0.29	0
	0	0	16	--	16	5	0	--	--	10	0
Wood Duck	0	0	0.04	0	0	0	0	0	0.04	0	0
	0	0	--	0	0	0	0	0	--	0	0
Wood Thrush	0.07	0.11	0.11	0.30	0.22	0.15	0.04	0.26	0.07	0.21	0.15
	5	16	5	--	--	--	6	--	--	--	21
Yellow-billed Cuckoo	0	0.04	0.07	0.04	0.11	0	0	0.04	0	0	0.04
	0	5	--	--	--	0	0	--	0	0	--
Yellow-breasted Chat	0.19	0.22	0.11	0.22	0.22	0.22	0.15	0.26	0.04	0.18	0.04
	27	27	16	--	--	11	17	--	--	--	5
Yellow-throated Vireo	0	0	0.04	0.04	0	0.04	0.08	0	0.04	0	0

Appendix A. Annual proportion of plots occupied (includes flyovers) by, and estimated abundance (determined using bird within 100-m of plot center) of breeding bird species at Hopewell Culture National Historical Park, Ohio during the 2005-2015 spring bird surveys.

Common name	<u>Proportion of plots occupied</u>										
	Abundance										
	2005 n=27	2006 n=27	2007 n=27	2008 n=27	2009 n=27	2010 n=27	2011 n=26	2012 n=27	2013 n=28	2014 n=28	2015 n=27
	0	0	--	--	0	--	11	0	--	0	0
Yellow-throated Warbler	0	0	0	0	0	0.04	0	0	0	0	0
	0	0	0	0	0	--	0	0	0	0	0
Yellow Warbler	0.15	0.15	0.04	0.30	0.30	0.22	0	0.07	0.14	0.21	0.07
	5	16	5	--	5	5	0	--	5	--	11

* — denotes when a species was present on a plot but outside 100-m of plot center therefore their annual abundance value could not be calculated.

Bolded species names are those species considered of conservation concern for either or both the Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions (U.S. Fish and Wildlife Service 2008).

Appendix B.

Appendix B. Regional trends in breeding birds recorded on Hopewell Culture National Historical Park, Ohio for years 2005 through 2013.

Common name	Eastern Tallgrass Prairie			Appalachian Mountains		
	Trend	95% Confidence Interval		Trend	95% Confidence Interval	
		Lower	Upper		Lower	Upper
Acadian Flycatcher	1.56	-2.77	6.84	-0.60	-1.80	1.08
American Crow	1.01	-0.16	2.16	0.69	0.10	1.27
American Goldfinch	-0.87	-2.21	0.50	0.11	-1.04	1.24
American Redstart	7.77	-0.19	18.62	0.98	-0.47	2.47
American Robin	0.91	0.21	1.64	0.91	0.36	1.46
American Woodcock*	0.99	-13.00	15.94	-1.18	-10.24	7.22
Bald Eagle	23.35	11.90	39.76	16.44	5.13	30.68
Baltimore Oriole	-1.71	-3.01	-0.65	-1.36	-2.83	0.13
Bank Swallow	-0.21	-8.08	6.41	-2.17	-12.58	6.79
Barn Swallow	-1.56	-2.70	-0.48	0.22	-0.76	1.25
Belted Kingfisher	-1.38	-5.00	1.92	-0.40	-2.27	1.44
Bewick's Wren	3.51	-7.09	13.78	-15.31	-26.50	-1.13
Blue-gray Gnatcatcher	1.63	-1.22	4.39	-1.58	-2.97	-0.21
Blue Grosbeak	3.22	1.14	5.31	-0.30	-1.69	1.06
Blue Jay	-1.76	-2.95	-0.55	-0.80	-1.52	-0.08
Blue-winged Warbler	1.01	-12.15	10.17	0.75	-2.26	4.39
Bobolink	-2.21	-6.11	1.79	-0.38	-2.02	1.35
Brown-headed Cowbird	-1.17	-2.25	-0.12	-2.36	-3.56	-1.19
Brown Thrasher	-1.63	-2.50	-0.77	0.84	-0.14	1.87

Appendix B. Regional trends in breeding birds recorded on Hopewell Culture National Historical Park, Ohio for years 2005 through 2013.

Common name	Eastern Tallgrass Prairie			Appalachian Mountains		
	Trend	95% Confidence Interval		Trend	95% Confidence Interval	
		Lower	Upper		Lower	Upper
Canada Goose	19.37	10.92	29.18	12.96	5.11	20.18
Carolina Chickadee	-0.09	-3.40	3.31	-0.23	-1.32	0.82
Carolina Wren	-4.69	-7.11	-2.17	0.19	-1.58	1.85
Cedar Waxwing	2.06	-1.25	5.50	1.92	-0.32	4.13
Chimney Swift	-4.69	-6.10	-3.37	-2.53	-3.67	-1.47
Chipping Sparrow	3.04	1.72	4.43	-1.45	-2.20	-0.71
Cliff Swallow	16.77	9.96	21.13	12.92	-18.99	27.54
Common Grackle	-4.75	-6.10	-3.41	-2.61	-3.70	-1.55
Common Yellowthroat	-1.35	-2.55	-0.16	-0.53	-1.34	0.32
Cooper's Hawk	9.16	4.59	13.26	4.28	0.80	7.21
Dickcissel	0.64	-0.72	2.05	21.00	-1.37	54.50
Downy Woodpecker	-0.84	-2.53	0.79	-2.04	-3.44	-0.75
Eastern Bluebird	1.63	-0.61	3.92	1.18	-0.40	2.69
Eastern Kingbird	-2.64	-4.04	-1.34	-0.77	-1.65	0.15
Eastern Meadowlark	-2.81	-3.84	-1.80	-3.38	-4.26	-2.40
Eastern Phoebe	0.02	-1.90	1.89	1.11	-0.09	2.39
Eastern Towhee	1.55	-0.23	3.32	-0.29	-1.16	0.58
Eastern Wood-pewee	-1.30	-2.74	0.05	-2.29	-3.21	-1.27
European Starling	-0.78	-1.84	0.18	-0.53	-1.53	0.57
Field Sparrow	-2.05	-3.30	-0.81	-1.74	-2.90	-0.51

Appendix B. Regional trends in breeding birds recorded on Hopewell Culture National Historical Park, Ohio for years 2005 through 2013.

Common name	Eastern Tallgrass Prairie			Appalachian Mountains		
	Trend	95% Confidence Interval		Trend	95% Confidence Interval	
		Lower	Upper		Lower	Upper
Grasshopper Sparrow	-5.70	-8.23	-3.56	-5.03	-6.86	-3.02
Gray Catbird	1.04	-0.04	2.14	1.27	0.50	2.08
Great Blue Heron	0.54	-1.59	2.60	4.17	1.03	7.00
Great Crested Flycatcher	-0.83	-2.50	0.69	-0.97	-2.11	0.14
Green Heron	-2.17	-5.05	-0.03	-1.02	-2.65	0.58
Henslow's Sparrow	6.36	-2.70	11.97	-3.05	-11.70	4.15
Horned Lark	-1.95	-3.25	-0.60	6.43	-1.32	17.34
House Finch	1.37	-1.78	4.75	-1.06	-3.68	1.74
House Sparrow*	-3.91	-4.98	-2.84	-3.61	-4.61	-2.63
House Wren	-0.08	-1.13	1.01	-0.31	-1.38	0.77
Indigo Bunting	-1.67	-2.49	-0.85	-2.31	-2.86	-1.76
Killdeer	-0.42	-1.75	0.85	-1.04	-2.56	0.48
Least Flycatcher	-2.20	-11.18	6.52	-1.24	-3.13	0.89
Mallard	1.53	-2.72	5.77	2.32	-1.13	5.13
Mourning Dove	-1.54	-2.32	-0.71	0.51	-0.37	1.33
Northern Bobwhite	-6.80	-8.50	-5.09	-9.09	-11.79	-6.32
Northern Cardinal	0.78	0.10	1.49	0.10	-0.56	0.73
Northern Flicker	na	na	na	na	na	na
Northern Harrier	-1.56	-10.82	6.23	1.57	-6.96	9.35
Northern Mockingbird	-0.78	-2.38	0.87	0.90	-0.26	2.09

Appendix B. Regional trends in breeding birds recorded on Hopewell Culture National Historical Park, Ohio for years 2005 through 2013.

Common name	Eastern Tallgrass Prairie			Appalachian Mountains		
	Trend	95% Confidence Interval		Trend	95% Confidence Interval	
		Lower	Upper		Lower	Upper
Northern Parula	3.82	1.05	6.45	1.60	0.35	3.09
Northern Rough-winged Swallow	2.21	-0.30	4.99	0.48	-1.60	2.33
Orchard Oriole	-1.62	-3.87	0.69	0.07	-1.52	2.02
Pileated Woodpecker	5.16	0.91	8.74	1.84	0.41	3.25
Prairie Warbler	2.22	-5.15	14.74	-1.53	-3.58	0.71
Prothonotary Warbler	5.04	0.24	11.15	-2.02	-7.87	6.90
Purple Martin	1.51	-2.61	5.06	-0.62	-4.13	2.52
Red-bellied Woodpecker	1.14	-0.18	2.47	3.32	2.18	4.40
Red-eyed Vireo	1.55	-0.31	3.28	0.38	-0.19	0.95
Red-tailed Hawk	-0.37	-2.22	1.21	1.65	-0.65	3.77
Red-winged Blackbird	-1.94	-2.70	-1.22	-1.06	-2.03	-0.09
Ring-necked Pheasant	-8.79	-12.10	-5.45	-5.44	-8.16	-2.40
Rock Dove	-2.66	-4.13	-1.05	-0.95	-3.05	1.02
Rose-breasted Grosbeak	0.71	-1.02	2.20	-2.39	-4.44	-0.40
Ruby-throated Hummingbird	0.26	-3.63	3.42	-0.03	-2.14	1.76
Savannah Sparrow	-3.49	-7.00	0.23	-3.63	-5.39	-2.04
Scarlet Tanager	-0.15	-4.29	3.67	-1.01	-2.09	0.07
Sedge Wren	-1.69	-11.07	6.32	na	na	na
Song Sparrow	-1.13	-2.17	-0.08	-0.89	-1.54	-0.27
Summer Tanager	4.18	1.51	6.82	-2.73	-5.26	-0.21

Appendix B. Regional trends in breeding birds recorded on Hopewell Culture National Historical Park, Ohio for years 2005 through 2013.

Common name	Eastern Tallgrass Prairie			Appalachian Mountains		
	Trend	95% Confidence Interval		Trend	95% Confidence Interval	
		Lower	Upper		Lower	Upper
Tree Swallow	4.55	0.67	8.65	4.97	2.65	7.35
Tufted titmouse	5.06	3.16	7.14	1.04	0.16	1.94
Turkey Vulture	8.24	5.56	10.99	3.53	1.17	5.90
Vesper Sparrow*	0.95	-1.66	3.85	-6.51	-10.17	-2.62
Warbling Vireo	0.09	-1.26	1.37	0.29	-1.44	1.78
White-breasted Nuthatch	0.41	-2.10	2.76	1.02	-0.80	2.68
White-eyed Vireo	-0.09	-4.27	3.26	1.28	-0.41	3.04
Willow Flycatcher	-1.36	-3.70	0.66	0.19	-1.66	2.00
Wild Turkey*	9.16	3.41	15.14	7.12	3.24	10.77
Wood Duck	3.69	0.59	6.84	3.92	-0.15	8.50
Wood Thrush	0.25	-2.24	2.86	-1.72	-2.65	-0.78
Yellow-billed Cuckoo	-4.27	-6.69	-1.72	-5.29	-7.21	-3.20
Yellow-breasted Chat	-1.94	-5.12	0.44	-2.94	-4.29	-1.53
Yellow-throated Vireo	4.96	2.54	7.47	0.01	-1.66	1.79
Yellow-throated Warbler	5.97	0.64	16.35	1.52	-0.37	3.56
Yellow Warbler	1.02	-1.18	3.43	-1.28	-2.48	-0.04

* Species recorded between point transects or other times outside of 5-min survey periods.

Bolded species names are those species considered of conservation concern for either or both the Eastern Tallgrass Prairie and Appalachian Mountain Bird Conservation Regions (U.S. Fish and Wildlife Service 2008).

Regional trend data from BBS surveys (Sauer et al. 2014).

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