



Bird Community Monitoring at Effigy Mounds National Monument, Iowa

2009-2010 Status Report

Natural Resource Data Series NPS/HTLN/NRDS—2010/111



ON THE COVER

Landscape at Effigy Mounds National Monument, Iowa
Photograph by: Lisa P. Thomas

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November 2010

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Please cite this publication as:

Peitz, D. G. 2010. Bird Community Monitoring at Effigy Mounds National Monument, Iowa: 2009 - 2010 status report. Natural Resource Data Series NPS/HTLN/NRDS—2010/111. National Park Service, Fort Collins, Colorado.

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 for 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.

We use trends in the composition and abundance of bird populations as long-term indicators of ecosystem integrity in the habitat of Effigy Mounds National Monument, Iowa (EFMO). 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 habitat 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 population size and community composition of birds on the Monument may reflect the effectiveness of management in restoring and maintaining the various vegetative communities at EFMO. Long-term trends in community composition and abundance of breeding bird populations provide one measure for assessing the ecological integrity and sustainability of these systems.

Methods

Site Selection for Bird Plots

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. Fifty-two permanent plots comprised the original grid, 18 of which fall in culturally sensitive areas or are not easily accessible. Several of the plots are only accessible by boat (Fig. 1). Thirty-four plots were surveyed for birds by Heartland I&M Network (HTLN) staff between May 29 and June 1, 2009. Forty-six plots were surveyed for birds by volunteers between May 20 and June 10, 2010. Steep terrain and high water levels preclude the assessment of habitat on all 52 plots in 2009, the year in which bird habitat assessment was conducted. Therefore, habitat was only assessed on the 34 plots sampled for birds in 2009.

During bird surveys, monitoring plots were located using navigation waypoints (Appendix 1) in a GPS unit and temporarily marked with 36-inch pin flags to aid in re-locating 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.

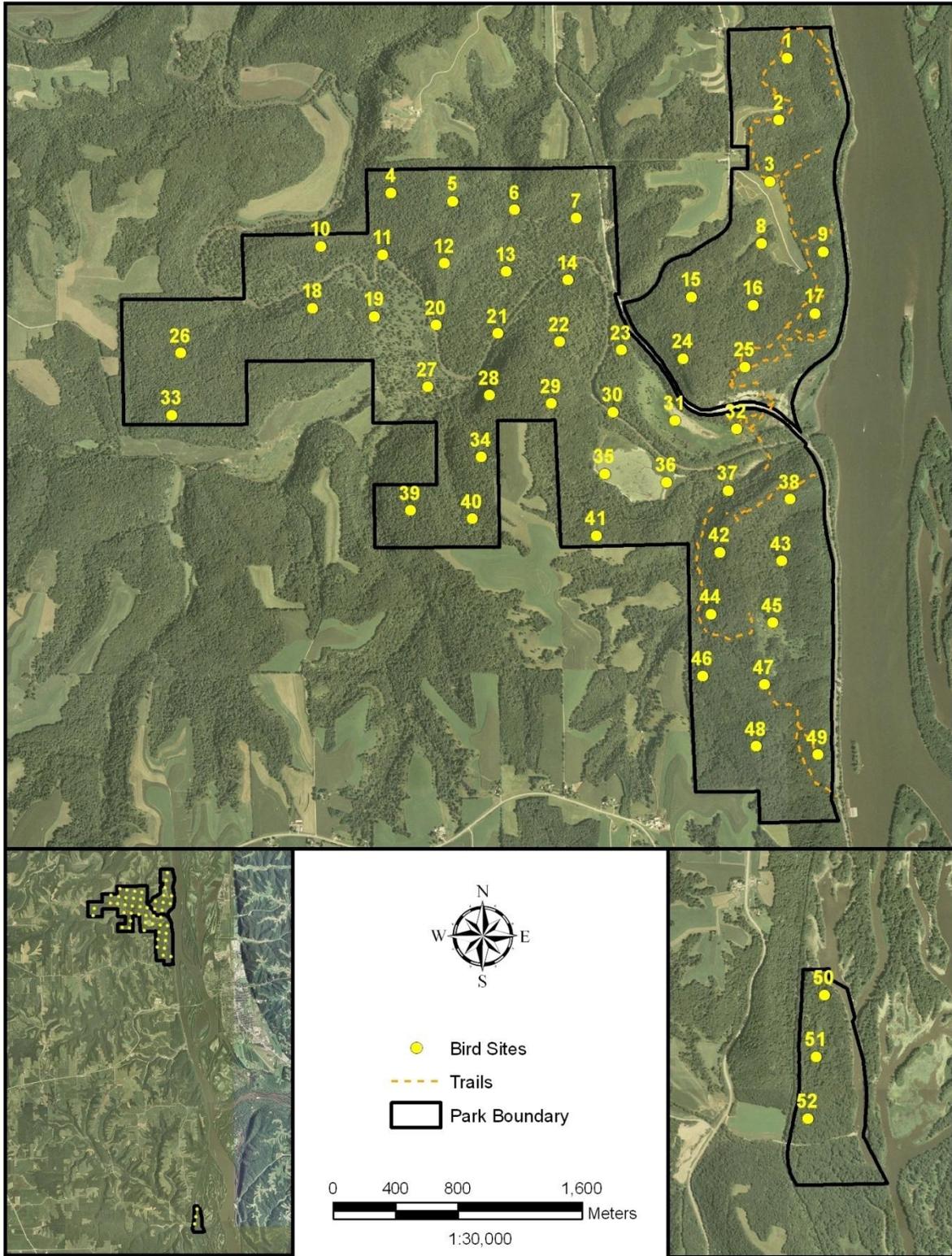


Figure 1. Bird plot locations on Effigy Mounds National Monument, Iowa.

Bird Surveys

Bird surveys followed methods outlined in the bird monitoring protocol by Peitz et al. (2008) and summarized below. 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 counted along with their corresponding distance from observer. Bird observations were separated into two time segments: those detected during the first three minutes of the count (to allow future comparisons with the national Breeding Bird Survey data), and any new birds detected during the final two minutes of the count. 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 observations. After completing a count at a plot, and filling out the data sheet, the observer(s) navigated to the next plot using a GPS unit. While traveling between plots, the observer(s) 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. We sampled birds during a period when it was light enough to observe birds to four hours after sunrise.

Bird Habitat

The collection of habitat data in 2009 followed methods outlined in the bird monitoring protocol by Peitz et al. (2008). A summary of the sampling methods follows: habitat data collection started after the first variable circular plot count was completed. Observers visited plots for habitat measures in the same order they were surveyed for birds to avoid disturbing birds on a plot prior to the survey. Once the habitat crew arrived at a plot, they set up the center subplot and completed all habitat measures for this subplot and the 50-m radius plot.

We characterized habitat available for each bird species on a number of different scales. Slope, slope variability, aspect, aspect variability, and topographic position of each 50-m radius plot were determined and recorded first. Measurements were recorded during this first year of monitoring, and will not be re-measured in subsequent years. The amount of various vegetation types (field/prairie, wooded floodplain, pond, trail, or woodland) and the amount of road and water cover on each plot sampled were recorded. As plots were sampled, horizontal vegetation cover was estimated on subplots in 0.25-m intervals from 0.0 to 2.0 meters above ground surface using a 0.15-m wide cover board. Area of the cover board obscured by vegetation was estimated at a 15-m distances from plot center. Using a graduated measuring rod, vertical vegetation structure was measured in 1-m increments up to 7.5 meters in height at four locations around the perimeter of the subplot. Locations were in the four cardinal directions. Vertical structure was recorded for deciduous and herbaceous vegetation. Trees were tallied by species and size class (<1.0 cm, 1.1 – 2.5 cm, 2.6 – 8.0 cm, 8.1 – 15.0 cm, 15.1 – 23.0 cm, 23.1 – 38.0 cm or >38.0 cm) on the subplot. Lastly, at the subplot, ground and foliar cover were recorded in a 1.78-m radius nested sample plot. Ground cover included deciduous and grass litter, bare soil, rock, woody debris (>2.5 cm diameter), and unvegetated. Foliar cover was estimated for six plant guilds, including warm- and cool-season grasses, forbs, moss and lichens, shrubs and vines, tree seedlings, and total foliar cover (<1.5 m tall). Average parameter values were reported for the Monument.

Data Analysis

Prior to summary analysis, the residency status (permanent resident, summer resident, migrant, species out of their normal range, and winter resident) of each bird species recorded was determined. Identifying the residency of each species helps to exclude migrants, species out of their normal range, and winter residents from analysis of breeding birds within EFMO.

Hereafter, permanent and summer resident birds are referred to as breeding species. The frequency and abundance of breeding bird species were determined two ways. First, for each breeding species, the number of individuals encountered per plot visit was determined (individuals / plot visit). And second, the proportion of plots occupied by each breeding species was determined (total number of plots occupied by a species / total number of plots visited).

Location and permanent abiotic measures on each plot and habitat subplot were determined. Averages (\pm std dev) for semi-permanent plot data, including road and water cover were calculated from plot estimates. Using plot values, averages (\pm std dev) for horizontal vegetation cover between 0 – 0.25, 0.25-0.5, 0.5 – 0.75, 0.75-1.0, 1.0 – 1.25, 1.25-1.5, 1.5 – 1.75, and 1.75 – 2.0 meters were calculated. Average (\pm std dev) vertical structure diversity was estimated and reported as well.

$$\text{Structural Diversity Index} = \frac{((\sum p_i / 8) + a) * 100}{2}$$

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

Within each habitat, ground cover, including deciduous and grass litter, bare soil, rock, woody debris (>2.5 cm DBH), and unvegetated were averaged (\pm std dev) across plots. Foliar cover, by guild of warm- and cool-season grasses, forbs, mosses and lichens, shrubs and vines, tree seedlings and total foliar cover (<1.5 m tall) were averaged (\pm std dev) across plots as well. Also reported were species composition and size classes of trees.

Results

Bird Surveys

Seventy-one avian species were recorded on EFMO during surveys May 29 through June 1, 2009; and May 20 through June 10, 2010 (Table 1). Sixty-six of the 71 species are year round or summer residents (Stokes and Stokes 1996). Two species, Bald Eagle (*Haliaeetus leucocephalus*) and Brown Creeper (*Certhia americana*) are winter residents to the Monument. The Northern Parula (*Parula americana*) is a migrant through the area, and the White-eyed Vireo (*Vireo griseus*) and Worm-eating Warbler (*Helmitheros vermivorum*) are outside of their normal range. Four summer residents, Chimney Swift (*Chaetura pelagica*), Eastern Meadowlark (*Sturnella magna*), Great Blue Heron (*Ardea Herodias*), and Northern Rough-winged Swallow (*Stelgidopteryx serripennis*) were only recorded outside of 5-min survey periods. The Acadian Flycatcher (*Empidonax virescens*), Blue-winged Warbler (*Vermivora pinus*), Brown Thrasher (*Toxostoma rufum*), Cerulean Warbler (*Dendroica cerulea*), Eastern Towhee (*Pipilo erythrophthalmus*), Grasshopper Sparrow (*Ammodramus savannarum*), Indigo Bunting (*Passerina cyanea*), Prothonotary Warbler (*Protonotaria citrea*), Red-bellied Woodpecker (*Melanerpes carolinus*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Red-shouldered Hawk (*Buteo lineatus*), Willow Flycatcher (*Empidonax traillii*), Wood Thrush (*Hylocichla mustelina*), Yellow-bellied Sapsucker (*Sphyrapicus varius*) and Yellow-throated Vireo (*Vireo flavifrons*) are breeding species of continental importance (Rich et al. 2004). The Bald Eagle and White-eyed Vireo are species of continental importance as well. On average, Eastern Wood-pewee (*Contopus virens*) was the most commonly encountered and widely distributed species on the Monument, annually (Table 2).

Table 1. Species recorded at Effigy Mounds National Monument, Iowa during breeding bird surveys in 2009 and 2010.

Common name	Species name	AOU code	Residency ¹
Acadian Flycatcher	<i>Empidonax virescens</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	SR
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BAEA	WR
Baltimore Oriole	<i>Icterus galbula</i>	BAOR	SR
Belted Kingfisher	<i>Megaceryle alcyon</i>	BEKI	R
Black-and-white Warbler	<i>Mniotilta varia</i>	BAWW	SR
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	BBCU	SR
Black-capped Chickadee	<i>Poecile atricapillus</i>	BCCH	R
Blue Jay	<i>Cyanocitta cristata</i>	BLJA	R
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	BGGN	SR
Blue-winged Warbler	<i>Vermivora pinus</i>	BWWA	SR
Brown Creeper	<i>Certhia americana</i>	BRCR	WR
Brown Thrasher	<i>Toxostoma rufum</i>	BRTH	SR
Brown-headed Cowbird	<i>Molothrus ater</i>	BHCO	R
Canada Goose	<i>Branta canadensis</i>	CAGO	SR
Cedar Waxwing	<i>Bombycilla cedrorum</i>	CEDW	R
Cerulean Warbler	<i>Dendroica cerulean</i>	CERW	SR
Chimney Swift	<i>Chaetura pelagic</i>	CHSW	SR
Common Grackle	<i>Quiscalus quiscula</i>	COGR	R
Common Yellowthroat	<i>Geothlypis trichas</i>	COYE	SR
Downy Woodpecker	<i>Picoides pubescens</i>	DOWO	R
Eastern Kingbird	<i>Tyrannus tyrannus</i>	EAKI	SR
Eastern Meadowlark	<i>Sturnella magna</i>	EAME	SR
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	EATO	SR
Eastern Wood-pewee	<i>Contopus virens</i>	EAWP	SR
(Eastern) Tufted Titmouse	<i>Baeolophus bicolor</i>	ETTI	R
European Starling	<i>Sturnus vulgaris</i>	EUST	R
Field Sparrow	<i>Spizella pusilla</i>	FISP	SR
Great Blue Heron	<i>Ardea Herodias</i>	GBHE	SR
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	GCFL	SR
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	GRSP	SR
Gray Catbird	<i>Dumetella carolinensis</i>	GRCA	SR
Hairy Woodpecker	<i>Picoides villosus</i>	HAWO	R
House Wren	<i>Troglodytes aedon</i>	HOWR	SR
Indigo Bunting	<i>Passerina cyanea</i>	INBU	SR
Least Flycatcher	<i>Empidonax minimus</i>	LEFL	SR
Mourning Dove	<i>Zenaida macroura</i>	MODO	R
Northern Cardinal	<i>Cardinalis cardinalis</i>	NOCA	R
Northern Parula	<i>Parula Americana</i>	NOPA	M
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	NRWS	SR
Ovenbird	<i>Seiurus aurocapilla</i>	OVEN	SR
Pileated Woodpecker	<i>Dryocopus pileatus</i>	PIWO	R
Prothonotary Warbler	<i>Protonotaria citrea</i>	PROW	SR

Table 1. Species recorded at Effigy Mounds National Monument, Iowa during breeding bird surveys in 2009 and 2010 (continued).

Common name	Species name	AOU code	Residency ¹
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	RBWO	R
Red-eyed Vireo	<i>Vireo olivaceus</i>	REVI	SR
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	RHWO	R
Red-shouldered Hawk	<i>Buteo lineatus</i>	RSHA	R
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RTHA	R
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	RWBL	R
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	RBGR	SR
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	RTHU	SR
Scarlet Tanager	<i>Piranga olivacea</i>	SCTA	SR
Song Sparrow	<i>Melospiza melodia</i>	SOSP	R
Turkey Vulture	<i>Cathartes aura</i>	TUVU	SR
Veery	<i>Catharus fuscescens</i>	VEER	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	O
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
Worm-eating Warbler	<i>Helmitheros vermivorum</i>	WEWA	O
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	YBCU	SR
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	YBSA	R
Northern (Yellow-shafted) Flicker	<i>Colaptes auratus</i>	YSFL	R
Yellow-throated Vireo	<i>Vireo flavifrons</i>	YTVI	SR
Yellow Warbler	<i>Dendroica petechia</i>	YWAR	SR

¹ Residency status: SR = summer resident; R = year around resident; WR = winter resident; M = late season migrant; O = outside of normal range (Stokes and Stokes 1996).

Species names are valid and verified names obtained from ITIS. (Integrated Taxonomic Information System. Accessed in 2010, <http://www.itis.gov/>).

Bolded species names are those species considered of continental importance (Rich et al. 2004).

Table 2. Number of individuals encountered per plot visit, and proportion of plots occupied for breeding bird species recorded at Effigy Mounds National Monument, Iowa during the 2009 and 2010 breeding bird surveys. Number of individuals per plot, and proportion of plots occupied includes all individuals recorded on plots during a 5-min survey, including flyovers.

Common name	Individuals / plot visit		Proportion of plots occupied	
	2009 (n = 34)	2010 (n = 46)	2009 (n = 34)	2010 (n = 46)
Acadian Flycatcher	0.06	0.13	0.06	0.13
American Crow	0.24	0.13	0.09	0.11
American Goldfinch	0.06	0.37	0.03	0.33
American Redstart	0.18	0.89	0.15	0.59
American Robin	0.38	1.30	0.29	0.89
Baltimore Oriole	0.15	0.65	0.12	0.46
Belted Kingfisher	0.00	0.02	0.00	0.02
Black-and-white Warbler	0.03	0.00	0.03	0.00
Black-billed Cuckoo	0.06	0.02	0.06	0.02
Black-capped Chickadee	0.03	0.11	0.03	0.09
Blue Jay	0.15	0.43	0.12	0.33
Blue-gray Gnatcatcher	0.18	0.26	0.18	0.23
Blue-winged warbler	0.00	0.09	0.00	0.07
Brown Thrasher	0.03	0.00	0.03	0.00
Brown-headed Cowbird	0.09	0.11	0.09	0.11
Canada Goose	0.00	0.02	0.00	0.02
Cedar Waxwing	0.00	0.02	0.00	0.02
Cerulean Warbler	0.24	0.33	0.18	0.28
Common Grackle	0.00	0.07	0.00	0.07
Common Yellowthroat	0.09	0.63	0.09	0.39
Downy Woodpecker	0.12	0.33	0.09	0.26
Eastern Kingbird	0.06	0.00	0.03	0.00
Eastern Towhee	0.03	0.04	0.03	0.04
Eastern Wood-pewee	0.68	0.80	0.62	0.65
(Eastern) Tufted Titmouse	0.06	0.37	0.06	0.33
European Starling	0.00	0.02	0.00	0.02
Field Sparrow	0.03	0.04	0.03	0.02
Great Crested Flycatcher	0.21	0.13	0.21	0.11
Grasshopper Sparrow	0.00	0.02	0.00	0.02
Gray Catbird	0.03	0.13	0.03	0.13
Hairy Woodpecker	0.00	0.22	0.00	0.22
House Wren	0.15	0.98	0.15	0.70
Indigo Bunting	0.21	0.28	0.18	0.24
Least Flycatcher	0.00	0.02	0.00	0.02
Mourning Dove	0.00	0.04	0.00	0.04
Northern Cardinal	0.06	0.20	0.06	0.20
Ovenbird	0.26	0.33	0.24	0.26
Pileated Woodpecker	0.12	0.28	0.09	0.28
Prothonotary Warbler	0.03	0.11	0.03	0.11
Red-bellied Woodpecker	0.18	0.52	0.12	0.50
Red-eyed Vireo	0.24	0.63	0.21	0.48
Red-headed Woodpecker	0.00	0.13	0.00	0.11

Table 2. Number of individuals encountered per plot visit, and proportion of plots occupied for breeding bird species recorded at Effigy Mounds National Monument, Iowa during the 2009 and 2010 breeding bird surveys. Number of individuals per plot, and proportion of plots occupied includes all individuals recorded on plots during a 5-min survey, including flyovers (continued).

Common Name	Individuals / plot visit		Proportion of plots occupied	
	2009 (n = 34)	2010 (n = 46)	2009 (n = 34)	2010 (n = 46)
Red-shouldered Hawk	0.00	0.02	0.00	0.02
Red-tailed Hawk	0.00	0.02	0.00	0.02
Red-winged Blackbird	0.03	0.17	0.03	0.07
Rose-breasted Grosbeak	0.21	0.59	0.15	0.50
Ruby-throated Hummingbird	0.06	0.04	0.06	0.04
Scarlet Tanager	0.26	0.17	0.24	0.17
Song Sparrow	0.15	0.57	0.12	0.35
Turkey Vulture	0.00	0.13	0.00	0.02
Veery	0.06	0.00	0.06	0.00
Warbling Vireo	0.00	0.13	0.00	0.11
White-breasted Nuthatch	0.09	0.22	0.09	0.20
Willow Flycatcher	0.06	0.02	0.06	0.02
Wild Turkey	0.47	0.07	0.06	0.07
Wood Duck	0.00	0.13	0.00	0.11
Wood Thrush	0.12	0.17	0.12	0.13
Yellow-billed Cuckoo	0.12	0.17	0.12	0.17
Yellow-bellied Sapsucker	0.15	0.07	0.09	0.07
Northern (Yellow-shafted) Flicker	0.00	0.02	0.00	0.02
Yellow-throated Vireo	0.00	0.11	0.00	0.11
Yellow Warbler	0.00	0.02	0.00	0.02

Bird Habitat

Abiotic features of plots sampled for breeding birds and habitat composition are given in Table 3. Plots on the Monument are located in areas with slopes as high as 35 degrees. Slope and aspect variability within plots ranges from low to high on the Monument.

Habitats on plots consist primarily of the woodland and wooded floodplain types, with much lesser amounts of other types present (Table 4). Canopy cover averaged ~89%, with cover provided by hardwood trees. Basal area from hardwood trees averaged 9.48 m² / ha on plots. Hardwood tree species from 10 different families contributed to the canopy cover and basal area (Table 5).

The densest vegetation occurred in the horizontal profile classes 0.25 and 0.50 meters, when read from a 15-m distance (Table 4). However, vegetation cover was recorded in all height classes. Average vertical structure diversity estimate is ~24% across plots.

Deciduous litter was the dominant litter type recorded (Table 4). Plots were primarily unvegetated at ground level, with forbs dominating the forage guilds during our late-May early-June 2009 bird surveys. Total foliar coverage averaged ~23% across plots sampled.

Table 3. Abiotic features of 50-m radius plots sampled for breeding birds at Effigy Mounds National Monument, Iowa in 2009.

Plot number	Slope (°)	Slope variability	Aspect (°)	Aspect variability	Topographic position	Habitat type
EFMOTweety1	9	Medium	88	Low	Mid-slope	Woodland
EFMOTweety2	9	Medium	169	Low	Mid-slope	Woodland
EFMOTweety3	7	Low	347	Low	Mid-slope	Grassland
EFMOTweety4	7	Low	321	Low	Upper-slope	Woodland
EFMOTweety5	14	High	43	High	Draw	Woodland
EFMOTweety6				Not sampled		
EFMOTweety7				Not sampled		
EFMOTweety8	7	High	211	High	Draw	Wooded Floodplain
EFMOTweety9	12	Low	29	Low	--	Woodland
EFMOTweety10				Not sampled		
EFMOTweety11				Not sampled		
EFMOTweety12	17	Low	172	Medium	Draw	Woodland
EFMOTweety13	1	Low	154	Low	Level	Wooded Floodplain
EFMOTweety14	2	Low	89	Low	Level	Wooded Floodplain
EFMOTweety15	9	High	270	High	Draw	Wooded Floodplain
EFMOTweety16	4	High	227	High	Draw	Woodland
EFMOTweety17	12	Low	132	Low	Draw	Woodland
EFMOTweety18	13	Low	38	Low	--	Woodland
EFMOTweety19	3	Low	359	Low	Depression	Woodland
EFMOTweety20				Not sampled		
EFMOTweety21				Not sampled		
EFMOTweety22	21	Medium	47	Low	Lower-slope	Woodland
EFMOTweety23				Not sampled		
EFMOTweety24	16	Low	208	Low	Upper-slope	Woodland
EFMOTweety25	14	Low	287	Low	Upper-slope	Woodland
EFMOTweety26	20	Low	36	Low	Mid-slope	Woodland
EFMOTweety27	1	Low	94	Low	Depression	Woodland
EFMOTweety28				Not sampled		
EFMOTweety29				Not sampled		
EFMOTweety30				Not sampled		
EFMOTweety31				Not sampled		
EFMOTweety32				Not sampled		
EFMOTweety33	19	Medium	204	Low	Mid-slope	Woodland
EFMOTweety34	14	Medium	32	Low	Upper-slope	Woodland
EFMOTweety35				Not sampled		
EFMOTweety36				Not sampled		
EFMOTweety37	27	Low	308	Low	Lower-slope	Wooded Floodplain
EFMOTweety38	35	Low	150	Low	Mid-slope	Woodland
EFMOTweety39	8	Low	300	Low	Mid-slope	Woodland
EFMOTweety40	11	Medium	346	Medium	Draw	Wooded Floodplain
EFMOTweety41	11	Low	18	Low	Upper-slope	Woodland
EFMOTweety42	21	Low	268	Low	Mid-slope	Woodland
EFMOTweety43	15	Low	252	Low	--	Wooded Floodplain
EFMOTweety44	30	Low	268	Low	Upper-slope	Woodland
EFMOTweety45	13	Low	27	Low	Mid-slope	Grassland
EFMOTweety46	19	Low	298	Low	Mid-slope	Woodland
EFMOTweety47	6	Medium	304	Low	Upper-slope	Woodland
EFMOTweety48				Not sampled		
EFMOTweety49				Not sampled		
EFMOTweety50				Not sampled		
EFMOTweety51				Not sampled		
EFMOTweety52	1	Low	359	Low	Level	Woodland

Table 4. Averages (\pm std dev) for habitat parameters measured on 34 plots at Effigy Mounds National Monument, Iowa during the 2009 bird breeding season. Within the scale in which habitat parameters are collected, 50-m plot, 5-m subplot, and 1.78-m sample plot, percentages of coverage may not necessarily sum to 100% as values are averaged over mid-point values of cover classes (i.e. class 1 = 0.5%, class 2 = 3.0%, class 3 = 15.0%, class 4 = 37.5%, class 5 = 62.5%, class 6 = 85.0%, and class 7 = 97.5%).

Habitat Parameter	Averages (\pm std dev)
	50 meter plot
Field/Prairie (%)	4.43 (17.82)
Wooded Floodplain (%)	15.07 (34.35)
Pond (%)	0.09 (0.51)
Trail (%)	1.06 (2.75)
Woodland (%)	75.82 (37.18)
	5 meter subplot
Canopy Cover	
Hardwood (%)	88.95 (27.53)
Canopy Height	
Hardwood (m)	23.51 (8.23)
Basal Area	
Hardwood (m ² / ha)	9.48 (4.65)
Vegetation Profile	
0.00 – 0.25 m (%)	85.68 (28.14)
0.25 – 0.50 m (%)	70.56 (37.98)
0.50 – 0.75 m (%)	32.12 (42.34)
0.75 – 1.00 m (%)	19.57 (35.97)
1.00 – 1.25 m (%)	14.16 (30.48)
1.25 – 1.50 m (%)	4.32 (15.00)
1.50 – 1.75 m (%)	8.66 (23.00)
1.75 – 2.00 m (%)	12.35 (30.10)
Vertical structure diversity (%)	24.26 (15.09)
	1.78 meter sample plot
Deciduous Litter (%)	51.38 (27.03)
Grass Litter (%)	6.76 (22.43)
Bare Soil (%)	10.34 (15.15)
Rock (%)	4.38 (17.01)
Woody Debris (%)	15.82 (13.87)
Unvegetated (%)	74.04 (17.52)
Cool-season Grass (%)	6.90 (17.68)
Warm-season Grass (%)	0.44 (2.57)
Forb (%)	23.68 (18.64)
Moss and Lichen (%)	3.00 (5.22)
Woody Shrub and Vine (%)	3.18 (3.21)
Tree Seedling (%)	1.50 (3.64)
Total Foliar (%)	23.31 (25.65)

Table 5. Stems per hectare of trees found on Effigy Mounds National Monument, Iowa by size class, during the 2009 bird breeding season. Stems per hectare of trees are reported by family.

Family	<1.0 cm	1.1 – 2.5 cm	2.6 – 8.0 cm	8.1 – 15.0 cm	15.1 – 23.0 cm	23.1 – 38.0 cm	>38.0 cm
Aceraceae	3.75	11.24	67.42	52.43	37.45	41.20	33.71
Betulaceae	--	--	22.47	7.49	--	--	--
Cornaceae	22.47	--	3.75	--	--	--	--
Fagaceae	--	--	3.75	3.75	3.75	7.49	11.24
Juglandaceae	--	7.49	37.45	18.73	14.98	--	--
Oleaceae	3.75	3.75	11.24	3.75	18.73	--	3.75
Rosaceae	--	3.75	3.75	3.75	3.75	3.75	--
Salicaceae	--	--	--	--	--	3.75	--
Tiliaceae	--	--	7.49	22.47	11.24	7.49	3.75
Ulmaceae	18.73	22.47	97.38	41.20	7.49	3.75	--
Total Stems	48.69	59.93	292.13	168.54	101.12	74.91	63.67
Snag	--	11.24	37.45	14.98	3.75	7.49	11.24

Summary

Bird surveys and habitat assessment work were initiated at Effigy Mounds National Monument, Iowa in 2009, to assist the park in assessing the ecological integrity of habitat on the Monument through time. Sixty-six of the 71 bird species recorded are permanent or summer residents to the area (Stokes and Stokes 1996). Current efforts to restore and maintain the mixed habitats at EFMO should provide a diversity of habitats necessary to meet the varied requirements of the 15 breeding species of continental importance observed.

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Appendix

Appendix 1. Waypoints for Effigy Mounds National Monument, Iowa – UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
EFMOTweety1	647837.313	4774424.000	EFMO_1
EFMOTweety2	647783.375	4774027.500	EFMO_2
EFMOTweety3	647729.438	4773631.000	EFMO_3
EFMOTweety4	645297.438	4773558.500	EFMO_4
EFMOTweety5	645693.813	4773504.500	EFMO_5
EFMOTweety6	646090.125	4773450.500	EFMO_6
EFMOTweety7	646486.500	4773396.500	EFMO_7
EFMOTweety8	647675.563	4773235.000	EFMO_8
EFMOTweety9	648071.875	4773181.000	EFMO_9
EFMOTweety10	644847.188	4773216.000	EFMO_10
EFMOTweety11	645243.563	4773162.000	EFMO_11
EFMOTweety12	645639.875	4773108.000	EFMO_12
EFMOTweety13	646036.250	4773054.000	EFMO_13
EFMOTweety14	646432.563	4773000.000	EFMO_14
EFMOTweety15	647225.313	4772892.500	EFMO_15
EFMOTweety16	647621.625	4772838.500	EFMO_16
EFMOTweety17	648018.000	4772784.500	EFMO_17
EFMOTweety18	644793.250	4772819.500	EFMO_18
EFMOTweety19	645189.625	4772765.500	EFMO_19
EFMOTweety20	645586.000	4772711.500	EFMO_20
EFMOTweety21	645982.313	4772658.000	EFMO_21
EFMOTweety22	646378.688	4772604.000	EFMO_22
EFMOTweety23	646775.063	4772550.000	EFMO_23
EFMOTweety24	647171.375	4772496.000	EFMO_24
EFMOTweety25	647567.750	4772442.000	EFMO_25
EFMOTweety26	643946.688	4772531.000	EFMO_26
EFMOTweety27	645532.063	4772315.500	EFMO_27
EFMOTweety28	645928.438	4772261.500	EFMO_28
EFMOTweety29	646324.750	4772207.500	EFMO_29
EFMOTweety30	646721.125	4772153.500	EFMO_30
EFMOTweety31	647117.500	4772099.500	EFMO_31
EFMOTweety32	647513.813	4772046.000	EFMO_32
EFMOTweety33	643892.750	4772134.500	EFMO_33
EFMOTweety34	645874.500	4771865.000	EFMO_34
EFMOTweety35	646667.188	4771757.000	EFMO_35
EFMOTweety36	647063.563	4771703.500	EFMO_36
EFMOTweety37	647459.938	4771649.500	EFMO_37
EFMOTweety38	647856.250	4771595.500	EFMO_38
EFMOTweety39	645424.250	4771522.500	EFMO_39
EFMOTweety40	645820.625	4771468.500	EFMO_40
EFMOTweety41	646613.313	4771361.000	EFMO_41
EFMOTweety42	647406.000	4771253.000	EFMO_42
EFMOTweety43	647802.375	4771199.000	EFMO_43
EFMOTweety44	647352.063	4770856.500	EFMO_44
EFMOTweety45	647748.438	4770803.000	EFMO_45
EFMOTweety46	647298.188	4770460.500	EFMO_46
EFMOTweety47	647694.563	4770406.500	EFMO_47
EFMOTweety48	647640.625	4770010.000	EFMO_48
EFMOTweety49	648037.000	4769956.000	EFMO_49
EFMOTweety50	649428.607	4756445.473	EFMO_50
EFMOTweety51	649374.693	4756049.123	EFMO_51
EFMOTweety52	649320.780	4755652.773	EFMO_52