



Bird Monitoring at Hopewell Culture National Historical Site, Ohio: 2005-2007 Status Report

Natural Resource Technical Report NPS/HTLN/NRTR—2008/101



ON THE COVER

Landscape at Hopewell Culture National Historical Site
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Bird Monitoring at Hopewell Culture National Historical Site, Ohio: 2005-2007 Status Report

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Executive Summary

During 2005, the Heartland I&M Network and Prairie Cluster Prototype Monitoring Program (HTLN) initiated breeding bird surveys on 27 plots at Hopewell Culture National Historical Site, Ohio (HOCU) to address two objectives through time. The first objective is to monitor changes in bird community composition and abundance. The second objective is to monitor the responses of bird communities to changes in habitat structure and other habitat variables related to management activities. This report provides plot specific and park-wide data on populations and breeding habitat of birds at HOCU. Results from 2005 through 2007 serve as a baseline for monitoring future changes in bird populations and habitat. We recorded 67 species of birds during the three years of surveys. Thirty species are permanent residents of Ohio. Thirty-six species are summer residents only. The remaining species is a migrant. Partners in Flight, a coalition of agencies and individuals whose mission is to conserve North America's declining bird populations, have classified 15 species recorded on the park as species of continental importance. Seven of the species of continental importance were observed annually, demonstrating the importance of the park to bird conservation. Red-winged blackbird is the most common species at HOCU during the breeding season, followed by Field sparrow, Indigo bunting, Northern cardinal, Song sparrow, American robin, Eastern meadowlark, Dickcissel, and Grasshopper sparrow. Eighteen species were represented by a single observation in only one of the three survey years. However, the occurrence of many of these rare species in the second and third survey years helped increase the species richness and diversity of these later years.

Initial habitat assessments show that bird plots are generally located in fescue/orchard grass or old field habitats, with a small amount of several other habitat types present on plots. The mixed structural composition of habitats at HOCU positively influenced the diversity of birds observed. With this report, park staff will be able to better plan management objectives, and future monitoring will aid in assessing their effectiveness. Monitoring data also provide park staff with additional information for use in interpreting their natural resources.

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, 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 in their parks through their interpretive programs.

Historically, lands in and around Hopewell Culture National Historical Site, Ohio (HOCU) were diverse and complex. The Prairie Peninsula with its tallgrass prairie, savannah, and forested riparian habitats approaches the park from the north and west (Fitzgerald et al. 2000). To the south and east are the Ohio Hills, with their oak-hickory forest (Rosenberg and Dettmers 2004). The Interior Low Plateaus, with its diverse Midwestern and eastern plant communities, lays south-west of the park (Ford et al. 2000), and likely influences birds and habitat in the park. To date, conversion of upwards of 83% of the lands in the Prairie Peninsula to agricultural use (i.e., row crops or hay pastures, Fitzgerald et al. 2000) has occurred, with lands on the park being no exception. Similar land conversions have occurred in the Ohio Hills and Interior Low Plateau.

Data collected during the U.S. Geological Survey's annual North American Breeding Bird Surveys (BBS) between 1966 and 2007 indicate that many bird species in Ohio show evidence of population declines (Sauer et al. 2008). Grassland species such as the Brown-headed cowbird (*Molothrus ater*), Eastern meadowlark (*Sturnella magna*), Field sparrow (*Spizella pusilla*), Grasshopper sparrow (*Ammodramus savannarum*), Henslow's sparrow (*Ammodramus henslowii*), Red-winged blackbird (*Agelaius phoeniceus*), and Song sparrow (*Melospiza melodia*) have declined at alarming rates. Woodland species such as the Acadian flycatcher (*Empidonax virescens*), Eastern wood-pewee (*Contopus virens*), and Tufted titmouse (*Parus bicolor*) have also declined, along with some more habitat generalists like the Northern bobwhite (*Colinus virginianus*), Northern flicker (*Colaptes auratus*), and Ring-necked pheasant (*Phasianus colchicus*). The destruction and fragmentation of landscapes, as well as structural degradation of remaining habitats, have contributed to these declines.

We use trends in the composition and abundance of bird populations as long-term indicators of ecosystem integrity in the bird habitats of HOCU. Ecosystem integrity is defined as the system's capability to maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organization comparable to that of 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 numbers and composition of the bird community in the prairie, savannah or forest habitats of the park may reflect management's effectiveness at restoring these communities. At HOCU, efforts to restore a native prairie are underway. Monitoring, initiated in 2005, will aid in assessing the success of restoration effort. 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.

Objectives

There are two primary objectives for monitoring breeding birds at Hopewell Culture National Historical Site:

- Identify significant temporal changes in the species composition and abundance of the 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 prescribed fire on bird populations by correlating changes in bird community composition and abundance with changes in specific habitat variables (e.g. vegetation structure, ground cover).

This report summarizes survey results for the first three years of monitoring.

Methods

Site Selections

Permanent monitoring locations or 'plots' were selected by overlaying a systematic grid of 400 x 400 meter cells (originating from a random start point) on all five units of the park. Our sampling grid also matches an established grid that had been used to conduct bird inventories on the park. We established 27 permanent plots at HOCU (Figure 1).

During bird surveys, monitoring plots are located using navigation way-points (Table 1) in a GPS unit and temporarily marked with 36 inch pin flags to aid in re-locating the plots for habitat assessment, thus eliminating the need for permanent plot markers. We collected pin flags from each plot once the habitat work was completed. Monitoring plots were re-located each year we conduct a bird survey.

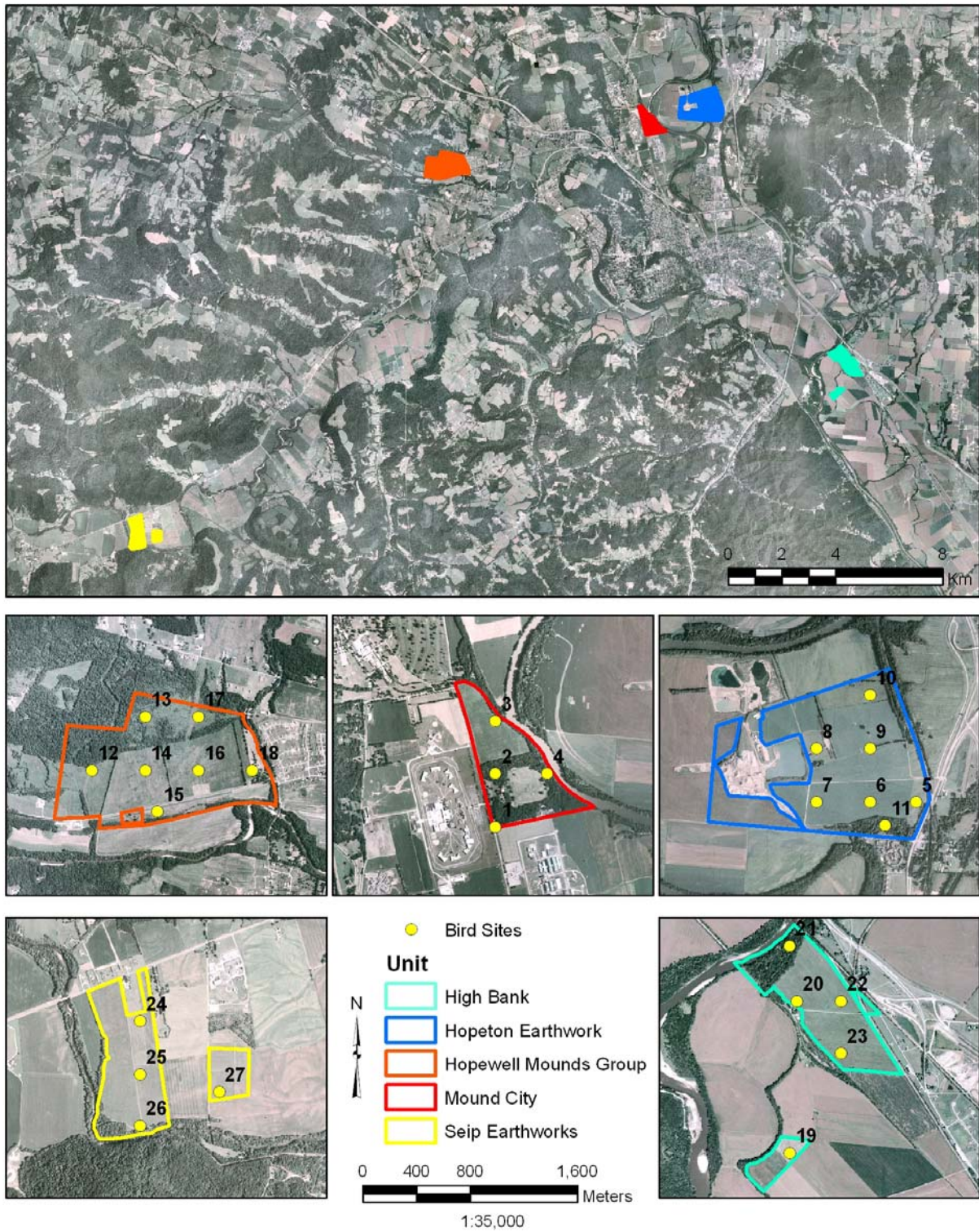


Figure 1. Bird plot locations on Hopewell Culture National Historical Site, Ohio.

Table 1. Plot I.D. and habitat type for each breeding bird survey plot at Hopewell Culture National Historical Site, Ohio. Also given are x and y UTM coordinates for each plot. UTM Zone 17 North, Datum 1983 (Conus).

Plot I.D.	Habitat Type	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
HOCUTweety1 Lawn	/ Woodland	327116.650	4360162.840	MCVCP1
HOCUTweety2 W	oodland	327116.650	4360562.010	MCVCP2
HOCUTweety3 Fescu	e-Orchard Grass	327116.650	4360953.620	MCVCP4
HOCUTweety4	Lawn / Riparian Woodland	327503.720	4360562.010	MCVCP3
HOCUTweety5 Fescu	e-Orchard Grass	329876.420	4360965.010	HTVCP1
HOCUTweety6 Fescu	e-Orchard Grass	329534.060	4360965.010	HTVCP2
HOCUTweety7 Fescu	e-Orchard Grass	329135.980	4360965.010	HTVCP3
HOCUTweety8 Fescu	e-Orchard Grass	329135.980	4361364.530	HTVCP5
HOCUTweety9 Fescu	e-Orchard Grass	329534.060	4361364.530	HTVCP6
HOCUTweety10 Resto	red Prairie	329534.060	4361765.480	HTVCP7
HOCUTweety11 Rip	arian Woodland	329648.180	4360790.860	HTVCP8
HOCUTweety12 O	ld Field	319135.000	4358980.000	HWVCP1
HOCUTweety13 Sh	rub / Woodland	319534.000	4359380.000	HWVCP2
HOCUTweety14 Fescu	e-Orchard Grass	319534.000	4358980.000	HWVCP3
HOCUTweety15 O	ld Field	319625.000	4358670.000	HWVCP4
HOCUTweety16 Fescu	e-Orchard Grass	319933.000	4358980.000	HWVCP5
HOCUTweety17 O	ld Field	319933.000	4359380.000	HWVCP6
HOCUTweety18 Fescu	e-Orchard Grass	320332.000	4358980.000	HWVCP7
HOCUTweety19 O	ld Field	334310.530	4350593.650	HBVCP1
HOCUTweety20 Fescu	e-Orchard Grass	334364.530	4351727.860	HBVCP3
HOCUTweety21 Rip	arian Woodland	334310.530	4352141.990	HBVCP4
HOCUTweety22 Fescu	e-Orchard Grass	334693.860	4351727.860	HBVCP5
HOCUTweety23 O	ld Field	334693.860	4351337.690	HBVCP6
HOCUTweety24 O	ld Field	308213.000	4345591.000	SPVCP1
HOCUTweety25 O	ld Field	308213.000	4345192.000	SPVCP2
HOCUTweety26	Old Field / Riparian Woodland	308213.000	4344810.000	SPVCP3
HOCUTweety27 O	ld Field	308802.000	4345059.999	SPVCP4

Bird Surveys

Bird surveys followed methods outlined in the bird monitoring protocol by Peitz et al. (2003) 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 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 travelling 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. We sampled all 27 plots in each of three years: 2005, 2006 and 2007. Sample dates were June 1 to June 3, May 31 to June 2, and June 12 to June 13, respectively. 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 counts were started as soon as the observer reached plot center. Our method took into account the fact that birds close to the observer have a higher probability of being detected (if they were not flushed) than birds far from the observer and that different species have different detection functions (i.e., the probability of detecting a bird at different distances from the observer). An important assumption of the method is that a bird exactly at the center of the plot has a probability of $p = 1$ of being detected, and that there is a high probability of detecting birds within the first 5-10 meters of plot center. The most important birds to detect are those very close to the observer (within the first 5-10 meters), and it is highly desirable that estimated distances, or those taken with a rangefinder, be within 1-2 meters of actual distances for any bird within 20 meters of the observer. However, we recorded all birds seen or heard along with distance from the observer when possible. For this report, all birds seen or heard during the full 5-min are included.

Bird Habitat

The collection of habitat data followed methods outlined in the bird monitoring protocol by Peitz et al. (2003) and summarized below. 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 a survey. In 2005 and 2006, once the habitat crew arrived at a plot, they set up subplot one (plot center) and completed all habitat measures for this subplot and the 50-m radius plot. Next, subplots two, three and four were located and habitat measures completed (Figure 2). The azimuth to subplot two was determined randomly, and subplots three and four were positioned 120 degrees on either side of two. Azimuths were determined during the first year of monitoring and maintained in the subsequent year. In 2007, habitat measures were taken on subplot one and the 50-m radius plot

only. Before data analyzes, subplot values in 2005 and 2006 are averaged to obtain a plot value for comparison to the 2007 single subplot values.

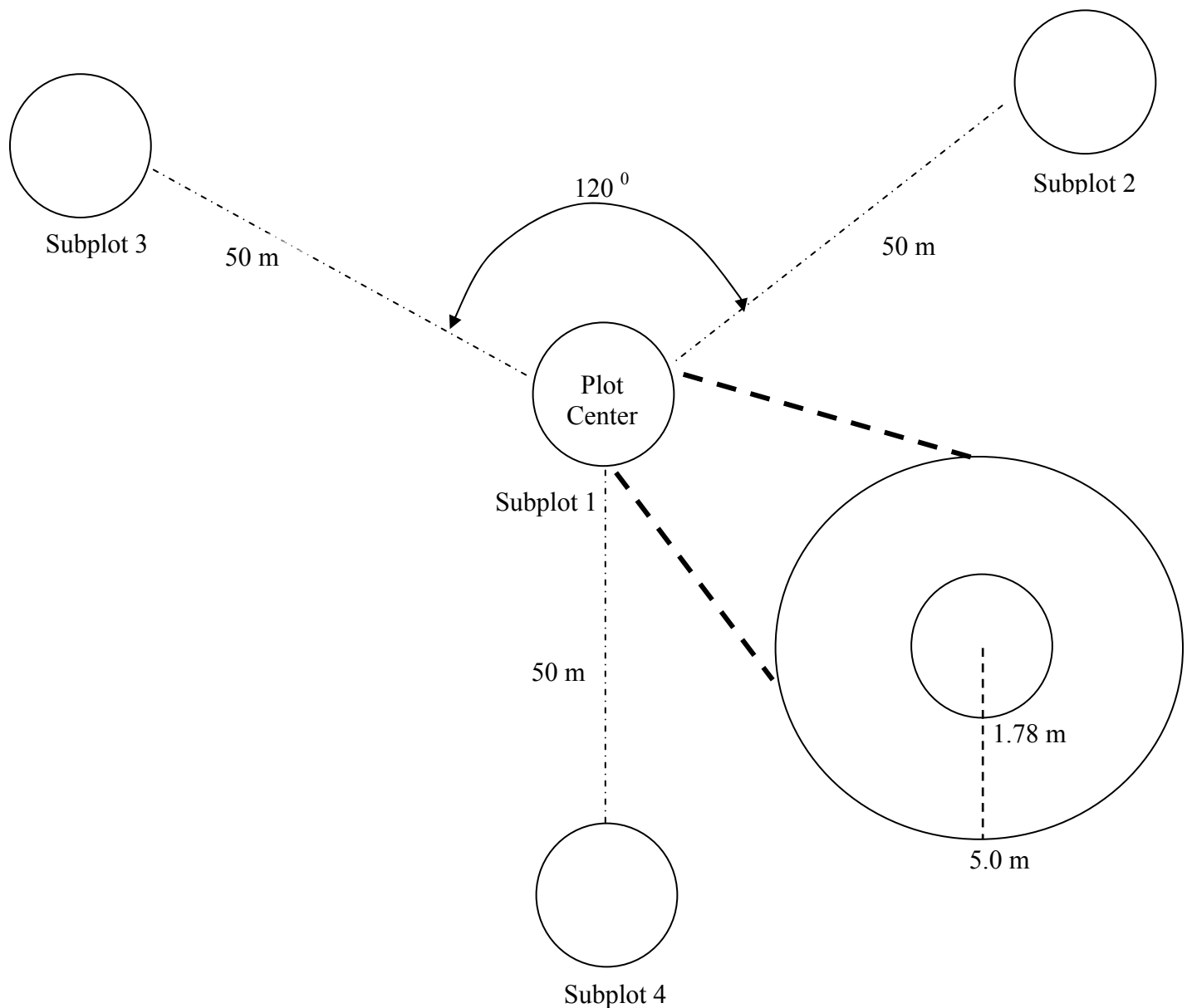


Figure 2. Spatial arrangement of vegetation subplots.

Habitat available to each bird species was characterized at a number of different scales. First, slope, slope variability, aspect, aspect variability and topographic position of each 50-m radius plot were determined and recorded. These measurements were recorded once during the first year of monitoring (2005). Each year, the amount of various vegetation types and the amount of road and water cover on each plot were recorded. Second, azimuth ($^{\circ}$) to and slope ($^{\circ}$) and aspect ($^{\circ}$) of each 5-m subplot (Figure 2) were determined and recorded once during the first year of monitoring (2005). Each year a 5-m subplot was sampled, horizontal vegetation cover

was estimated in 0.5-m intervals from 0.0 to 2.0 meters above ground surface using a cover board. The area of the cover board obscured by vegetation was estimated at 5- and 15-m distances from the center of each subplot. 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 each subplot. Locations were in the four cardinal directions. Vertical structure was recorded for deciduous, coniferous and herbaceous vegetation. Third, within each subplot, ground and foliar cover were recorded in 1.78-m radius nested sample plots. Ground cover included deciduous and grass litter, bare soil, rock, woody debris (>2.50 cm DBH) and un-vegetated. Foliar cover was estimated for six plant guilds, including warm- and cool-season grasses, forbs, moss and lichens, shrubs and vines, and tree seedlings and for total foliar cover (<1.50 m tall).

Data Analysis

Prior to summary analysis, the residency status (permanent resident, summer resident, migrant) of each bird species recorded was determined. Identifying the residency of each species helps to exclude migrants from analysis of breeding birds within HOCU. The variable circular plot is the unit of replication for analysis. Once estimates for all parameters have been obtained for each variable circular plot, averages and standard deviations among variable circular plots can be obtained for park-wide inferences.

The frequency and abundance of bird species were reported in four ways, annually. 1) For each species, the number of individuals encountered per plot visit (individuals / plot visit) was averaged over all plots. 2) The proportion of plots occupied by each species was determined (total number of plots occupied by a species/27). 3) Restricting the area of inference to a 100-m radius (3.14 ha) around each plot center, we determined each species density (individuals / 3.14 ha) and averaged these values across all plots (average density $\pm$ std dev). 4) To examine local density, density was calculated using data from only plots where a species was encountered. Distance software, which accounts for un-detected individuals, will be used in future species density estimates once there are enough observations (~60) to do so accurately (Buckland et al. 1993, Buckland et al. 2001). Appendix 1 lists the number of resident individuals recorded on each plot, by species. A map was created showing species richness and the richness of species of continental importance, as determined by Partners in Flight (Rich et al. 2004), by plot.

Annual bird diversity, richness, and distribution evenness were calculated for permanent and summer resident males, by plot, and park-wide averages ($\pm$ std dev) were determined. Flyover males were included in each calculation. Bird diversity values for each plot were calculated 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 population consisting of the i^{th} species (Shannon, 1949). Species richness is the total number of bird taxa recorded per plot. Species distribution evenness was calculated for each plot using Pielou (J):

$$J' = \frac{H'}{\ln H}$$

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

Location and permanent abiotic measures on each plot and habitat subplot were reported. Annual averages ($\pm$ std dev) for semi-permanent plot data, including road and water cover, were calculated from plot estimates. Using calculated plot averages or values, averages ($\pm$ std dev) for horizontal vegetation cover between 0 - 0.5, 0.25 - 0.75, 0.5 - 1.0, 0.75 - 1.25, 1.0 - 1.5, 1.25 - 1.75, and 1.5 - 2.0 meters were calculated for both 5- and 15-m distances. Average ($\pm$ std dev) annual vertical structure diversity was estimated and reported. Vertical structure diversity values were determined for each plot by summing the percents of possible touches (12) from vegetation within each 1-m height increment actually touched; dividing this value by the number of height increments measured (8); adding the resulting value to the percent of increments occupied; multiplying this value by 100; and then dividing it by two. Thus, the vertical structure diversity values is weighted to equally represent both the vertical height of vegetation and how dense the vegetation is within each height increment.

Within each plot, ground cover, including deciduous and grass litter, bare soil, rock, woody debris (>2.50 cm DBH), and unvegetated were averaged across subplots. Foliar cover, by guild of warm- and cool-season grasses, forbs, mosses and lichens, shrubs and vines, tree seedlings, and total foliar cover (<1.50 m tall) were averaged across subplots within a plot as well. Appendix 2 lists average habitat parameter values recorded annually for each plot.

Relationships between the richness of permanent and summer resident males, and three representative habitat variables (maximum vegetation height and percent horizontal vegetation between 0.5-1.0 m height, measured from a distance of 15-m, and structural diversity), in each of three years (2005, 2006, and 2007) across all sites were examined. The variables were not normal distribution, and log transformations failed to normalize the distributions. Therefore, relationships were analyzed using the non-parametric, Spearman's rho. No relationships were significant at $p < 0.05$.

Results

Bird Surveys

Sixty-seven bird species were recorded during the breeding bird surveys at HOCU in 2005-2007 (Table 2). Thirty of the 67 species recorded are classified as permanent residents (Stokes and Stokes 1995). Thirty-six species are classified as summer residents. Classification of the remaining species is migrant. Three species, including the migrant, were observed outside 5-min survey periods. Twenty-seven of the 67 species recorded were observed in each survey year. The remaining species were recorded in only one or two of the survey years. Fifteen species--Acadian flycatcher (*Empidonax virescens*), Blue-winged warbler (*Vermivora pinus*) Brown thrasher (*Toxostoma rufum*), Carolina wren (*Thryothorus ludovicianus*), Dickcissel (*Spiza americana*), Eastern towhee (*Pipilo erythrophthalmus*), Grasshopper sparrow (*Ammodramus savannarum*), Henslow's sparrow (*Ammodramus hensloii*), Indigo bunting (*Passerina cyanea*),

Prairie warbler (*Dendroica discolor*), Red-bellied woodpecker (*Melanerpes carolinus*), White-eyed Vireo (*Vireo griseus*), Willow flycatcher (*Empidonax traillii*), Wood thrush (*Hylocichla mustelina*), and Yellow-throated vireo (*Vireo flavifrons*)--are considered species of continental importance (Rich et al. 2004). The Carolina wren, Dickcissel, Eastern towhee, Grasshopper sparrow, Henslow's sparrow, Indigo bunting, and Wood thrush were recorded in all three survey years, making them good candidates for long-term population monitoring.

The Red-winged blackbird (*Agelaius phoeniceus*) is the most commonly occurring species at HOCU during the breeding season based on the mean number of individuals per plot and the proportion of plots occupied (Tables 3 and 4). Field sparrow (*Spizella pusilla*), Indigo bunting, Northern cardinal (*Cardinalis cardinalis*), Song sparrow (*Melospiza melodia*), American robin (*Turdus migratorius*), Eastern meadowlark (*Sturnella magna*), Dickcissel, and Grasshopper sparrow are moderately abundant, occurring on at least 20% of the plots across the park in most years. Eighteen species were represented by a single observation from plots in only one of the three survey years. Average density of each bird species on the park during the breeding seasons of 2005 through 2007 are listed in Table 5. Average densities of each species for plots they occupied are listed in Table 6. Red-winged blackbird had the highest densities of any species across the park as well as on plots they occupied.

Figures 3a, 3b, and 3c illustrate annual species richness and the richness of species of continental importance by plot for HOCU, for 2005, 2006, and 2007, respectively. Based on average ($\pm$ std dev) species richness, diversity and species distribution evenness values, the bird community at HOCU during the breeding season appears to be getting more diverse (Figure 4). Between 2005 and 2006, and 2006 and 2007 diversity values increased 21.72 and 19.95 %, respectively; species richness increased 51.58 and 47.21 %, respectively; and evenness values increased 4.36 and 1.20 %, respectively.

Table 2. Bird species recorded during breeding bird surveys at Hopewell Culture National Historical Site, Ohio in 2005 – 2007. Residency status of each species is given.

Common name	Species name	AOU code	Residency ¹
Acadian flycatcher	Empidonax virescens	ACFL	SR
American crow	Corvus brachyrhynchos	AMCR	R
American goldfinch	Carduelis tristis	AMGO	R
American robin	Turdus migratorius	AMRO	R
Bank swallow	Riparia riparia	BANS	SR
Barn swallow	Hirundo rustica	BARS	SR
Belted kingfisher	Ceryle alcyon	BEKI	R
Bewick's wren	Thryomanes bewickii	BEWR	SR
Black-throated blue warbler*	Dendroica caerulescens	BTBW	SR
Blue grosbeak	Guiraca caerulea	BLGR	SR
Blue jay	Cyanocitta cristata	BLJA	R
Blue-gray gnatcatcher	Poliophtila caerulea	BGGN	SR
Blue-winged warbler	Vermivora pinus	BWWA	SR
Brown thrasher	Toxostoma rufum	BRTH	SR
Brown-headed cowbird	Molothrus ater	BHCO	R
Canada goose	Branta canadensis	CAGO	R
Carolina chickadee	Parus carolinensis	CACH	R
Carolina wren	Thryothorus ludovicianus	CARW	R
Common grackle	Quiscalus quiscula	COGR	R
Common yellowthroat	Geothlypis trichas	COYE	SR
Dickcissel Spiz	a americana	DICK	SR
Downy woodpecker	Picoides pubescens	DOWO	R
Eastern (Rufous-side) towhee	Pipilo erythrophthalmus	EATO	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 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
Henslow's sparrow	Ammodramus henslowii	HESP	SR
House finch	Carpodacus mexicanus	HOFI	R
House wren	Troglodytes aedon	HOWR	SR
Indigo bunting	Passerina cyanea	INBU	SR
Killdeer* Ch	aradrius vociferous	KILL	R
Mourning dove	Zenaida macroura	MODO	R
Northern (Baltimore) oriole	Icterus galbula	BAOR	SR
Northern (Yellow-shafted) flicker C	olaptes auratus	YSFL	R
Northern bobwhite	Colinus virginianus	NOBO	R
Northern cardinal	Cardinalis cardinalis	NOCA	R

Table 2. continued

Common name	Species name	AOU code	Residency
Northern mockingbird	<i>Minus polyglottos</i>	NOMO	R
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	NRWS	SR
Orchard oriole	<i>Icterus spurius</i>	OROR	SR
Prairie Warbler*	<i>Dendroica discolor</i>	PRAW	M
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
Sedge wren	<i>Cistothorus platensis</i>	SEWR	SR
Song sparrow	<i>Melospiza melodia</i>	SOSP	R
Tree swallow	<i>Tachycineta bicolor</i>	TRES	SR
(Eastern) Tufted titmouse	<i>Baeolophus bicolor</i>	ETTI	R
Turkey vulture	<i>Cathartes aura</i>	TUVU	SR
Warbling vireo	<i>Vireo gilvus</i>	WAVI	SR
White-eyed vireo	<i>Vireo griseus</i>	WEVI	SR
Willow flycatcher	<i>Empidonax traillii</i>	WIFL	SR
Wood duck	<i>Aix sponsa</i>	WODU	SR
Wood thrush	<i>Hylocichla mustelina</i>	WOTH	SR
Yellow warbler	<i>Dendroica petechia</i>	YWAR	SR
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	YBCU	SR
Yellow-breasted chat	<i>Icteria virens</i>	YBCH	SR
Yellow-throated vireo	<i>Vireo flavifrons</i>	YTVI	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; According to Stokes and Stokes (1995).

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 continental importance (Rich et al. 2004).

Table 3. Number of individuals encountered per plot visit (including flyovers), averaged over all 27 plots annually, for bird species recorded at Hopewell Culture National Historical Site, Ohio during breeding bird surveys. Individual species results are listed by year, 2005-2007.

Common name	Species name	2005 Individual / plot visit	2006 Individuals / plot visit	2007 Individuals / plot visit
Acadian flycatcher	Empidonax virens	--	--	0.04
American crow	Corvus brachyrhynchos	0.07	0.07	0.04
American goldfinch	Carduelis tristis	0.04	0.19	0.19
American robin	Turdus migratorius	0.22	0.26	0.30
Bank swallow	Riparia riparia	--	0.04	--
Barn swallow	Hirundo rustica	--	0.04	--
Belted kingfisher	Ceryle alcyon	0.04	0.04	--
Bewick's wren	Thryomanes bewickii	--	0.19	--
Blue grosbeak	Guiraca caerulea	--	0.19	0.04
Blue jay	Cyanocitta cristata	0.04	0.07	0.07
Blue-gray gnatcatcher	Polioptila caerulea	0.04	--	0.04
Blue-winged warbler	Vermivora pinus	--	0.04	--
Brown thrasher	Toxostoma rufum	--	0.15	0.11
Brown-headed cowbird	Molothrus ater	0.04	0.04	--
Canada goose	Branta canadensis	--	0.04	--
Carolina chickadee	Parus carolinensis	--	--	0.07
Carolina wren	Thryothorus ludovicianus	0.30	0.11	0.11
Common grackle	Quiscalus quiscula	--	--	0.07
Common yellowthroat	Geothlypis trichas	0.22	0.11	0.37
Dickcissel Spiz	a americana	0.30 0.19 0.26		
Downy woodpecker	Picoides pubescens	--	--	0.04
Eastern (Rufous-side) towhee	Pipilo erythrophthalmus	0.11	0.07	0.19
Eastern bluebird	Sialia sialis	--	0.15	--
Eastern kingbird	Tyrannus tyrannus	--	0.04	--
Eastern meadowlark	Sturnella magna	0.33	0.26	0.15
Eastern phoebe	Sayornis phoebe	0.04	--	--
Eastern wood-pewee	Contopus virens	0.04 0.	19 0.	07
European starling	Sturnus vulgaris	0.04 0.	04 0.	30
Field sparrow	Spizella pusilla	0.26	0.37	0.56
Grasshopper sparrow	Ammodramus savannarum	0.19 0.	37 0.	15
Gray catbird	Dumetella carolinensis	--	0.04	0.04
Great blue heron	Ardea herodias	0.04	0.07	--
Henslow's sparrow	Ammodramus henslowii	0.07	0.07	0.11
House finch	Carpodacus mexicanus	0.04	--	--
House wren	Troglodytes aedon	0.04	--	0.11
Indigo bunting	Passerina cyanea	0.30	0.19	0.56
Mourning dove	Zenaida macroura	0.04	0.19	0.11
Northern (Baltimore) oriole	Icterus galbula	0.04	--	0.07
Northern (Yellow-shafted) flicker	Colaptes auratus	--	--	0.04
Northern bobwhite	Colinus virginianus	0.15	0.07	0.04

Table 3. continued

Common name	Species name	2005 Individual / plot visit	2006 Individuals / plot visit	2007 Individuals / plot visit
Northern cardinal	<i>Cardinalis cardinalis</i>	0.22	0.19	0.48
Northern mockingbird	<i>Mimus polyglottos</i>	--	--	0.07
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	--	--	0.04
Orchard oriole	<i>Icterus spurius</i>	--	--	0.07
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	--	--	0.04
Red-eyed vireo	<i>Vireo olivaceus</i>	0.04 0.07	0.04	
Red-tailed hawk	<i>Buteo jamaicensis</i>	0.04	0.04	0.07
Red-winged blackbird Agel	<i>Agelaius phoeniceus</i> 2.	19	2.04	1.89
Ring-necked pheasant	<i>Phasianus colchicus</i>	0.22	0.04	0.04
Rock dove	<i>Columba livia</i>	0.07	--	--
Sedge wren	<i>Cistothorus platensis</i>	--	--	0.04
Song sparrow	<i>Melospiza melodia</i>	0.33	0.15	0.37
Tree swallow	<i>Tachycineta bicolor</i>	0.30 0.	07 0.	15
(Eastern) Tufted titmouse	<i>Baeolophus bicolor</i>	0.15	0.07	--
Turkey vulture	<i>Cathartes aura</i>	0.04	--	--
Warbling vireo	<i>Vireo gilvus</i>	--	--	0.04
White-eyed vireo	<i>Vireo griseus</i>	--	--	0.04
Willow flycatcher	<i>Empidonax traillii</i>	--	--	0.15
Wood duck	<i>Aix sponsa</i>	--	--	0.04
Wood thrush	<i>Hylocichla mustelina</i>	0.07 0.	11 0.	11
Yellow warbler	<i>Dendroica petechia</i>	0.15 0.	22 0.	04
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	--	0.04	0.07
Yellow-breasted chat	<i>Icteria virens</i>	0.19	0.26	0.15
Yellow-throated vireo	<i>Vireo flavifrons</i>	--	--	0.04

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

Table 4. Proportion of plots (out of 27) occupied annually by bird species (including flyovers) at Hopewell Culture National Historical Site, Ohio during breeding bird surveys. Individual species results are listed by year, 2005-2007.

Common name	Species name	2005 Proportion of plots occupied	2006 Proportion of plots occupied	2007 Proportion of plots occupied
Acadian flycatcher	Empidonax virescens	-- --		0.04
American crow	Corvus brachyrhynchos	0.07	0.07	0.04
American goldfinch	Carduelis tristis	0.04	0.11	0.15
American robin	Turdus migratorius	0.22	0.19	0.22
Bank swallow	Riparia riparia	--	0.04	--
Barn swallow	Hirundo rustica	--	0.04	--
Belted kingfisher	Ceryle alcyon	0.04	0.04	--
Bewick's wren	Thryomanes bewickii	--	0.15	--
Blue grosbeak	Guiraca caerulea	--	0.04	0.04
Blue jay	Cyanocitta cristata	0.04	0.07	0.07
Blue-gray gnatcatcher	Polioptila caerulea	0.04	--	0.04
Blue-winged warbler	Vermivora pinus	--	0.04	--
Brown thrasher	Toxostoma rufum	-- 0.	11	0.11
Brown-headed cowbird	Molothrus ater	0.04	0.04	--
Canada goose	Branta canadensis	--	0.04	--
Carolina chickadee	Parus carolinensis	--	--	0.07
Carolina wren	Thryothorus ludovicianus	0.26 0.	11 0.	11
Common grackle	Quiscalus quiscula	--	--	0.07
Common yellowthroat	Geothlypis trichas	0.15	0.11	0.30
Dickcissel Spiz	a americana	0.22 0.	11 0.	19
Downy woodpecker	Picoides pubescens	--	--	0.04
Eastern (Rufous-side) towhee	Pipilo erythrophthalmus	0.11 0.	07 0.	19
Eastern bluebird	Sialia sialis	--	0.07	--
Eastern kingbird	Tyrannus tyrannus	--	0.04	--
Eastern meadowlark	Sturnella magna	0.33	0.19	0.11
Eastern phoebe	Sayornis phoebe	0.04	--	--
Eastern wood-pewee	Contopus virens	0.04 0.	19 0.	07
European starling	Sturnus vulgaris	0.04 0.	04 0.	22
Field sparrow	Spizella pusilla	0.26	0.22	0.33
Grasshopper sparrow	Ammodramus savannarum	0.19 0.	26 0.	15
Gray catbird	Dumetella carolinensis	--	0.04	0.04
Great blue heron	Ardea herodias	0.04	0.07	--
Henslow's sparrow	Ammodramus henslowii	0.04 0.	04 0.	04
House finch	Carpodacus mexicanus	0.04	--	--
House wren	Troglodytes aedon	0.04	--	0.11
Indigo bunting	Passerina cyanea	0.19 0.	15 0.	41
Mourning dove	Zenaida macroura	0.04	0.11	0.07
Northern (Baltimore) oriole	Icterus galbula	0.04	--	0.07
Northern (Yellow-shafted) flicker	Colaptes auratus	--	--	0.04

Table 4. continued

Common name	Species name	2005 Proportion of plots occupied	2006 Proportion of plots occupied	2007 Proportion of plots occupied
Northern bobwhite	<i>Colinus virginianus</i>	0.11	0.04	0.04
Northern cardinal	<i>Cardinalis cardinalis</i>	0.22	0.19	0.37
Northern mockingbird	<i>Mimus polyglottos</i>	--	--	0.07
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	--	--	0.04
Orchard oriole	<i>Icterus spurius</i>	--	--	0.07
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	-- --		0.04
Red-eyed vireo	<i>Vireo olivaceus</i>	0.04 0.07 0.04		
Red-tailed hawk	<i>Buteo jamaicensis</i>	0.04	0.04	0.07
Red-winged blackbird Agel	<i>Agelaius phoeniceus</i>	0.63	0.67	0.67
Ring-necked pheasant	<i>Phasianus colchicus</i>	0.22	0.04	0.04
Rock dove	<i>Columba livia</i>	0.04	--	--
Sedge wren	<i>Cistothorus platensis</i>	--	--	0.04
Song sparrow	<i>Melospiza melodia</i>	0.26	0.04	0.30
Tree swallow	<i>Tachycineta bicolor</i>	0.26 0.	0.07 0.	0.07
(Eastern) Tufted titmouse	<i>Baeolophus bicolor</i>	0.11	0.07	--
Turkey vulture	<i>Cathartes aura</i>	0.04	--	--
Warbling vireo	<i>Vireo gilvus</i>	--	--	0.04
White-eyed vireo	<i>Vireo griseus</i>	--	--	0.04
Willow flycatcher	<i>Empidonax traillii</i>	--	--	0.15
Wood duck	<i>Aix sponsa</i>	--	--	0.04
Wood thrush	<i>Hylocichla mustelina</i>	0.07 0.	0.11 0.	0.11
Yellow warbler	<i>Dendroica petechia</i>	0.15 0.	0.15 0.	0.04
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	--	0.04	0.07
Yellow-breasted chat	<i>Icteria virens</i>	0.19	0.22	0.11
Yellow-throated vireo	<i>Vireo flavifrons</i>	-- --		0.04

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

Table 5. Average breeding bird densities ($\pm$ std. dev.) at Hopewell Culture National Historical Site, Ohio. Individual species results are listed by year, 2005-2007. Species densities are only for individuals recorded within 100-m of plot center during a 5-min survey, excluding flyovers.

Common name	Species name	2005 Indiv. / ha	2006 Indiv. / ha	2007 Indiv. / ha
Acadian flycatcher	Empidonax virescens	--	--	0.01 (0.06)
American goldfinch	Carduelis tristis	0.04 (0.18)	0.07 (0.37)	0.01 (0.06)
American robin	Turdus migratorius	0.02 (0.08)	0.08 (0.21)	0.07 (0.20)
Belted kingfisher	Ceryle alcyon	0.01 (0.06)	--	--
Bewick's wren	Thryomanes bewickii	--	0.06 (0.15)	--
Blue grosbeak	Guiraca caerulea	--	0.05 (0.25)	--
Blue jay	Cyanocitta cristata	0.01 (0.06)	0.01 (0.06)	0.02 (0.09)
Blue-gray gnatcatcher	Poliophtila caerulea	0.01 (0.06)	-- 0.01	(0.06)
Blue-winged warbler	Vermivora pinus	--	0.01 (0.06)	--
Carolina chickadee	Parus carolinensis	--	--	0.01 (0.06)
Carolina wren	Thryothorus ludovicianus	0.06 (0.15)	0.02 (0.09)	0.02 (0.09)
Common yellowthroat	Geothlypis trichas	0.05 (0.19)	0.04 (0.10)	0.04 (0.10)
Dickcissel	Spiza americana	0.09 (0.32)	0.06 (0.18)	0.06 (0.20)
Downy woodpecker	Picoides pubescens	--	--	0.01 (0.06)
Eastern (Rufous-side) towhee	Pipilo erythrophthalmus	0.01 (0.06)	0.01 (0.06)	0.02 (0.09)
Eastern bluebird	Sialia sialis	--	0.04 (0.18)	--
Eastern meadowlark	Sturnella magna	0.05 (0.12)	0.04 (0.13)	0.01 (0.06)
Eastern phoebe	Sayornis phoebe	0.01 (0.06)	--	--
Eastern wood-pewee	Contopus virens	0.01 (0.06)	0.05 (0.12)	--
European starling	Sturnus vulgaris	--	--	0.01 (0.06)
Field sparrow	Spizella pusilla	0.04 (0.10)	0.05 (0.15)	0.14 (0.35)
Grasshopper sparrow	Ammodramus savannarum	0.01 (0.06)	0.12 (0.22)	0.01 (0.06)
Gray catbird	Dumetella carolinensis	--	0.01 (0.06)	--
Henslow's sparrow	Ammodramus henslowii	0.02 (0.12)	0.02 (0.12)	0.04 (0.18)
House finch	Carpodacus mexicanus	0.01 (0.06)	--	--
House wren	Troglodytes aedon	0.01 (0.06)	--	--
Indigo bunting	Passerina cyanea	0.06 (0.22)	0.04 (0.13)	0.09 (0.19)
Mourning dove	Zenaida macroura	--	0.01 (0.06)	--
Northern (Baltimore) oriole	Icterus galbula	0.01 (0.06)	--	0.01 (0.06)
Northern cardinal	Cardinalis cardinalis	0.02 (0.09)	0.02 (0.09)	0.09 (0.19)
Northern mockingbird	Mimus polyglottos	--	--	0.01 (0.06)
Red-eyed vireo	Vireo olivaceus	-- 0.01	(0.06)	0.01 (0.06)
Red-winged blackbird	Agelaius phoeniceus	0.57 (0.89)	0.53 (0.78)	0.37 (0.46)
Rock dove	Columba livia	0.02 (0.12)	--	--
Song sparrow	Melospiza melodia	0.05 (0.19)	0.05 (0.25)	0.07 (0.16)
Tree swallow	Tachycineta bicolor	0.11 (0.55)	--	0.04 (0.18)
(Eastern) Tufted titmouse	Baeolophus bicolor	0.02 (0.12)	0.01 (0.06)	--
Willow flycatcher	Empidonax traillii	--	--	0.04 (0.10)
Wood thrush	Hylocichla mustelina	0.01 (0.06)	0.04 (0.10)	0.01 (0.06)

Table 5. continued

Common name	Species name	2005 Indiv. / ha	2006 Indiv. / ha	2007 Indiv. / ha
Yellow warbler	<i>Dendroica petechia</i>	0.01 (0.06)	0.04 (0.13)	0.01 (0.06)
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	--	0.01 (0.06)	--
Yellow-breasted chat	<i>Icteria virens</i>	0.06 (0.13)	0.06 (0.15)	0.04 (0.14)

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

Table 6. Average annual bird density ($\pm$ std. dev.) for plots occupied at Hopewell Culture National Historical Site, Ohio during breeding bird surveys. Individual species results are listed by year, 2005-2007. Species densities are only for individuals recorded within 100-m of plot center during a 5-min survey, excluding flyovers. A standard deviation of 0.00 indicates the species occurred on two or more plots with equal density. When a species occurred on only one plot, a standard deviation could not be calculated.

Common name	Species name	2005 Indiv. / ha	2006 Indiv. / ha	2007 Indiv. / ha
Acadian flycatcher	Empidonax virescens	--	--	0.32
American goldfinch	Carduelis tristis	0.96	1.91	0.32
American robin	Turdus migratorius	0.32 (0.00)	0.45 (0.28)	0.48 (0.32)
Belted kingfisher	Ceryle alcyon	0.32	--	--
Bewick's wren	Thryomanes bewickii	--	0.40 (0.16)	--
Blue grosbeak	Guiraca caerulea	--	1.27	--
Blue jay	Cyanocitta cristata	0.32	0.32	0.32 (0.00)
Blue-gray gnatcatcher	Polioptila caerulea	0.32	--	0.32
Blue-winged warbler	Vermivora pinus	--	0.32	--
Carolina chickadee	Parus carolinensis	--	--	0.32
Carolina wren	Thryothorus ludovicianus	0.40 (0.16)	0.32 (0.00)	0.32 (0.00)
Common yellowthroat	Geothlypis trichas	0.64 (0.45)	0.32 (0.00)	0.32 (0.00)
Dickcissel Spiz	a americana	0.64 (0.64)	0.53 (0.18)	0.53 (0.37)
Downy woodpecker	Picoides pubescens	--	--	0.32
Eastern (Rufous-side) towhee	Pipilo erythrophthalmus	0.32	0.32	0.32 (0.00)
Eastern bluebird	Sialia sialis	--	1.00	--
Eastern meadowlark	Sturnella magna	0.32	0.45 (0.23)	0.32
Eastern phoebe	Sayornis phoebe	0.32	--	--
Eastern wood-pewee	Contopus virens	0.32	0.32 (0.00)	--
European starling	Sturnus vulgaris	--	--	0.32
Field sparrow	Spizella pusilla	0.32 (0.00)	0.43 (0.18)	0.64 (0.49)
Grasshopper sparrow	Ammodramus savannarum	0.32	0.46 (0.17)	0.32
Gray catbird	Dumetella carolinensis	--	0.32	--
Henslow's sparrow	Ammodramus henslowii	0.64	0.64	0.96
House finch	Carpodacus mexicanus	0.32	--	--
House wren	Troglodytes aedon	0.32	--	--
Indigo bunting	Passerina cyanea	0.80 (0.23)	0.48 (0.23)	0.43 (0.16)
Mourning dove	Zenaida macroura	--	0.32	--
Northern (Baltimore) oriole	Icterus galbula	0.32	--	0.32
Northern cardinal	Cardinalis cardinalis	0.32 (0.00)	0.32 (0.00)	0.43 (0.16)
Northern mockingbird	Minus polyglottos	--	--	0.32
Red-eyed vireo	Vireo olivaceus	--	0.32	0.32
Red-winged blackbird	Agelaius phoeniceus	1.27 (0.95)	0.90 (0.83)	0.76 (0.38)
Rock dove	Columba livia	0.64	--	--
Song sparrow	Melospiza melodia	0.64 (0.45)	1.27	0.38 (0.14)
Tree swallow	Tachycineta bicolor	2.84	--	0.96
(Eastern) Tufted titmouse	Baeolophus bicolor	0.64	0.32	--
Willow flycatcher	Empidonax traillii	--	--	0.32 (0.00)

Table 6. continued

Common name	Species name	2005 Indiv. / ha	2006 Indiv. / ha	2007 Indiv. / ha
Wood thrush	Hylocichla mustelina	0.32	0.32 (0.00)	0.32
Yellow warbler	Dendroica petechia	0.32	0.48 (0.23)	0.32
Yellow-billed cuckoo	Coccyzus americanus	--	0.32	--
Yellow-breasted chat	Icteria virens	0.31 (0.00)	0.40 (0.16)	0.48 (0.23)

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

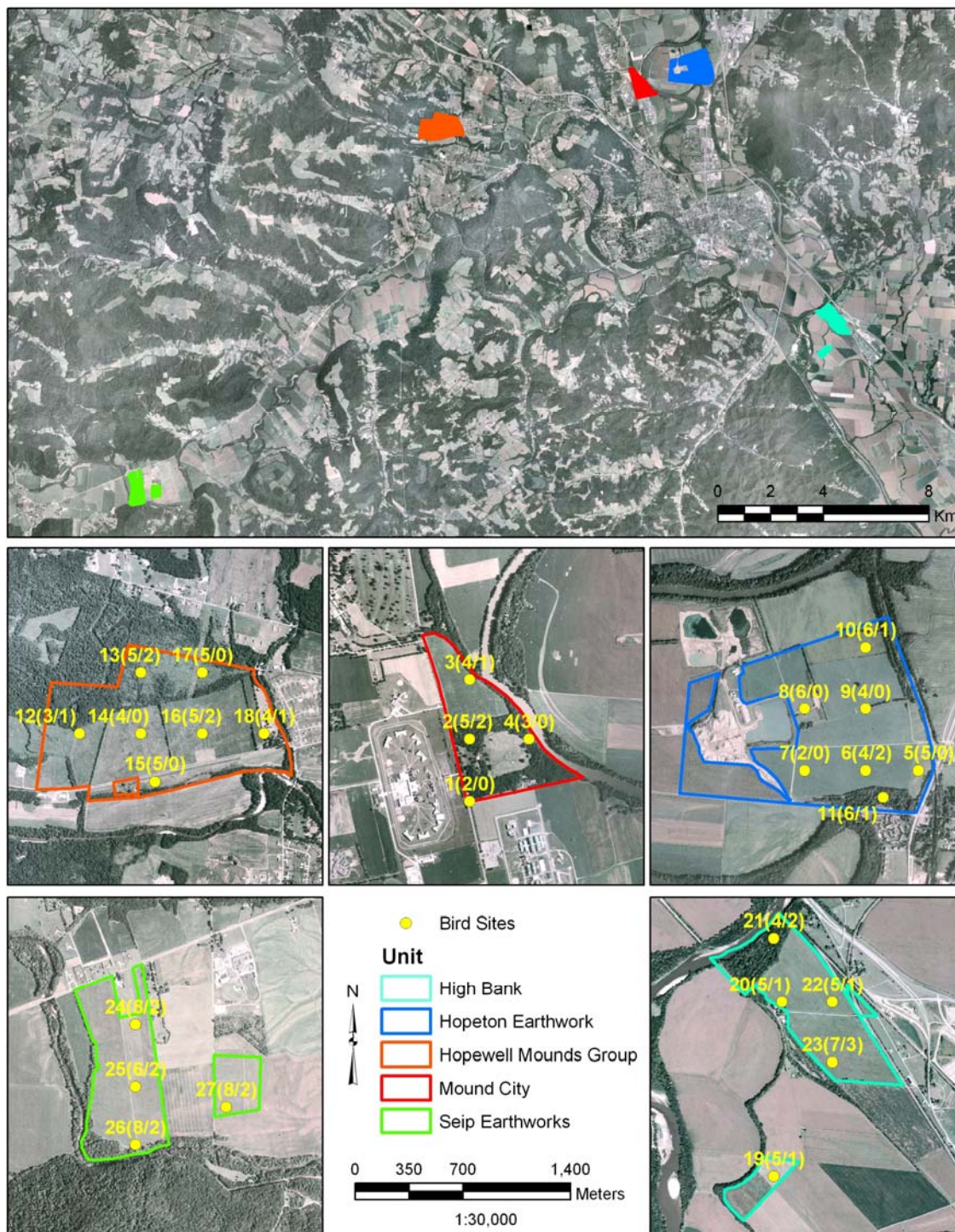


Figure 3a. Bird species richness and the richness of species of continental importance for each plot on Hopewell Culture National Historical Site, Ohio during the breeding season of 2005.

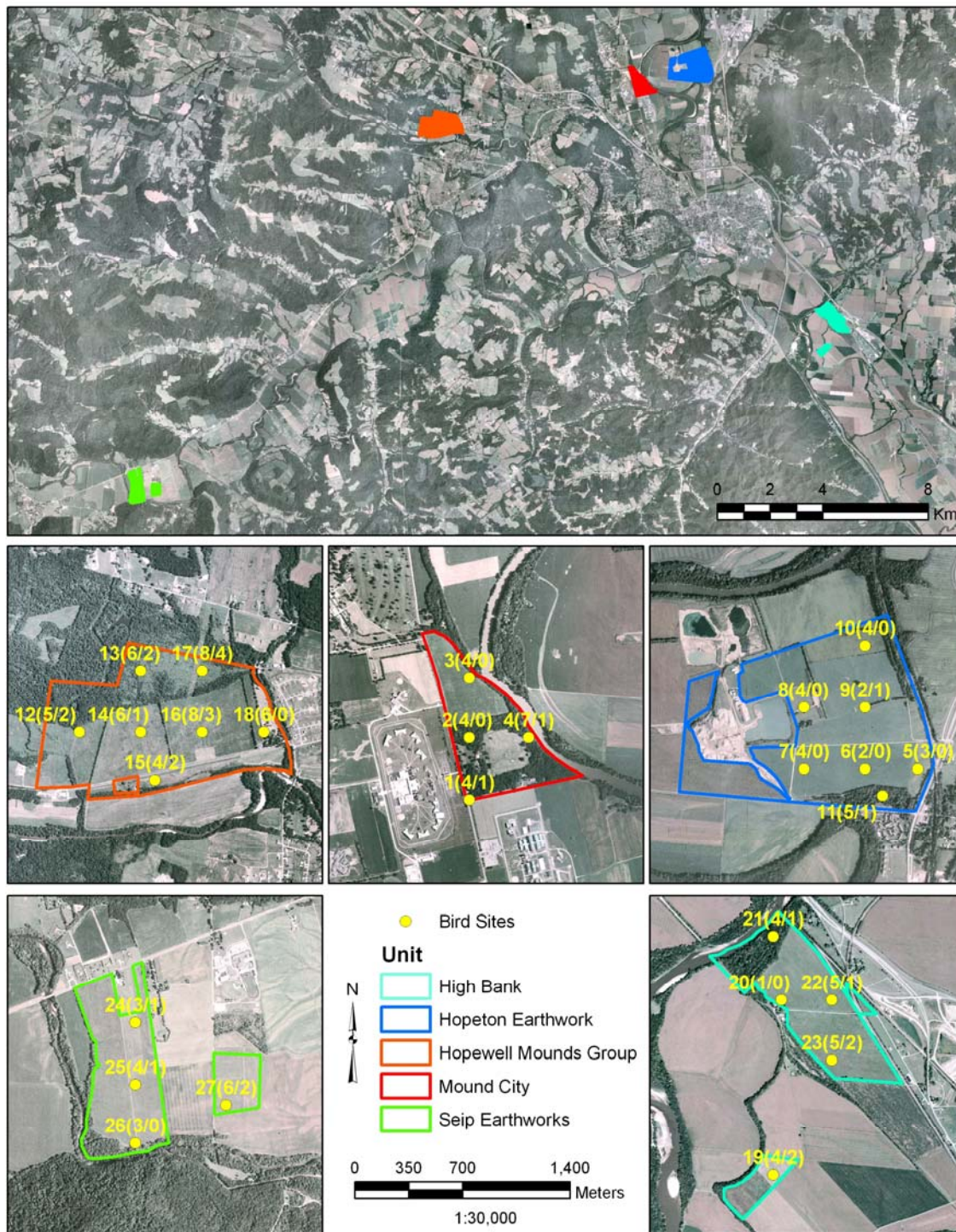


Figure 3b. Bird species richness and the richness of species of continental importance for each plot on Hopewell Culture National Historical Site, Ohio during the breeding season of 2006.

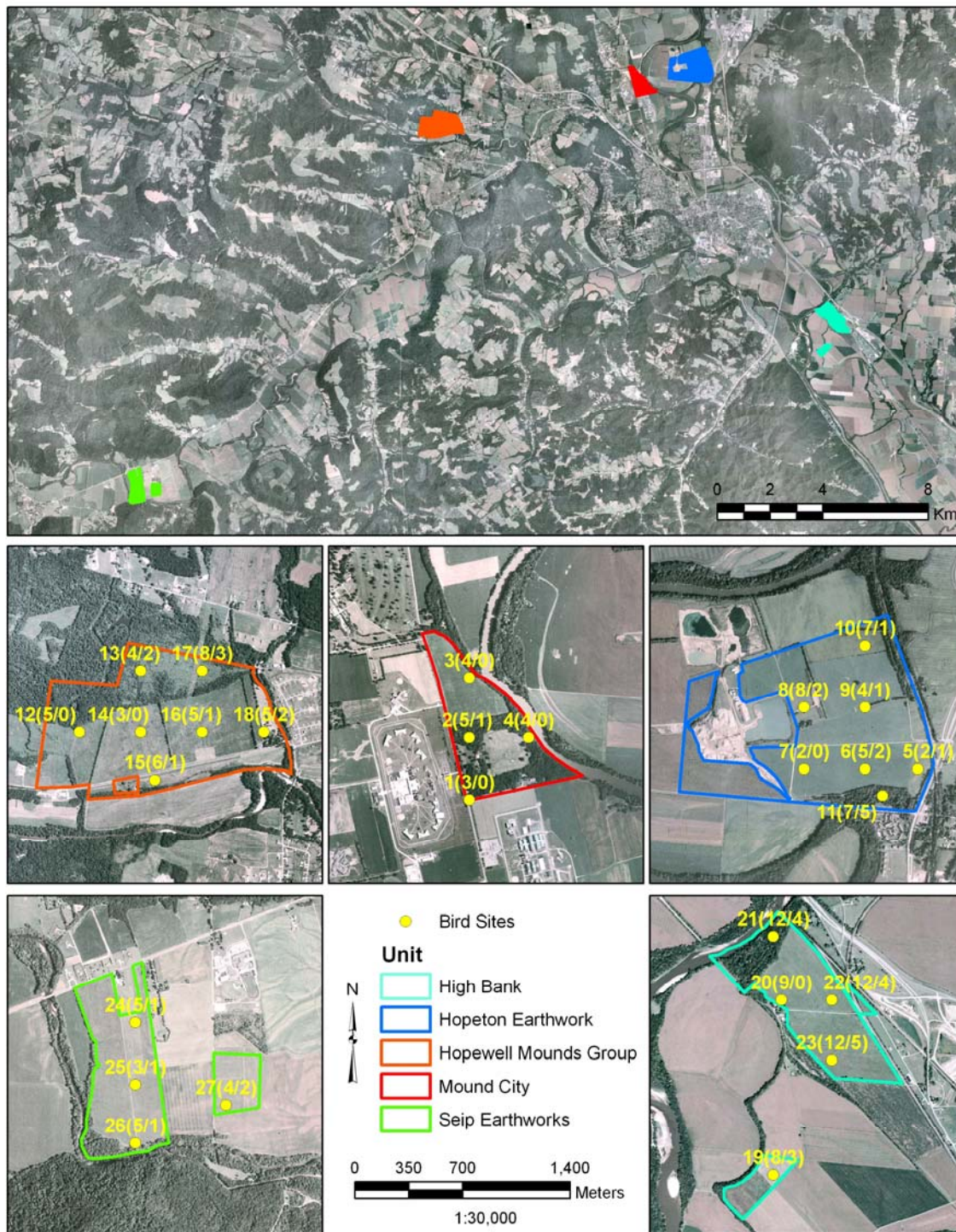


Figure 3c. Bird species richness and the richness of species of continental importance for each plot on Hopewell Culture National Historical Site, Ohio during the breeding season of 2007.

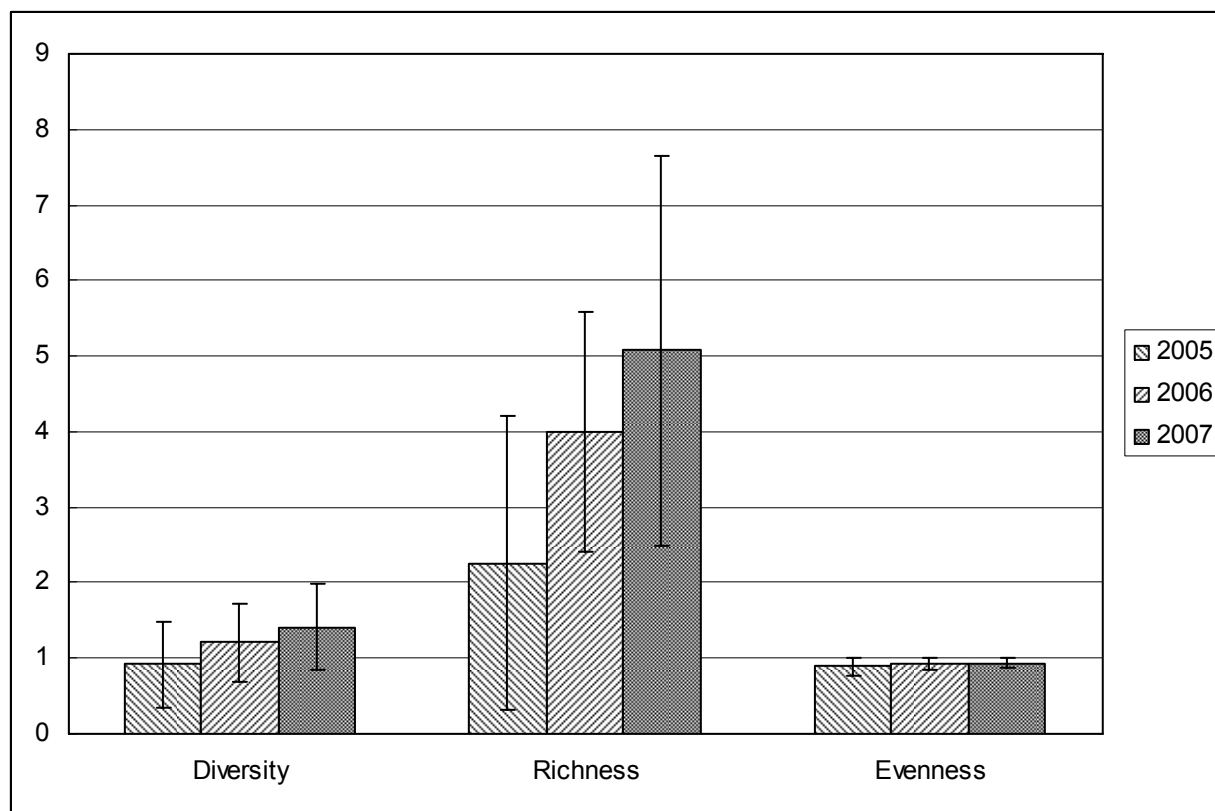


Figure 4. Average ($\pm$ std dev) species richness, diversity and species distribution evenness values for the bird community at Hopewell Culture National Historical Site, Ohio during the breeding seasons of 2005, 2006, and 2007.

Bird Habitat

Abiotic features of plots sampled for breeding birds and habitat composition on HOCU are given in Table 7. Slope across all survey plots is low, 7° or less with the exception of plot 4, which was 18°. Slope and aspect variability is low to medium for most plots sampled, plots 4 and 21 being the exceptions. Topographic position of plots is level ground, with the exception of one plot each located on an escarpment-face, upper-slope, mid-slope, lower-slope, or depression.

Bird survey plots on HOCU are located primarily in fescue/orchard grass or old field habitat types, with smaller amounts of several other habitat types present (Table 8). Hardwood canopy cover, canopy height, and basal area varied only slightly across years. Trees from the Aceraceae and Rosaceae families dominated the hardwood species, thus canopy cover, canopy height, and basal area (Table 9). Conifers were an insignificant component of the woodland composition. Average vegetation height and horizontal density to 2-m were similar across years as well. Vertical structure diversity estimates varied by 28% across years, and appears to be moderately low for the park.

Grass litter was the dominant litter type found on plots, followed by deciduous (Table 8). Conifer litter was not recorded in any significant amount during bird surveys. Ground cover was mostly grass litter and bare soil. Cool-season grasses and forbs had the greatest foliar cover in all years, followed by woody shrubs and vines, tree seedlings, warm-season grasses, and moss and lichens. Total foliar coverage averaged 44.60 % (2005), 56.25 % (2006), and 43.80 % (2007) across plots. The percent difference, in our high (2006) and low (2007) total foliar cover values during bird surveys was 22 %.

Table 7. Abiotic features of 50-m radius plots sampled for breeding birds at Hopewell Culture National Historical Site, Ohio.

Plot number	Slope (°)	Slope variability	Aspect (°)	Aspect variability	Topographic position
HOCUTweety1 0		low	289	low	Level
HOCUTweety2 2.5		low	97	low	Level
HOCUTweety3 1		low	99	low	Level
HOCUTweety4 18		high	49	high	escarpment-face
HOCUTweety5 7		medium	302	medium	mid-slope
HOCUTweety6 1		low	125	low	Level
HOCUTweety7 1		low	89	low	Level
HOCUTweety8 1.5		medium	88	medium	Level
HOCUTweety9 0		low	42	low	Level
HOCUTweety10 0		low	39	low	Level
HOCUTweety11 1		low	305	low	Level
HOCUTweety12 2		medium	220	medium	Level
HOCUTweety13 3		medium	232	medium	upper-slope
HOCUTweety14 1		low	2	low	Level
HOCUTweety15 2		low	190	low	depression
HOCUTweety16 1		low	336	low	Level
HOCUTweety17 1		low	220	low	Level
HOCUTweety18 3		low	60	low	Level
HOCUTweety19 2		low	9	low	Level
HOCUTweety20 3		low	225	low	Level
HOCUTweety21 2		high	162	high	lower-slope
HOCUTweety22	1.5 low		2 low		Level
HOCUTweety23 0		low	245	low	Level
HOCUTweety24 1		low	10	low	Level
HOCUTweety25 1		low	15	low	Level
HOCUTweety26 2		medium	49	medium	Level
HOCUTweety27 1		low	264	low	Level

Table 8. Averages ($\pm$ std dev) for habitat parameters at Hopewell Culture National Historical Site, Ohio during the bird breeding season, 2005-2007. 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	2005		2006		2007	
	Mean st	d dev M	ean	std dev M	ean st	d dev
50 meter plot coverage						
Cornfield (%)	--	-- 0.	02	0.10 --	--	--
Fescue/Orchard Grass (%)	37.96 47	.14 37	.59	45.65 35	.02 43	.90
Lawn (%)	1.11	4.00 1.	78 4.	80	0.04 0.	13
Old Field (%)	30.94 44	.97 31	.11	44.97 28	.43 42	.30
Parking Lot (%)	--	--	--	--	0.56	2.89
Pasture Road (%)	0.11	0.56 1.	35 4.	01	0.26 0.	80
Paved Road (%)	0.02	0.10 0.	67 2.	92	0.04 0.	13
Restored Prairie (%)	3.61 18	.76 3.	61 18	.76 3.	61	18.76
Riparian Woodland (%)	9.20	26.57	10.20	27.97	9.20	26.57
Shrubland (%)	4.17 18	.87 0.	67	2.92	--	--
Stream (%)	1.41	7.21 0.	78 2.	95	0.02 0.	10
Trail (%)	0.11	0.58 0.	11 0.	58	0.11 0.	58
Tree Line (%)	0.11	0.58	--	--	0.04	0.13
Woodland (%)	5.94 21	.89 9.	17 25	.05 8.	61	25.08
5 meter subplot						
Canopy cover						
Hardwood (%)	20.66	33.82	21.91	34.43	19.5	36.65
Canopy Height						
Hardwood (m)	3.34	9.69	3.35	7.40	2.26	8.39
Basal Area						
Hardwood (m ² /ha)	2.32	4.54 1.	65 3.	46	1.00 2.	57
Horizontal vegetation profile at 5-m						
0.0 – 0.5 m (%)	91.00	11.32	88.33	17.86	85.74	22.19
0.25 – 0.75 m (%)	71.16	29.00	72.13	26.26	71.39	31.69
0.5 – 1.0 m (%)	47.93	32.44	46.43	28.48	30.61	28.96
0.75 – 1.25 m (%)	25.26	27.46	21.81	23.66	12.72	23.36
1.0 – 1.5 m (%)	12.84	21.42	10.96	18.97	5.69	19.88
1.25 – 1.75 m (%)	6.92	14.49	9.95	21.91	5.93	21.90
1.5 – 2.0 m (%)	5.85	11.49	10.45	23.14	10.09	28.01
Horizontal vegetation profile at 15-m						
0.0 – 0.5 m (%)	95.04	7.00	94.24	11.95	95.28	11.55
0.25 – 0.75 m (%)	88.21	14.18	89.62	20.52	90.83	24.11
0.5 – 1.0 m (%)	67.89	31.05	69.16	24.53	70.67	37.07
0.75 – 1.25 m (%)	44.36	34.72	36.84	32.88	32.41	36.76
1.0 – 1.5 m (%)	25.40	32.73	20.88	31.24	13.48	31.30
1.25 – 1.75 m (%)	15.72	27.65	15.24	27.27	14.00	34.22
1.5 – 2.0 m (%)	14.03	27.21	15.78	26.59	12.22	31.56
Vertical structure diversity	27.22 19	.03 24	.86	18.36 19	.50 16	.07
1.78 meter sample plot coverage						
Conifer litter (%)	0.88	3.35 1	.51 7	.69	0.00 0	.00
Deciduous litter (%)	4.26	9.48	5.80	13.68	1.74	7.19
Grass litter (%)	24.82 2	1.23 1	8.01	18.60 2	3.04 1	7.99
Bare soil (%)	54.73 24	.07 64	.96	16.85 32	.78 17	.50

Table 8. continued

Habitat Parameter	2005		2006		2007	
	Mean st	d dev M	ean	std dev M	ean st	d dev
Rock (%)	1.85	6.27 2.	90 6.	40	0.20 0.	59
Woody debris (%)	4.06 11	.53 4.	02 10	.99 0.	17	0.59
Unvegetated (%)	83.69 13	.88 77	.67	13.87 85	.93	3.34
Warm-season grass (%)	0.06	0.15 0.	29 1.	04	0.89 1.	04
Cool-season grass (%)	22.04 17	.85 25	.74	16.02 15	.70 13	.20
Forb (%)	20.88 11	.47 28	.45	14.78	8.00	8.39
Moss and lichen (%)	0.00	0.00 3.	24 3.	59	0.00 0.	00
Woody shrub and vine (%)	3.43	10.02	4.40	6.87	0.61	2.88
Tree seedling (%)	1.00	4.07 1.	36 3.	44	0.22 0.	59
Total foliar (%)	44.60 16	.96 56	.25	14.39 43	.80 18	.32

Table 9. Stems per hectare of trees by size class found on Hopewell Culture National Historical Site, Ohio during the 2005-2007 bird-breeding seasons. 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		
	2005	2006 2	007 2	005	2006 2	007 2	005	2006 2	007 2	005	2006 2	007 2	005	2006 2	007 2	005	2006 2	007 2	005	2006 2	007
Aceraceae	76	30	16	87				40	11	39			29	21		7	13	27			5
Caprifoliaceae	55	175	0	67	79	5	8				2	5	0				0	0	0		0
Cornaceae	0	0	0	0	0	0	5				0	0	0				0	0	0		0
Elaeagnaceae	12	21	0	5	27	32	36	49	32	0	1	11	0				0	0	0		0
Fabaceae	0	0	0	0	0	0	5				1	0	4				0	0	0		0
Hippocastanaceae	4	1	0	0	2	5	8			2	11	5	2	0	1		0	0	0		0
Juglandaceae	1	0	0	4	0	0		10	5	11	2	4	21	1			5	5	4		1
Lauraceae	0	0	0	0	0	0	0				1	0	1				0	0	0		0
Moraceae	0	0	0	0	0	0		10	5	5	0						0	0	0		0
Oleacea	16	12	5	11	13	11	11	17	53	0			1	27	0		0	0	0		0
Platanaceae	0	1	0	0	0	0	0				0	0	0				0	0	0		0
Rosaceae	61	6	48	15	58	106	25	78	202	1	7	0	4				1	5	2		0
Sapindaceae	7	10	0	0	6	0	4				7	0	0				0	0	0		0
Tiliaceae	0	0	0	0	0	0	1				0	0	8				0	0	0		0
Ulmaceae	6	8	0	2	6	5	38	32	5	24	19	16	13	11	0	10					0
Total stems	238	264	69	191	231	17	5	20	0	228	34	5	52	49	107	28	19	21	24	22	5
Snags	7	30	0	6	15	0	17	10	21	5	5	16	2	2	16	1	1	5	2	2	0

Discussion

Bird surveys and habitat assessment work was initiated at HOCU in 2005, to assist the park in assessing the integrity of their woodlands and fields through time. Sixty-six of the 67 bird species recorded during the breeding bird surveys are permanent or summer residents to the area (Stokes and Stokes 1995). Therefore, these species have some value in characterizing the breeding bird community of the park through time. Changes in the numbers of the most common and widely distributed species--Red-winged blackbird, Field sparrow, Indigo bunting, Northern cardinal, Song sparrow, American robin, Eastern meadowlark, Dickcissel, and Grasshopper sparrow--will serve as better measures for assessing changing habitat conditions. For example, species like the Dickcissel have improved reproductive success when grass cover is dense, forbs presence is heavy, and litter cover is thick (Johnson et al. 1998, Winter 1998). Therefore, a decline in Dickcissel numbers could indicate changes in any one or all three of these measures. Less common and widely distributed species will likely occur so infrequently that a strong species-habitat relationship may not be established.

Changes in the populations of seven species--Carolina wren, Dickcissel, Eastern towhee, Grasshopper sparrow, Henslow's sparrow, Indigo bunting, and Wood thrush--are of special interest. All seven species are of continental importance (Rich et al. 2004) and have occurred on the park each survey year. Seven of the eight additional species of continental importance--Acadian flycatcher, Blue-winged warbler, Brown thrasher, Red-bellied woodpecker, White-eyed Vireo, Willow flycatcher, and Yellow-throated vireo--may occur infrequently or rarely enough that they may not demonstrate reliable population trends on which to base management actions. However, significant alterations to the habitat or surrounding area may improve habitat conditions for these species. For example, Brown thrasher is a species with a strong affinity to shrubs, usually within one to three meters of the ground (Johnson et al. 1998). Shrubs, vines and tree seedlings were a minor habitat component during our surveys. However, allowing shrubs to invade on the fescue/orchard grass and old field habitats may improve the park habitat for this species, but doing so may be counter to other management goals. The Prairie warbler, the final species of continental importance, is a migrant through the park and holds little value in assessing breeding population trends or the effects of habitat management on these trends.

Since 1966, Red-winged blackbirds, the most common species at HOCU, have shown precipitous declines in many areas of North America (Sauer et al. 2008). Blackwell and Dolbeer (2001) found that the species decline in Ohio (53%) is due in part to changing agriculture practices. Therefore, the importance of the park to conservation of even its most common species cannot be underestimated. Management decisions aimed at influencing bird populations should center on those species identified as of local or continental importance. However, species common to the park, such as the Red-winged blackbird, need consideration in a broader context of bird conservation when making management decisions.

Currently, open field habitat types and a lesser component of mixed woodlands dominate HOCU. The mix of other habitats seen across the park is a contributing factor to the rich and diverse bird community observed. However, the mix of habitat types on the park makes it difficult to elucidate relationships between bird richness and habitat parameters. In fact, no relationships were found between the richness of permanent and summer resident males, and

selected habitat variables at the $p < 0.05$ significance level. With much of the park in fescue/orchard grass fields, cool season grasses dominated the vegetation observed. However, forbs were also an important vegetation component on the park, especially in 2006. As native plantings replace fescue/orchard grass fields and old field with their mix of habitat types a stronger relationship between bird richness and habitat types should develop. Currently, many of the species seen on the park are habitat generalist with no affiliation to a particular habitat type. The increasing bird diversity and richness observed on the park during our surveys will likely level off or drop with time, as more native habitat types develop and habitat generalist drop out of the bird population.

In planning management actions that aim to improve habitat for birds, one should refer to Figures 3a, 3b, and 3c, Appendix 1, and Appendix 2. Figures 3a, 3b, and 3c and Appendix 1 identify areas where species richness and the richness of species of continental importance are greatest on the park, allowing managers to prioritize areas for habitat improvement. Appendix 2 describes in detail each habitat parameter found on a plot. Managers may choose to manipulate a particular habitat element to benefit a particular species or many species. Management actions aimed at improving habitat for a single species may come at a price to other species, unless that species is a keystone species for the desired habitat conditions (i.e., Grasshopper sparrow in grasslands). The utility of richness, diversity and evenness values will increase when we examine changes in the bird community through time--20, 30 or more years-- and these changes may be linked to management activity rather than innate variability of the habitats present.

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Appendix 1a. Bird species counts by plot for Hopewell Culture National Historical Site, Ohio in 2005. Data includes all species recorded from a plot during a 5 min. survey. A species may have been recorded as a flyover only. No species recorded outside a 5 min. survey were included.

P L O T	Species Code																																						
	A M C R	A M G O	A M R O	B A O R	B E K I	B G G N	B H C O	B L J A	C A R W	C O Y E	D I C K	E A M E	E A P H	E A T O	E A W P	E T T I	E U S T	F I S P	G B H E	G R S P	H E S P	H O F I	H O W R	I N B U	M O D O	N O B O	N O C A	R E V I	R O D O	R P H E	R T H A	R W B L	S O S P	T R E S	T U V U	W O T H			
1	0	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
2	0	0	0		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3	0	0	0		1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
4	0	0	0		0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2	0	0	6	0	0	0	0	0
6	0	0	0		0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	0	
7	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	
8	0	0	0		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	8	1	1	0	0	0	
9	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	9	1	2	0	0	0	
10	0	0	0		0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	
11	0	0	0	1	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
12	0	0	0		0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	0	0	0	0	0	0	
15	0	0	0		0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	
16	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	
17	0	0	0		0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	
18	0	0	0		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	
19	0	0	1		0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	2	0	0	0	0	0	
20	0	0	0		0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0
21	0	0	3		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
22	0	0	1		0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0
23	0	0	1		0	0	0	0	0	0	0	4	0	0	0	1	0	0	1	0	8	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
24	1	0	0		0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0
25	0	0	0		0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
26	0	3	0		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	0	0	0	0	0	
27	1	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	

SPP = Species Richness

SCI = The Species Richness for a plot of "Species of Continental Importance"

Appendix 1a. continued

Species Code				
P	Y	Y	S	S
L	B	W	P	C
O	C	A	P	C
T	H	R	P	I
1 0		0	2 0	
2 0		0	5 2	
3 0		0	4 1	
4 0		0	3 0	
5 0		0	5 0	
6 0		0	4 2	
7 0		0	2 0	
8 0		0	6 0	
9 0		0	4 0	
10 0		0	6 1	
11 1		0	6 1	
12 1		0	3 1	
13 1		1	5 2	
14 0		1	4 0	
15 0		0	5 0	
16 1		0	5 2	
17 0		0	5 0	
18 0		0	4 1	
19 0		0	5 1	
20 0		1	5 1	
21 0		1	4 2	
22 0		0	5 1	
23 0		0	7 3	
24 0		0	8 2	
25 0		0	6 2	
26 1		0	8 2	
27 0		0	8 2	

Appendix 1b. Bird species counts by plot for Hopewell Culture National Historical Site, Ohio in 2006. Data includes all species recorded from a plot during a 5 min. survey. A species may have been recorded as a flyover only. No species recorded outside a 5 min. survey were included.

P L O T	Species Code																																						
	A M C R	A M G O	A M R O	B A N S	B A R S	B E K I	B E W R	B H C O	B L G R	B L J A	B R T H	B W A	C A G O	C A R W	C O Y E	D I C K	E A B L	E A K I	E A M E	E A T O	E A W P	E T I	E U S T	F I S P	G B R C A	G R S P	G R S P	H E S P	I N B U	M O D O	N O B O	N O C A	R E V I	R P H E	R T H A	R W B L			
1	003			0	0	0	1	0	0	0	00		0	0	0	0	00		0	0	10		0	0	0	0	00		0	0	0	01		00		0		0	
2	001			0	0	0	0	0	0	0	00		0	0	0	0	00		0	0	11		0	0	0	0	00		0	0	0	10		00		0		0	
3	101			0	0	0	0	0	0	0	00		0	0	0	0	00		0	0	10		0	0	0	0	00		0	0	0	00		00		00		12	
4	001			0	0	1	0	0	0	0	00		0	0	0	0	00		0	0	10		0	0	0	0	00		0	1	0	10		00		0		0	
5	000			1	0	0	0	0	0	0	00		0	0	0	0	00		0	0	00		0	0	0	0	00		0	0	0	00		00		00		4	
6	000			0	0	0	0	0	0	0	00		0	0	0	0	00		0	0	00		0	0	0	0	00		0	0	0	00		00		00		7	
7	200			0	0	0	0	2	0	0	00		0	0	0	0	00		0	0	00		0	0	2	0	00		0	0	0	00		00		00		2	
8	000			0	1	0	1	0	0	0	00		0	0	0	0	00		0	0	00		0	0	0	0	00		0	3	0	00		00		00		3	
9	000			0	0	0	0	0	0	0	00		0	0	0	2	00		0	0	00		0	0	0	0	00		0	0	0	00		00		00		13	
10	000			0	0	0	0	0	0	0	00		0	0	0	0	00		0	0	00		0	0	0	0	00		0	0	0	10		00		0		1	
11	000			0	0	0	2	0	0	0	00		0	0	0	0	00		0	0	00		0	0	0	1	00		0	0	0	00		00		00		1	
12	000			0	0	0	0	0	0	0	00		0	1	1	0	00		1	0	00		0	0	0	0	10		0	0	0	00		00		00		0	
13	000			0	0	0	0	0	0	0	01		0	0	1	0	00		0	1	00		0	1	0	0	00		0	0	0	10		00		00		0	
14	000			0	0	0	0	0	0	0	00		0	0	0	0	00		2	0	01		0	1	0	0	10		0	0	0	00		00		00		2	
15	000			0	0	0	0	0	0	1	00		0	0	0	0	00		0	0	00		0	0	0	0	10		1	0	0	00		00		00		3	
16	000			0	0	0	0	0	0	0	10		0	1	0	0	00		1	0	00		0	1	1	0	02		0	0	0	00		00		00		2	
17	010			0	0	0	0	0	0	0	10		0	1	0	0	00		0	1	00		0	1	0	0	00		2	0	0	00		01		0		0	
18	000			0	0	0	0	0	0	0	00		10	0	1	0	00		0	0	00		1	0	0	0	00		0	2	0	00		00		00		8	
19	010			0	0	0	0	0	0	1	00		0	0	0	0	00		0	0	00		0	0	0	0	20		1	0	0	00		00		00		0	
20	000			0	0	0	0	0	0	0	00		0	0	0	0	00		0	0	00		0	0	0	0	00		0	0	0	00		00		00		11	
21	001			0	0	0	1	0	0	0	00		0	0	0	0	00		0	0	10		0	0	0	0	00		0	0	0	00		00		00		0	
22	000			0	0	0	0	0	0	0	00		0	0	0	0	01		2	0	00		0	0	0	0	10		0	0	0	10		00		00		1	
23	000			0	0	0	0	0	0	0	00		0	0	0	2	00		0	0	00		0	3	0	0	20		0	0	0	00		00		00		1	
24	000			0	0	0	0	0	0	0	20		0	0	0	0	00		1	0	00		0	0	0	0	00		0	0	0	00		00		00		4	
25	000			0	0	0	0	0	0	0	00		0	0	0	1	00		0	0	00		0	3	0	0	00		0	0	0	00		10		0		4	
26	000			0	0	0	0	0	5	0	00		0	0	0	0	30		0	0	00		0	0	0	0	00		0	0	2	00		00		00		0	
27	070			0	0	0	0	0	0	0	00		0	0	0	0	10		0	0	00		0	0	0	0	20		1	0	0	01		00		00		2	

SPP = Species Richness

SCI = The Species Richness for a plot of "Species of Continental Importance"

Appendix 1b. continued

Species Code								
P	S	T	W	Y	Y	Y	S	S
L	O	R	O	B	B	W	S	S
O	S	E	T	C	C	A	S	C
T	P	S	H	H	U	R	P	I
10		0	0	000			41	
20		0	0	000			40	
30		0	0	000			40	
40		0	1	010			71	
50		0	0	002			30	
60		0	0	001			20	
70		0	0	000			40	
80		0	0	000			40	
90		0	0	000			21	
104		0	0	001			40	
110		0	1	002			51	
120		0	0	200			52	
130		0	0	100			62	
140		1	0	000			61	
150		0	0	100			42	
160		0	0	100			83	
170		0	0	100			84	
180		1	0	000			60	
190		0	0	000			42	
200		0	0	000			10	
210		0	1	000			41	
220		0	0	000			51	
230		0	0	100			52	
240		0	0	000			31	
250		0	0	000			41	
260		0	0	000			30	
270		0	0	000			62	

Appendix 1c. Bird species counts by plot for Hopewell Culture National Historical Site, Ohio in 2007. Data includes all species recorded from a plot during a 5 min. survey. A species may have been recorded as a flyover only. No species recorded outside a 5 min. survey were included.

P L O T	Species Code																																			
	A C F L	A M C R	A M G O	A M R O	B A G R	B G G R	B L L J A	B R T H	C A C H	C A R W	C O G R	C O Y E	D I C K	D O W O	E A M E	E A T O	E A W P	E U S T	F I S P	G R C A	G R S P	H E S P	H O W R	I N B U	M O D O	N O B O	N O C A	N O M O	N O R S	O R O R	R B W O	R E V I	R P H E	R T H A	R W B L	
1	0	0	0	3	000		1	0	0	0	00		0	00		0	0	300		00		0	0	00	0	0	0	0	0	0	0	00	00		0	0
2	0	0	0	1	100		0	0	1	0	00		0	00		0	0	000		00		0	1	00	1	0	0	0	0	0	0	00	00		0	0
3	0	0	0	0	100		0	0	0	0	00		0	00		0	0	010		00		0	0	00	1	0	0	0	0	0	00	00		0	0	
4	0	0	0	1	000		0	0	1	0	00		0	00		0	1	000		00		0	0	00	0	0	0	0	0	0	10		0	0		
5	0	0	0	0	000		0	0	0	0	00		0	00		1	0	000		00		0	0	00	0	0	0	0	0	0	00	00		0	6	
6	0	0	0	0	000		0	0	0	0	00		0	00		0	0	000		00		0	2	20	0	0	0	0	0	0	00	00		0	5	
7	0	0	0	0	000		0	0	0	0	00		0	00		0	0	000		00		0	0	00	0	0	0	0	0	0	00	00		0	4	
8	0	0	0	1	000		0	1	0	0	01		0	01		0	0	010		00		0	1	00	0	0	0	0	0	0	00	00		0	4	
9	0	0	0	0	001		0	0	0	0	00		0	00		0	0	000		10		0	0	00	0	0	0	0	0	0	00	00		0	10	
10	0	0	2	0	000		0	1	0	0	00		0	00		0	0	010		00		0	0	00	1	0	0	0	0	0	00	00		0	4	
11	1	0	0	0	010		0	0	0	1	00		0	00		1	0	000		00		0	1	00	1	0	0	0	0	0	00	00		0	0	
12	0	0	1	0	000		0	0	0	0	01		0	10		0	0	050		00		0	0	00	0	0	1	0	0	00	00		0	0		
13	0	0	0	0	000		0	0	0	0	00		0	00		1	0	000		00		0	0	00	0	0	0	0	0	0	00	00		0	0	
14	0	0	0	0	000		0	0	0	0	00		0	02		0	0	000		00		0	0	00	0	0	0	0	0	0	00	00		0	20	
15	0	0	0	0	000		0	0	0	1	00		0	00		0	0	020		00		0	0	00	0	0	0	0	0	0	00	00		1	2	
16	0	0	0	0	000		0	0	0	0	01		0	00		0	0	100		03		0	0	00	0	0	0	0	0	0	01		0	3		
17	0	0	0	0	000		0	0	0	0	00		0	00		1	0	020		00		0	2	00	3	1	0	0	0	0	00	00		1	1	
18	0	0	0	0	000		0	0	0	0	00		0	00		0	0	010		00		0	2	00	2	0	0	0	0	0	00	00		0	1	
19	0	0	0	0	000		0	0	0	0	00		1	00		0	0	101		10		1	1	00	0	0	0	0	0	0	00	00		0	1	
20	0	0	1	1	000		0	0	0	0	01		0	00		0	0	000		00		1	0	10	1	0	0	0	0	0	00	00		0	1	
21	0	0	0	1	000		0	0	0	1	01		0	00		0	1	100		00		1	1	00	1	0	0	0	0	1	00	00		0	0	
22	0	0	0	0	000		0	0	0	0	10		0	01		0	0	100		10		0	1	00	1	1	0	1	0	00	00		0	1		
23	0	1	0	0	000		0	1	0	0	31		1	00		1	0	210		10		0	2	00	0	0	0	1	0	00	00		0	1		
24	0	0	3	0	000		0	0	0	0	02		1	00		0	0	000		00		0	0	00	1	0	0	0	0	0	00	00		0	10	
25	0	0	0	0	000		0	0	0	0	00		3	00		0	0	010		00		0	0	00	0	0	0	0	0	0	00	00		0	3	
26	0	0	0	0	000		1	0	0	0	02		0	00		0	0	000		00		0	1	01	0	0	0	0	0	0	00	00		0	0	
27	0	0	0	0	000		0	0	0	0	00		1	00		0	0	000		00		0	0	00	0	0	0	0	0	0	00	00		0	2	

SPP = Species Richness

SCI = The Species Richness for a plot of "Species of Continental Importance"

Appendix 1c. continued

P L O T	Species Code														
	S	S	T	W	W	W	W	Y	Y	Y	Y	Y	S	S	
	E	O	R	A	E	I	O	B	B	S	T	W	P	P	
	W	S	E	V	V	F	D	C	C	F	V	A	P	C	
	R	P	S	I	I	L	U	H	H	U	L	I	R	P	I
1 0		0	0	0	00		0	0	00		0	0	0	30	
2 0		0	0	0	00		0	0	00		0	0	0	51	
3 0		1	0	0	00		0	0	00		0	0	0	40	
4 0		0	0	0	00		0	0	00		0	0	0	40	
5 0		0	0	0	00		0	0	00		0	0	0	21	
6 0		0	0	1	00		0	1	00		0	0	0	52	
7 0		0	0	0	00		0	0	00		0	0	0	20	
8 0		0	6	0	00		1	0	00		0	0	0	82	
9 0		1	0	0	00		0	0	00		0	0	0	41	
10 0		2	0	0	00		0	0	01		0	0	0	71	
11 0		0	0	0	00		0	1	00		0	0	0	75	
12 0		0	0	0	00		0	0	00		0	0	0	50	
13 0		0	0	0	01		0	0	21		0	0	0	42	
14 0		0	0	0	00		0	0	10		0	0	0	30	
15 0		0	0	0	00		0	0	10		0	0	1	61	
16 0		0	0	0	00		0	0	00		0	0	0	51	
17 0		0	0	0	01		0	0	00		0	0	0	83	
18 0		0	0	0	01		0	0	00		0	0	0	52	
19 0		1	0	0	00		0	0	00		0	0	0	83	
20 1		1	0	0	00		0	0	00		0	0	0	90	
21 0		1	0	0	00		0	1	00		1	0	0	124	
22 0		1	0	0	11		0	0	00		0	0	0	124	
23 0		0	0	0	00		0	0	00		0	0	0	125	
24 0		0	0	0	00		0	0	00		0	0	0	51	
25 0		0	0	0	00		0	0	00		0	0	0	31	
26 0		0	3	0	00		0	0	00		0	0	0	51	
27 0		2	0	0	00		0	0	00		0	1	0	42	

Appendix 2. Habitat parameters at Hopewell Culture National Historical Site, Ohio during the 2005-2007 bird breeding seasons. 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	Plot 1			Plot 2			Plot 3		
	2005 2	006 2	007 2	005	2006 2	007 2	005 2	006 2	007
50 meter plot coverage									
Corn Field (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
Fescue/Orchard grass (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	97.5	85.0	85.0
Lawn (%)	15.0	15.0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
Old Field (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
Parking Lot (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
Pasture Road (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 3.	0	0.0
Paved Road (%)	0.5	15.0	0.5 0.	0	0.0 0.	0	0.0 0.	0	0.0
Restored Prairie (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
Riparian Woodland (%)	0.0 0	.0	0.0 0	.0	0.0 0	.0	0.5 3	.0	0.5
Shrub (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
Stream (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
Trail (%)	0.0 0.	0	0.0 3.	0	3.0 3.	0	0.0 0.	0	0.0
Tree Line (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
Woodland (%)	62.5 62	.5	85.0 97	.5	85.0 85	.0	0.0	0.0	0.0
5 meter sample plot coverage									
Canopy cover									
Hardwood (%)	95.2 99	.2	38.2 93	.9	95.1 96	.5	99.8 98	.0	0.0
Total cover (%)	95.2 99	.2	38.2 93	.9	95.1 96	.5	99.8 98	.0	0.0
Canopy height									
Hardwood (m)	11.4 15	.5	6.5	10.6	11.1 10	.0	14.0 18	.0	0.0
Basal Area									
Hardwood (m2/ha)	10.3	4.3	0.0 6.	8	5.3 5.	0	12.0	3.0	0.0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	74.2 93	.3	97.5 61	.9	79.4 62	.5	97.5 97	.5	37.5
0.25 - 0.75 m (%)	33.5	66.0	97.5	37.6	41.5	62.5	97.5	97.5	0.0
0.5 - 1.0 m (%)	13.5 57	.7	97.5 40	.1	47.6 37	.5	94.4 91	.3	0.0
0.75 - 1.25 m (%)	6.2	41.0	97.5	49.4	67.0	3.0	79.4	65.0	0.0
1.0 - 1.5 m (%)	11.0 21	.0	97.5 40	.6	49.4 15	.0	40.8 35	.3	0.0
1.25 - 1.75 m (%)	34.3	37.7	97.5	40.6	49.5	0.0	21.4	24.5	0.0
1.5 - 2.0 m (%)	26.8 65	.8	97.5 23	.1	32.0 15	.0	21.3 24	.4	0.0
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	89.2 97	.5	97.5 97	.5	97.5 97	.5	97.5 97	.5	97.5
0.25 - 0.75 m (%)	65.8	85.8	97.5	97.5	97.5	97.5	97.5	97.5	15.0
0.5 - 1.0 m (%)	73.3 65	.8	97.5 94	.4	94.4 97	.5	97.5 97	.5	0.0
0.75 - 1.25 m (%)	65.8	58.3	97.5	82.5	97.5	97.5	97.5	97.5	0.0
1.0 - 1.5 m (%)	81.7 33	.5	97.5 82	.5	97.5 97	.5	82.5 85	.6	0.0
1.25 - 1.75 m (%)	69.2	34.5	97.5	82.5	94.4	97.5	28.4	29.0	0.0
1.5 - 2.0 m (%)	58.3 65	.8	97.5 76	.9	70.6 97	.5	24.4 24	.4	0.0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	66.7	33.3	0.0	62.5	37.5	100.0	18.8	6.3	0.0
1.0 - 2.0 m (%)	25.0	8.3	0.0	37.5	18.8	75.0	6.3	6.3	0.0
2.0 - 3.0 m (%)	25.0	33.3	0.0	50.0	31.3	0.0	6.3	6.3	0.0

Appendix 2. continued

Habitat Parameter	Plot 1				Plot 2		Plot 3		
	2005 2	006 2	007 2	005	2006 2	007 2	005 2	006 2	007
3.0 - 4.0 m (%)	58.3 41	.7	50.0 31	.3	18.8 25	.0	6.3	12.5	0.0
4.0 - 5.0 m (%)	75.0 25	.0	25.0 12	.5	31.3 25	.0	6.3	6.3	0.0
5.0 - 6.0 m (%)	41.7	8.3	25.0	25.0	31.3	25.0	6.3	6.3	0.0
6.0 - 7.0 m (%)	25.0 0.	0	25.0 6.	3	18.8 0.	0	6.3	6.3	0.0
7.0 - 7.5 m (%)	25.0	0.0	50.0	12.5	12.5	50.0	12.5	6.3	0.0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	33.3	58.3	100.0	56.3	56.3	0.0	93.8	100.0	100.0
1.0 - 2.0 m (%)	0.0	16.7	25.0	0.0	0.0	0.0	62.5	50.0	0.0
2.0 - 3.0 m (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
3.0 - 4.0 m (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
4.0 - 5.0 m (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
5.0 - 6.0 m (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
6.0 - 7.0 m (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
7.0 - 7.5 m (%)	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0 0.	0	0.0
1.78 meter sample plot coverage									
Deciduous litter (%)	42.7	46.7	0.5	22.5	23.3	3.0	3.8	0.8	0.0
Conifer litter (%)	0.0 0	.0	0.0 0	.0	0.0 0	.0	0.0 0	.0	0.0
Grass litter (%)	20.8 0	.2	15.0 0	.5	0.1	0.0	35.0 8	.4	62.5
Bare soil (%)	22.5	38.3	37.5	77.5 68.1		37.5	50.0 73.8		37.5
Rock (%)	0.0 0.	2	0.0 0.	0	10.4	0.5	0.0 0.	4	0.0
Woody debris (%)	6.2 7.	0	0.0 2.	2	12.0	3.0	3.8 0.	8	0.0
Unvegetated (%)	9.3	89.2	85.0 97	.5	85.0 97	.5	79.4 85	.0	85.0
Warm season grass (%)	0.0 0.	0	0.5 0.	0	0.1 0.	0	0.0 0.	0	3.0
Cool season grass (%)	1.0 1.	0	3.0 0.	5	0.1 0.	0	46.3	35.1	15.0
Forb (%)	12.7 2.	2	3.0 14	.5	6.0	3.0	6.0 17	.6	3.0
Moss and lichen (%)	0.0 6.	0	0.0 0.	0	12.0	0.0	0.0 0.	0	0.0
Shrub and vine (%)	0.5	10.0	15.0	11.0	17.6	0.5	0.8	9.4	0.0
Tree seedling (%)	21.2	14.5	3.0 0.	5	8.4 0.	5	0.1 3.	8	0.0
Total foliar (%)	42.7 30	.0	62.5 22	.5	31.9 15	.0	50.0 56	.3	37.5

Appendix 2. continued

Habitat Parameter	Plot 4			Plot 5			Plot 6		
	2005	2006 2	007	2005 2	006	2007	2005 2	006	2007
50 meter plot coverage									
Corn Field (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Fescue/Orchard grass (%)	0.0	0.0	0.0	97.5	97.5 62	.5 97	.5 97	.5	97.5
Lawn (%)	15.0	15.0	0.5	0.0	0.0 0.	0 0.	0 0.	0	0.0
Old Field (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Parking Lot (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Pasture Road (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Paved Road (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Restored Prairie (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Riparian Woodland (%)	62.5	62.5	62.5	0.0	0.0 0	.0 0	.0 0	.0	0.0
Shrub (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Stream (%)	37.5	15.0	0.0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Trail (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Tree Line (%)	0.0 0.	0 0.	0	0.0	0.0 0.	5 0.	0 0.	0	0.0
Woodland (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
5 meter sample plot coverage									
Canopy cover									
Hardwood (%)	86.8	0.0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Total cover (%)	86.8	0.0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Canopy height									
Hardwood (m)	21.7	0.0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Basal Area									
Hardwood (m2/ha)	13.3	0.0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	65.8 65	.8 97	.5	97.5	91.3 97	.5 97	.5 97	.5	97.5
0.25 - 0.75 m (%)	33.3 53	.3 97	.5	97.5	53.1 85	.0 97	.5 97	.5	97.5
0.5 1.0 m (%)	25.8 25	.8	0.0	94.4	26.5 37	.5 76	.9 88	.8	62.5
0.75 - 1.25 m (%)	12.5	21.0	0.0	58.8	0.5	15.0	65.1	64.5	37.5
1.0 - 1.5 m (%)	5.0 28	.3 0.	0	15.8	0.0	0.0 28	.3 4.	8	0.5
1.25 - 1.75 m (%)	5.0	10.0	0.0	0.1	0.0	0.0	0.8	0.0	0.0
1.5 - 2.0 m (%)	12.5	0.2 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	70.0	77.5 97	.5	97.5 97	.5	97.5	97.5 97	.5	97.5
0.25 - 0.75 m (%)	60.8	65.0	97.5	97.5	94.4	97.5	97.5	97.5	97.5
0.5 1.0 m (%)	60.8	60.8 15	.0	97.5 67	.6	85.0	97.5 97	.5	85.0
0.75 - 1.25 m (%)	56.7	65.0	15.0	76.9	16.6	15.0	97.5	97.5	37.5
1.0 - 1.5 m (%)	45.0	53.3	15.0	21.6	1.0	0.0	68.1	22.9	0.5
1.25 - 1.75 m (%)	33.3	40.8	0.0	0.8	0.0	0.0	19.5	0.1	0.0
1.5 - 2.0 m (%)	28.3	6.0 0.	0	0.0 0.	0	0.0	0.0 0.	0	0.0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	8.3	16.7	100.0	0.0	0.0 0.	0 0.	0 0.	0	0.0
1.0 - 2.0 m (%)	25.0	16.7	50.0	0.0	0.0 0.	0 0.	0 0.	0	0.0
2.0 - 3.0 m (%)	16.7	16.7	25.0	0.0	0.0 0.	0 0.	0 0.	0	0.0
3.0 - 4.0 m (%)	16.7	8.3 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
4.0 - 5.0 m (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
5.0 - 6.0 m (%)	16.7	8.3 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
6.0 - 7.0 m (%)	16.7	0.0	25.0	0.0	0.0 0.	0 0.	0 0.	0	0.0

Appendix 2. continued

Habitat Parameter	Plot 4			Plot 5			Plot 6		
	2005 2	006 2	007	2005 2	006	2007 2	005 2	006 2	007
7.0 - 7.5 m (%)	16.7	8.3 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	100.0 10	0.0	25.0	100.0 10	0.0	100.0 10	0.0 10	0.0 10	0.0
1.0 - 2.0 m (%)	0.0	0.0	0.0	18.8	12.5 25	.0 25	.0 50	.0	50.0
2.0 - 3.0 m (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
3.0 - 4.0 m (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
4.0 - 5.0 m (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
5.0 - 6.0 m (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
6.0 - 7.0 m (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
7.0 - 7.5 m (%)	0.0 0.	0 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
1.78 meter sample plot coverage									
Deciduous litter (%)	41.8	11.0	3.0	0.0	0.0 0	.0 0	.0 0	.0	0.0
Conifer litter (%)	0.0 0	.0 0	.0	0.0	0.0 0	.0 0	.0 0	.0	0.0
Grass litter (%)	21.0 2	0.8	0.0	44.4	50.0 1	5.0 2	6.3 1	5.0	37.5
Bare soil (%)	18.5	69.2	62.5	38.1	50.0 37.5 62		.5 62.5		15.0
Rock (%)	0.0 1.	3 0.	5	0.0	0.5 0.	0 0.	0 0.	5	0.0
Woody debris (%)	6.2 2.	2 0.	0	0.0	0.0 0.	0 0.	0 0.	0	0.0
Unvegetated (%)	74.2 77	.5 85	.0	85.0	62.5 85	.0 79	.4 68	.1	85.0
Warm season grass (%)	0.0 0.	2 0.	0	0.1	0.0 0.	5 0.	8 0.	0	3.0
Cool season grass (%)	32.7 21	.0	0.5	38.1	32.5 15	.0 29	.5 50	.0	37.5
Forb (%)	5.3 46	.7	15.0	14.0	50.6 3.	0 41	.4	32.5	3.0
Moss and lichen (%)	0.0 2.	0 0.	0	0.0	0.3 0.	0 0.	0	11.3	0.0
Shrub and vine (%)	49.2	6.0 0.	5	0.4	0.0 0.	0 0.	0 0.	0	0.0
Tree seedling (%)	0.3 1.	0 0.	5	0.0	0.0 0.	0 0.	0 0.	0	0.0
Total foliar (%)	81.7 70	.0 37	.5	43.8	79.4 37	.5 62	.5 85	.0	62.5

Appendix 2. continued

Habitat Parameter	Plot 7			Plot 8		Plot 9			
	2005	2006 2	007 2	005 2	006	2007 2	005 2	006 2	007
50 meter plot coverage									
Corn Field (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Fescue/Orchard grass (%)	97.5 97	.5 97	.5 85	.0 85	.0	62.5 97	.5 97	.5 97	.5
Lawn (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Old Field (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Parking Lot (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Pasture Road (%)	0.0 0.	0 0.	0 3.	0	15.0	3.0 0.	0 0.	0 0.	0
Paved Road (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Restored Prairie (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Riparian Woodland (%)	0.0 0	.0 0	.0 0	.0 0	.0	0.0 0	.0 0	.0 0	.0
Shrub (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Stream (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Trail (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Tree Line (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Woodland (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
5 meter sample plot coverage									
Canopy cover									
Hardwood (%)	0.0 0.	0 0.	0	17.2	22.8	0.0 0.	0 0.	0 0.	0
Total cover (%)	0.0 0.	0 0.	0	17.2	22.8	0.0 0.	0 0.	0 0.	0
Canopy height									
Hardwood (m)	0.0 0.	0 0.	0	13.4	15.5	0.0 0.	0 0.	0 0.	0
Basal Area									
Hardwood (m2/ha)	0.0 0.	0 0.	0 1.	0 2.	0	0.0 0.	0 0.	0 0.	0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	97.5 97	.5 97	.5 97	.5 73	.3	97.5 97	.5 97	.5 97	.5
0.25 - 0.75 m (%)	97.5 97	.5 97	.5 94	.4 73	.1	97.5 97	.5 85	.6 97	.5
0.5 1.0 m (%)	97.5 94	.4 37	.5 76	.3 58	.1	85.0 91	.3 47	.0 15	.0
0.75 - 1.25 m (%)	88.1	44.4	3.0	35.1	34.4	37.5	23.3	16.9	0.0
1.0 - 1.5 m (%)	68.1	16.6	0.0 4.	5 1.	6	0.0 0.	3 0.	0 0.	0
1.25 - 1.75 m (%)	4.6 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
1.5 - 2.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	97.5 97	.5 97	.5 97	.5 97	.5	97.5 97	.5 97	.5 97	.5
0.25 - 0.75 m (%)	97.5 97	.5 97	.5 94	.4 97	.5	97.5 97	.5 97	.5 97	.5
0.5 1.0 m (%)	97.5 94	.4 97	.5 88	.8 91	.3	97.5 97	.5 79	.4 97	.5
0.75 - 1.25 m (%)	97.5 73	.9 85	.0 58	.9 41	.5	62.5 91	.3 18	.9 85	.0
1.0 - 1.5 m (%)	91.3	43.8 0.	5 19	.5	22.1	0.0 20	.3 0.	1	0.0
1.25 - 1.75 m (%)	22.6	3.9 0.	0 0.	0 0.	1	0.0 0.	0 0.	0 0.	0
1.5 - 2.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
1.0 - 2.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
2.0 - 3.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
3.0 - 4.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
4.0 - 5.0 m (%)	0.0 0.	0 0.	0 6.	3 0.	0	0.0 0.	0 0.	0 0.	0
5.0 - 6.0 m (%)	0.0 0.	0 0.	0 6.	3 6.	3	0.0 0.	0 0.	0 0.	0
6.0 - 7.0 m (%)	0.0 0.	0 0.	0 6.	3 6.	3	0.0 0.	0 0.	0 0.	0

Appendix 2. continued

Habitat Parameter	Plot 7			Plot 8		Plot 9			
	2005	2006 2	007 2	005 2	006	2007 2	005 2	006 2	007
7.0 - 7.5 m (%)	0.0 0.	0 0.	0 6.	3 6.	3	0.0 0.	0 0.	0 0.	0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	100.0	100.0 10	0.0 10	0.0	93.8	100.0 10	0.0 10	0.0 10	0.0
1.0 - 2.0 m (%)	62.5 12	.5 25	.0 12	.5 12	.5	0.0	12.5	0.0	25.0
2.0 - 3.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
3.0 - 4.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
4.0 - 5.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
5.0 - 6.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
6.0 - 7.0 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
7.0 - 7.5 m (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
1.78 meter sample plot coverage									
Deciduous litter (%)	0.0 0	.0 0	.0 0	.1 0	.1	0.0 0	.0 0	.0 0	.0
Conifer litter (%)	0.0 0	.0 0	.0 0	.0 0	.0	0.0 0	.0 0	.0 0	.0
Grass litter (%)	1.8	3.0 3	7.5	44.4 8	.4	3.0 1	7.6	20.6	15.0
Bare soil (%)	85.0 85	.0 15	.0 43	.8 79.4		85.0 73	.8 79.4	37.5	
Rock (%)	0.0 0.	4 0.	0 0.	1 4.	1	0.5 0.	0 0.	5 0.	5
Woody debris (%)	0.0 0.	0 0.	0 0.	8 0.	1	0.0 0.	0 0.	0 0.	0
Unvegetated (%)	97.5 85	.0 85	.0 85	.0 76	.9	97.5 85	.0 62	.5 85	.0
Warm season grass (%)	0.0 0.	0 0.	5 0.	0 0.	0	0.5 0.	0 0.	0 3.	0
Cool season grass (%)	26.3 31	.9 15	.0 29	.5 35	.1	3.0	9.0	38.8 15	.0
Forb (%)	32.5 56	.3 15	.0 40	.8 23	.3	3.0	28.3 44	.4 15	.0
Moss and lichen (%)	0.0 0.	8 0.	0 0.	0 4.	5	0.0 0.	0 1.	8 0.	0
Shrub and vine (%)	0.0 0.	1 0.	0 0.	1 0.	0	0.0 0.	8 0.	0 0.	0
Tree seedling (%)	0.0 0.	0 0.	0 0.	0 0.	0	0.0 0.	0 0.	0 0.	0
Total foliar (%)	50.0 79	.4 62	.5 62	.5 50	.6	15.0 43	.8 68	.1 62	.5

Appendix 2. continued

Habitat Parameter	Plot 10				Plot 11			Plot 12	
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
50 meter plot coverage									
Corn Field (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Fescue/Orchard grass (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Lawn (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Old Field (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0	97.5	85.0	97.5
Parking Lot (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Pasture Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Paved Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Restored Prairie (%)	97.5	97.5	97.5	0.0	0.0 0.	0 0.	0	0.0 0.	0
Riparian Woodland (%)	0.0	0.0	0.0	97.5	97.5	85.0	0.0	0.0	0.0
Shrub (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Stream (%)	0.0	0.0 0.	0 0.	0	3.0 0.	5 0.	0	0.0 0.	0
Trail (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Tree Line (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Woodland (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	5	15.0	0.0
5 meter sampling plot coverage									
Canopy cover									
Hardwood (%)	0.0	0.0	0.0 95	.1	98.1	93.1 3.	9	14.0 0.	0
Total cover (%)	0.0	0.0	0.0 95	.1	96.9	93.1 3.	9	14.0 0.	0
Canopy height									
Hardwood (m)	0.0	0.0 0.	0	11.1	13.0	7.0 0.	0	0.0 0.	0
Basal Area									
Hardwood (m2/ha)	0.0	0.0 0.	0 5.	8	5.3 3.	0 0.	0	0.0 0.	0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	97.5	97.5 62	.5 97	.5	97.5 97	.5 97	.5	97.5 97	.5
0.25 - 0.75 m (%)	40.6	97.5 15	.0 66	.0	97.5 85	.0 94	.4	97.5 97	.5
0.5 - 1.0 m (%)	0.8	62.0	0.5	61.8	88.8 37	.5 85	.6	55.6 62	.5
0.75 - 1.25 m (%)	0.0	1.0	0.0	61.0	47.0	15.0	47.0	19.6	0.5
1.0 - 1.5 m (%)	0.0	0.1 0.	0	33.5	3.9 0.	0	13.1	3.8 0.	0
1.25 - 1.75 m (%)	0.0	0.0	0.0	32.5	25.0	0.0	0.8	0.1	0.0
1.5 - 2.0 m (%)	0.0	0.0 0.	0	33.5	15.6	0.0 0.	0	0.0 0.	0
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	97.5	97.5 97	.5 97	.5	97.5 97	.5 97	.5	97.5 97	.5
0.25 - 0.75 m (%)	76.9	97.5 97	.0 97	.5	97.5 97	.5 97	.5	97.5 97	.5
0.5 - 1.0 m (%)	1.6	88.8 62	.5 97	.5	97.5 97	.5 76	.9	70.6 85	.0
0.75 - 1.25 m (%)	0.0	25.9	0.0	74.2	23.3	37.5	43.9	34.0	3.0
1.0 - 1.5 m (%)	0.0	0.8 0.	0	38.5	0.9 0.	0 7.	5	24.5	0.0
1.25 - 1.75 m (%)	0.0	0.0	0.0	74.2	4.5	85.0	0.1	28.1	0.0
1.5 - 2.0 m (%)	0.0	0.0	0.0 85	.8	36.9	37.5 0.	1	48.8 0.	0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	0.0	0.0	0.0	12.5	0.0	0.0	12.5	12.5	25.0
1.0 - 2.0 m (%)	0.0	0.0 0.	0	25.0	6.3 0.	0 6.	3	0.0 0.	0
2.0 - 3.0 m (%)	0.0	0.0	0.0	25.0	37.5	50.0	0.0	0.0	0.0
3.0 - 4.0 m (%)	6.3	0.0	0.0	37.5	31.3	25.0	0.0	0.0	0.0
4.0 - 5.0 m (%)	0.0	0.0	0.0	43.8	50.0	25.0	0.0	0.0	0.0
5.0 - 6.0 m (%)	0.0	0.0 0.	0	50.0	18.8	0.0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0	12.5	25.0	0.0 0.	0	0.0 0.	0

Appendix 2. continued

Habitat Parameter	Plot 10			Plot 11			Plot 12		
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
7.0 - 7.5 m (%)	0.0 0.	0	0.0	6.3 6.	3	100.0	0.0 6.	3	0.0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	87.5	100.0 10	0.0 10	0.0	93.8	100.0 10	0.0	100.0	100.0
1.0 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.3 0.	0	12.5	6.3 0.	0
2.0 - 3.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
7.0 - 7.5 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.78 meter sample plot coverage									
Deciduous litter (%)	0.0	0.0 0	.0	11.6	14.6	0.5 1	.0	0.9 0	.5
Conifer litter (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0 0	.0	0.0 0	.0
Grass litter (%)	1.0	8.4 3	7.5 1	.0	1.8 1	5.0	23.3	20.9	15.0
Bare soil (%)	94.4	79.4	15.0	73.8	56.3 37.5 61		.9 73.1		37.5
Rock (%)	0.0	0.5 0.	0 0.	0	4.0 0.	0 0.	0	0.5 0.	0
Woody debris (%)	0.0	0.0 0.	0 1.	8	0.3 0.	0 0.	4	0.0 0.	0
Unvegetated (%)	94.4	85.0 85	.0 94	.4	73.8 85	.0 85	.0	85.0 85	.0
Warm season grass (%)	0.0	0.3 3.	0 0.	0	0.0 3.	0 0.	1	0.1 0.	5
Cool season grass (%)	0.3	14.6 37	.5	4.6	12.0 15	.0 15	.0	32.5	3.0
Forb (%)	12.0	50.0 3.	0 23	.3	32.5 3.	0 31	.9	26.5	15.0
Moss and lichen (%)	0.0	5.4 0.	0 0.	0	9.0 0.	0 0.	0	1.0 0.	0
Shrub and vine (%)	0.3	0.5 0.	0 1.	1	6.0 0.	5 4.	6	9.5 0.	0
Tree seedling (%)	0.1	0.0 0.	0 0.	4	0.1 0.	0 0.	0	0.0 0.	0
Total foliar (%)	12.0	56.3 62	.5 26	.3	56.3 62	.5 62	.5	62.5 37	.5

Appendix 2. continued

Habitat Parameter	Plot 13				Plot 14			Plot 15	
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
50 meter plot coverage									
Corn Field (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Fescue/Orchard grass (%)	0.0	15.0 3.	0 97	.5	97.5	97.5	0.0	0.0	0.0
Lawn (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Old Field (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0	85.0	97.5	85.0
Parking Lot (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Pasture Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Paved Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	3.0 0.	5
Restored Prairie (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Riparian Woodland (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0 0	.0	0.0 0	.0
Shrub (%)	97.5	15.0	0.0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Stream (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Trail (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Tree Line (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 3.	0	0.0 0.	0
Woodland (%)	0.0	85.0	62.5	0.0	0.0 0.	0 0.	0	0.0 0.	0
5 meter sampling plot coverage									
Canopy cover									
Hardwood (%)	66.0	58.7	76.4 0.	0	0.0	0.0 12	.2	49.9 0.	0
Total cover (%)	66.0	97.5	76.4 0.	0	0.0	0.0 12	.2	49.9 0.	0
Canopy height									
Hardwood (m)	5.5	4.2 3.	5 0.	0	0.0 0.	0	11.0	0.0 0.	0
Basal Area									
Hardwood (m2/ha)	4.0	0.0 1.	0 0.	0	0.0 0.	0 2.	0	1.0 0.	0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	97.5	94.4 62	.5 97	.5	94.4 97	.5 97	.5	97.5 97	.5
0.25 - 0.75 m (%)	80.0	94.4 15	.0 97	.5	56.3 62	.5 94	.4	71.3 97	.5
0.5 1.0 m (%)	58.3	82.5 15	.0 55	.6	17.0 37	.5 50	.1	26.9 15	.0
0.75 - 1.25 m (%)	64.5	65.0	15.0	0.4	0.1	0.5	10.3	4.8	0.5
1.0 - 1.5 m (%)	79.4	80.0	37.5	0.0	0.0 0.	0 0.	9	0.0 0.	0
1.25 - 1.75 m (%)	53.1	97.5	62.5	0.0	0.0	0.0	0.8	0.8	0.0
1.5 - 2.0 m (%)	44.5	97.5	97.5	0.0	0.0 0.	0 0.	3	1.5 0.	0
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	97.5	97.5 97	.5 97	.5	97.5 97	.5 97	.5	97.5 97	.5
0.25 - 0.75 m (%)	97.5	97.5 97	.5 97	.5	94.4 97	.5 97	.5	97.5 97	.5
0.5 1.0 m (%)	82.5	97.5 97	.5 88	.8	44.4 37	.5 65	.0	73.8 97	.5
0.75 - 1.25 m (%)	73.9	94.4	97.5	1.0	7.5	0.5	13.3	8.4	0.5
1.0 - 1.5 m (%)	82.5	97.5	97.5	0.0	0.0 0.	0 4.	5	0.1 0.	0
1.25 - 1.75 m (%)	94.4	97.5	97.5	0.0	0.0	0.0	0.9	0.1	0.0
1.5 - 2.0 m (%)	94.4	97.5	97.5	0.0	0.0 0.	0 0.	1	0.3 0.	0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	43.8	43.8	50.0	0.0	0.0 0.	0 0.	0	0.0 0.	0
1.0 - 2.0 m (%)	43.8	31.3	75.0	0.0	0.0 0.	0 0.	0	0.0 0.	0
2.0 - 3.0 m (%)	18.8	56.3	100.0	0.0	0.0 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	6.3	37.5	100.0	0.0	0.0 0.	0 0.	0	0.0 0.	0
4.0 - 5.0 m (%)	18.8	25.0	50.0	0.0	0.0 0.	0 0.	0	0.0 0.	0
5.0 - 6.0 m (%)	12.5	12.5	50.0	0.0	0.0 0.	0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	6.3 6.	3	50.0	0.0 0.	0	0.0	0.0 0.	0	0.0

Appendix 2. continued

Habitat Parameter	Plot 13			Plot 14			Plot 15		
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
7.0 - 7.5 m (%)	6.3 6.	3	25.0	0.0 0.	0	0.0	0.0 0.	0	0.0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	87.5	81.3	100.0	100.0	100.0	100.0	93.8	100.0	100.0
1.0 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
2.0 - 3.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
7.0 - 7.5 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.78 meter sample plot coverage									
Deciduous litter (%)	17.6	6.0 0	.5 0	.0	0.0 0	.0 3	.8	3.8 0	.5
Conifer litter (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0 0	.0	0.0 0	.0
Grass litter (%)	16.6	4.8	3.0	73.1	56.3 3	7.5 3	5.1	38.1 3	7.5
Bare soil (%)	61.9	73.8	37.5	11.6	38.1 15.0 38		.1 56.3		15.0
Rock (%)	0.0	0.5 0.	0 0.	0	0.5 0.	0 0.	0	0.5 0.	0
Woody debris (%)	11.6	0.0 0.	5 0.	1	0.0 0.	0 0.	1	0.0 0.	0
Unvegetated (%)	91.3	73.8 85	.0 85	.0	85.0 85	.0 91	.3	85.0 85	.0
Warm season grass (%)	0.1	0.1 0.	5 0.	0	0.1 0.	5 0.	0	0.0 0.	5
Cool season grass (%)	6.0	5.4	3.0	44.4	37.5 37	.5 20	.9	44.4 15	.0
Forb (%)	26.3	17.6	15.0 7.	8	11.4 3.	0 23	.3	20.6 3.	0
Moss and lichen (%)	0.0	9.0 0.	0 0.	0	1.8 0.	0 0.	0	0.3 0.	0
Shrub and vine (%)	20.3	28.9	0.0 0.	8	0.0 0.	0 0.	0	0.0 0.	0
Tree seedling (%)	3.0	13.1	0.5 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Total foliar (%)	68.1	61.9 37	.5 56	.3	43.8 62	.5 38	.1	56.3 62	.5

Appendix 2. continued

Habitat Parameter	Plot 16				Plot 17			Plot 18	
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
50 meter plot coverage									
Corn Field (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Fescue/Orchard grass (%)	62.5	97.5	97.5 0.	0	0.0	0.0 97	.5	62.5	62.5
Lawn (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	15.0	0.0
Old Field (%)	0.0	0.0	0.0	97.5	85.0	97.5	0.0	0.0	0.0
Parking Lot (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0	15.0
Pasture Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Paved Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Restored Prairie (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Riparian Woodland (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0 0	.0	0.0 0	.0
Shrub (%)	15.0	0.0 0.	0 0.	0	3.0 0.	0 0.	0	0.0 0.	0
Stream (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Trail (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Tree Line (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Woodland (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5 meter sampling plot coverage									
Canopy cover									
Hardwood (%)	0.0	0.0 0.	0 0.	0	33.0	0.0	36.2	55.4	52.5
Total cover (%)	0.0	0.0	0.0	0.0	33.0	0.0	36.2	55.4	52.5
Canopy height									
Hardwood (m)	0.0	0.0 0.	0 0.	0	3.6 0.	0	10.2	16.0	0.0
Basal Area									
Hardwood (m2/ha)	0.0	0.0 0.	0 0.	0	1.0 0.	0 6.	0	3.3 0.	0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	97.5	97.5 62	.5 97	.5	97.5 97	.5 97	.5	44.4 62	.5
0.25 - 0.75 m (%)	88.8	71.3	62.5	85.6	88.8	97.5	88.8	7.5	37.5
0.5 - 1.0 m (%)	38.3	28.9 15	.0 11	.6	70.6 62	.5 37	.6	0.1	0.5
0.75 - 1.25 m (%)	1.0	8.3	0.0	3.9	32.6	3.0	19.5	0.0	0.0
1.0 - 1.5 m (%)	0.0	0.3 0.	0 0.	0	24.5	0.0	10.1	0.0 0.	0
1.25 - 1.75 m (%)	0.0	0.0	0.0	0.0	21.3	0.0	0.3	0.0	0.0
1.5 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	31.3	0.0 0.	8	0.0 0.	0
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	97.5	97.5 97	.5 97	.5	97.5 97	.5 97	.5	88.8 97	.5
0.25 - 0.75 m (%)	97.5	94.4 97	.5 97	.5	97.5 97	.5 97	.5	56.3 97	.5
0.5 - 1.0 m (%)	53.1	44.4 37	.5 38	.1	76.9 97	.5 76	.9	45.8	0.5
0.75 - 1.25 m (%)	25.1	4.8	0.5	0.9	47.5	15.0	43.9	13.1	0.0
1.0 - 1.5 m (%)	0.1	0.3 0.	0 0.	0	28.1	0.0	20.1	0.1 0.	0
1.25 - 1.75 m (%)	0.0	0.0	0.0	0.0	24.5	0.0	9.4	9.4	0.0
1.5 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	15.6	0.0 3.	8	21.4	0.0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	0.0 0.	0	0.0	0.0 6.	3	25.0	0.0 0.	0	0.0
1.0 - 2.0 m (%)	6.3	0.0 0.	0 0.	0	18.8	0.0 0.	0	6.3 0.	0
2.0 - 3.0 m (%)	6.3	0.0 0.	0 0.	0	6.3 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	6.3	0.0 0.	0 0.	0	6.3 0.	0 6.	3	6.3 0.	0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 6.	3	0.0	25.0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0	25.0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	6.3	25.0

Appendix 2. continued

Habitat Parameter	Plot 16			Plot 17			Plot 18		
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
7.0 - 7.5 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 6.	3	0.0 0.	0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	93.8	100.0 10	0.0 10	0.0	100.0 10	0.0 10	0.0	100.0	100.0
1.0 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	6.3 0.	0
2.0 - 3.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
7.0 - 7.5 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.78 meter sample plot coverage									
Deciduous litter (%)	0.3	0.1 0	.0 0	.0	2.3 0	.5 0	.3	0.9 0	.5
Conifer litter (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0 0	.0	0.0 0	.0
Grass litter (%)	73.8	20.6 3	7.5 3	8.8	31.9 1	5.0 3	2.8	13.4 1	5.0
Bare soil (%)	23.3	68.1	15.0	44.4	68.1 37.5 29		.5 79.4		37.5
Rock (%)	0.0	0.5 0.	0 0.	0	0.5 0.	0 0.	0	6.0 0.	0
Woody debris (%)	0.1	0.0 0.	0 0.	0	3.9 0.	5 0.	8	1.0 0.	0
Unvegetated (%)	8.0	85.0 85	.0 85	.0	79.4 85	.0 76	.9	85.0 85	.0
Warm season grass (%)	0.0	0.0 0.	5 0.	0	0.1 0.	5 0.	0	5.4 0.	5
Cool season grass (%)	26.9	37.5 37	.5 44	.4	38.1 15	.0 56	.3	37.5 37	.5
Forb (%)	35.0	37.5 0.	5 14	.0	20.6	15.0 6.	0	15.0 3.	0
Moss and lichen (%)	0.0	4.8 0.	0 0.	0	0.1 0.	0 0.	0	0.0 0.	0
Shrub and vine (%)	0.9	3.8 0.	0 0.	9	13.9	0.0 0.	0	0.8 0.	0
Tree seedling (%)	0.3	0.0 0.	0 0.	0	0.0 0.	5 0.	1	0.0 0.	0
Total foliar (%)	61.9	62.5 37	.5 56	.3	61.9 62	.5 25	.1	43.8 37	.5

Appendix 2. continued

Habitat Parameter	Plot 19				Plot 20			Plot 21	
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
50 meter plot coverage									
Corn Field (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Fescue/Orchard grass (%)	0.0	0.0	0.0 97	.5	85.0	85.0 0.	0	0.0	0.0
Lawn (%)	0.0	0.0 0.	0 0.	0	3.0 0.	5 0.	0	0.0 0.	0
Old Field (%)	97.5	97.5	97.5	0.0	0.0 0.	0 0.	0	0.0 0.	0
Parking Lot (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Pasture Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Paved Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Restored Prairie (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Riparian Woodland (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0	85.0	97.5	97.5
Shrub (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Stream (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	5	3.0 0.	0
Trail (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Tree Line (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Woodland (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5 meter sampling plot coverage									
Canopy cover									
Hardwood (%)	0.0	0.0 0.	0	25.0	0.0 0.	0	98.8	98.1	99.3
Total cover (%)	0.0	0.0	0.0	25.0	0.0	0.0	98.8	98.1	99.3
Canopy height									
Hardwood (m)	0.0	0.0 0.	0 0.	0	0.0 0.	0	29.7	15.0	14.0
Basal Area									
Hardwood (m2/ha)	0.0	0.0 0.	0 2.	0	0.0 0.	0	17.3	14.0	10.0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	82.5	23.9 97	.5 97	.5	97.5 97	.5 73	.1	97.5 97	.5
0.25 - 0.75 m (%)	17.6	0.8	62.5	91.3	93.3	97.5	38.1	82.5	62.5
0.5 1.0 m (%)	0.1	0.0	3.0	68.1	54.3	37.5	5.3	47.0	15.0
0.75 - 1.25 m (%)	0.0	0.0	0.0	20.6	22.8	37.5	0.1	0.5	0.0
1.0 - 1.5 m (%)	0.0	0.0 0.	0 0.	1	1.2 3.	0 3.	8	15.9	0.0
1.25 - 1.75 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	9	2.4 0.	0
1.5 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 9.	4	14.0	62.5
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	97.5	38.1 97	.5 97	.5	97.5 97	.5 97	.5	97.5 97	.5
0.25 - 0.75 m (%)	67.5	0.8	97.5	97.5	97.5	97.5	82.5	97.5	97.5
0.5 1.0 m (%)	7.8	0.1	85.0 94	.4	85.8 97	.5 58	.8	88.8 97	.5
0.75 - 1.25 m (%)	0.0	0.0	0.0	62.5	58.3	0.0	7.6	49.5	62.5
1.0 - 1.5 m (%)	0.0	0.0	0.0	0.1	1.3	15.0	4.0	50.1	37.5
1.25 - 1.75 m (%)	0.0	0.0	0.0	0.0	0.0	0.5	7.5	44.5	0.0
1.5 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0	28.1	44.5	0.0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 6.	3	0.0	25.0
1.0 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	12.5	25.0
2.0 - 3.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0	12.5	18.8	25.0
3.0 - 4.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 6.	3	12.5	0.0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0	12.5	25.0	0.0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0	18.8	6.3 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0	12.5	6.3 0.	0

Appendix 2. continued

Habitat Parameter	Plot 19			Plot 20			Plot 21		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
7.0 - 7.5 m (%)	0.0	0.0	0.0	0	0.0	0	12.5	0.0	25.0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	100.0	93.8	100.0	100.0	100.0	100.0	81.3	93.8	50.0
1.0 - 2.0 m (%)	0.0	0	0.0	6.3	3	25.0	0.0	3	0.0
2.0 - 3.0 m (%)	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0
3.0 - 4.0 m (%)	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0
4.0 - 5.0 m (%)	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0
5.0 - 6.0 m (%)	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0
6.0 - 7.0 m (%)	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0
7.0 - 7.5 m (%)	0.0	0.0	0.0	0	0.0	0.0	0	0.0	0
1.78 meter sample plot coverage									
Deciduous litter (%)	0.0	0.0	.0	.0	0.0	.0	.1	52.6	37.5
Conifer litter (%)	0.0	0.0	.0	.0	0.0	.0	.0	0.0	.0
Grass litter (%)	0.4	2.4	0.5	20.6	45.8	37.5	0.5	0.4	3.0
Bare soil (%)	85.0	85.0	62.5	73.8	54.2	15.0	.1	41.4	15.0
Rock (%)	0.0	0.4	5.0	0	0.5	0.3	8	4.1	0
Woody debris (%)	0.0	0.0	0.0	0	0.0	0.4	8	9.0	5
Unvegetated (%)	85.0	85.0	.0	.1	85.0	.0	.4	85.0	.0
Warm season grass (%)	0.1	0.0	0.0	0	0.0	5.0	0	0.0	5
Cool season grass (%)	0.4	1.8	0.5	.1	37.5	37.5	5	2.3	.0
Forb (%)	31.9	.6	15.0	17.6	.0	3.0	26.5	.9	3.0
Moss and lichen (%)	0.0	6.0	0.0	0	0.5	0.0	0	1.8	0
Shrub and vine (%)	0.1	0.0	0.0	1	0.0	0.0	1	2.3	0
Tree seedling (%)	0.0	0.0	0.0	1	0.0	0.0	4	0.8	5
Total foliar (%)	31.9	37.5	.5	.0	62.5	.5	.5	44.4	.5

Appendix 2. continued

Habitat Parameter	Plot 22			Plot 23			Plot 24		
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
50 meter plot coverage									
Corn Field (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Fescue/Orchard grass (%)	97.5	97.5	97.5	0.0	0.0 0.	0 0.	0	0.0 0.	0
Lawn (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Old Field (%)	0.0	0.0	0.0	97.5	97.5 97	.5 97	.5	97.5 85	.0
Parking Lot (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Pasture Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	3.0 0.	0
Paved Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Restored Prairie (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Riparian Woodland (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0 0	.0	0.0 0	.0
Shrub (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Stream (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Trail (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Tree Line (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	5
Woodland (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5 meter sampling plot coverage									
Canopy cover									
Hardwood (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Total cover (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Canopy height									
Hardwood (m)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Basal Area									
Hardwood (m2/ha)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	97.5	94.4 15	.0 82	.5	97.5 97	.5 97	.5	97.5 97	.5
0.25 - 0.75 m (%)	97.5	49.4	0.0	17.6	80.0	62.5	91.3	82.5	85.0
0.5 1.0 m (%)	85.0	20.9 0.	0	0.1	29.5 0.	0 61	.9	59.4	15.0
0.75 - 1.25 m (%)	31.9	0.1	0.0	0.0	0.9	0.0	2.4	14.0	0.0
1.0 - 1.5 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.25 - 1.75 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.5 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	97.5	97.5 37	.5 94	.4	97.5 97	.5 97	.5	97.5 97	.5
0.25 - 0.75 m (%)	97.5	97.5	0.0	50.0	97.5	97.5	97.5	97.5	97.5
0.5 1.0 m (%)	94.4	50.0 0.	0	0.3	44.5 0.	0 88	.1	71.3	62.5
0.75 - 1.25 m (%)	70.6	1.0	0.0	0.0	1.0	0.0	20.9	19.5	0.5
1.0 - 1.5 m (%)	0.3	0.0 0.	0 0.	0	0.0 0.	0 0.	8	0.0 0.	0
1.25 - 1.75 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.5 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 6.	3	6.3 0.	0
1.0 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
2.0 - 3.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0

Appendix 2. continued

Habitat Parameter	Plot 22			Plot 23			Plot 24		
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
7.0 - 7.5 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	100.0	100.0 10	0.0 10	0.0	100.0 10	0.0 10	0.0	100.0	100.0
1.0 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
2.0 - 3.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
7.0 - 7.5 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.78 meter sample plot coverage									
Deciduous litter (%)	0.0	0.0 0	.0 0	.1	0.1 0	.0 0	.0	0.4 0	.0
Conifer litter (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0 0	.0	0.1 0	.0
Grass litter (%)	20.9	20.6 3	7.5 1	7.6	20.6 6	2.5 6	1.9	56.3 1	5.0
Bare soil (%)	61.9	79.4	15.0	79.4	79.4 37.5 20		.9 38.1		37.5
Rock (%)	0.0	0.5 0.	0 0.	0	1.1 0.	0 0.	8	0.0 0.	0
Woody debris (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Unvegetated (%)	88.1	85.0 85	.0 85	.0	85.0 85	.0 85	.0	68.1 85	.0
Warm season grass (%)	0.0	0.0 0.	0 0.	0	1.1 0.	5 0.	0	0.0 0.	5
Cool season grass (%)	50.6	31.9	3.0	5.4	20.3 15	.0 31	.9	50.0 15	.0
Forb (%)	11.6	17.6 0.	5 26	.3	44.4 0.	5	2.4	26.3	15.0
Moss and lichen (%)	0.0	1.1 0.	0 0.	0	0.4 0.	0 0.	0	0.8 0.	0
Shrub and vine (%)	0.1	0.0 0.	0 0.	4	0.8 0.	0 1.	8	11.3	0.0
Tree seedling (%)	0.1	0.0 0.	0 0.	3	0.0 0.	5 0.	0	0.8 0.	0
Total foliar (%)	56.3	37.5 15	.0 32	.5	56.3 37	.5 37	.5	68.1 62	.5

Appendix 2. continued

Habitat Parameter	Plot 25				Plot 26			Plot 27	
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
50 meter plot coverage									
Corn Field (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.5 0.	0
Fescue/Orchard grass (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Lawn (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Old Field (%)	97.5	97.5 85	.0 67	.5	85.0 37	.5 97	.5	97.5 85	.0
Parking Lot (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Pasture Road (%)	0.0	0.5 0.	5 0.	0	15.0	3.0 0.	0	0.0 0.	5
Paved Road (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Restored Prairie (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Riparian Woodland (%)	0.0	0.0 0	.0 3	.0	15.0	3.0 0	.0	0.0 0	.0
Shrub (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Stream (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Trail (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Tree Line (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Woodland (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5 meter sampling plot coverage									
Canopy cover									
Hardwood (%)	0.0	0.0 0.	0	51.2	17.7	0.0 0.	0	0.0 0.	0
Total cover (%)	0.0	0.0 0.	0	51.2	17.7	0.0 0.	0	0.0 0.	0
Canopy height									
Hardwood (m)	0.0	0.0 0.	0	13.0	0.0 0.	0 0.	0	0.0 0.	0
Basal Area									
Hardwood (m2/ha)	0.0	0.0 0.	0 4.	0	2.0 0.	0 0.	0	0.0 0.	0
Horizontal vegetation profile: 5-m									
0.0 - 0.5 m (%)	94.4	94.4 97	.5 94	.4	88.8 97	.5 97	.5	82.5 97	.5
0.25 - 0.75 m (%)	41.3	50.0 85	.0 73	.8	79.4 85	.0 47	.0	38.8 97	.5
0.5 1.0 m (%)	24.8	18.9 15	.0 38	.3	53.1 37	.5 16	.4	1.0	85.0
0.75 - 1.25 m (%)	0.8	4.0	0.5	15.9	16.5	15.0	0.3	0.0	62.5
1.0 - 1.5 m (%)	0.0	0.0 0.	0 0.	0	9.4 0.	0 0.	0	0.0 0.	0
1.25 - 1.75 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.5 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Horizontal vegetation profile: 15-m									
0.0 - 0.5 m (%)	97.5	97.5 97	.5 94	.4	97.5 97	.5 97	.5	97.5 97	.5
0.25 - 0.75 m (%)	73.8	97.5 97	.5 82	.5	79.4 97	.5 94	.4	94.4 97	.5
0.5 1.0 m (%)	29.0	38.1 97	.5 70	.8	41.3 85	.0 28	.9	59.4 97	.5
0.75 - 1.25 m (%)	21.3	4.8	62.5	28.9	22.0	37.5	3.9	13.1	62.5
1.0 - 1.5 m (%)	0.1	0.0 0.	0	24.4	0.0 0.	0 0.	1	0.1 3.	0
1.25 - 1.75 m (%)	0.0	0.0 0.	0 0.	1	0.0 0.	0 0.	1	0.0 0.	0
1.5 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
Vertical profile: Deciduous									
0.0 - 1.0 m (%)	6.3	6.3 0.	0 0.	0	6.3 0.	0 0.	0	0.0 0.	0
1.0 - 2.0 m (%)	0.0	0.0 0.	0 0.	0	6.3 0.	0 0.	0	0.0 0.	0
2.0 - 3.0 m (%)	0.0	0.0 0.	0 6.	3	0.0 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	0.0	0.0 0.	0 6.	3	0.0 0.	0 0.	0	0.0 0.	0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 6.	3	6.3 0.	0 0.	0	0.0 0.	0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0

Appendix 2. continued

Habitat Parameter	Plot 25			Plot 26			Plot 27		
	2005	2006 2	007 2	005	2006 2	007 2	005	2006	2007
7.0 - 7.5 m (%)	0.0	0.0 0.	0 6.	3	0.0 0.	0 0.	0	0.0 0.	0
Vertical profile: Herbaceous									
0.0 - 1.0 m (%)	100.0	100.0 10	0.0 10	0.0	100.0 10	0.0	87.5	100.0	100.0
1.0 - 2.0 m (%)	6.3	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
2.0 - 3.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
3.0 - 4.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
4.0 - 5.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
5.0 - 6.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
6.0 - 7.0 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
7.0 - 7.5 m (%)	0.0	0.0 0.	0 0.	0	0.0 0.	0 0.	0	0.0 0.	0
1.78 meter sample plot coverage									
Deciduous litter (%)	0.0	0.1 0	.0 0	.1	0.4 0	.0 0	.0	0.0 0	.0
Conifer litter (%)	0.0	0.0 0	.0 0	.0	0.0 0	.0 0	.0	0.0 0	.0
Grass litter (%)	19.6	0.5 1	5.0	26.5	23.3	15.0 0	.5	0.4 3	7.5
Bare soil (%)	61.9	85.0	37.5	47.0	56.3 37.5 73		.8 76.9		15.0
Rock (%)	0.0	0.4 0.	0 0.	0	0.4 0.	0	10.1	8.4 3.	0
Woody debris (%)	0.0	0.0 0.	0 0.	1	0.1 0.	0 0.	0	0.0 0.	0
Unvegetated (%)	85.0	79.4 85	.0 73	.8	85.0 85	.0 88	.1	88.1 85	.0
Warm season grass (%)	0.0	0.1 0.	5 0.	1	0.3 0.	5 0.	3	0.0 0.	5
Cool season grass (%)	17.3	12.0 3.	0 25	.3	32.5	15.0 0.	4	4.8 15	.0
Forb (%)	17.6	43.8 37	.5 35	.1	28.9 15	.0 26	.3	35.1	3.0
Moss and lichen (%)	0.0	1.6 0.	0 0.	0	4.6 0.	0 0.	0	0.9 0.	0
Shrub and vine (%)	0.1	3.8 0.	0 1.	1	0.1 0.	0 0.	1	0.0 0.	0
Tree seedling (%)	0.0	0.0 0.	0 0.	1	0.3 0.	0 0.	0	0.0 0.	0
Total foliar (%)	32.5	56.3 62	.5 50	.6	62.5 37	.5 26	.3	38.1 37	.5

The NPS has organized its parks with significant natural resources into 32 networks linked by geography and shared natural resource characteristics. HTLN is composed of 15 National Park Service (NPS) units in eight Midwestern states. These parks contain a wide variety of natural and cultural resources including sites focused on commemorating civil war battlefields, Native American heritage, westward expansion, and our U.S. Presidents. The Network is charged with creating inventories of its species and natural features as well as monitoring trends and issues in order to make sound management decisions. Critical inventories help park managers understand the natural resources in their care while monitoring programs help them understand meaningful change in natural systems and to respond accordingly. The Heartland Network helps to link natural and cultural resources by protecting the habitat of our history.

The I&M program bridges the gap between science and management with a third of its efforts aimed at making information accessible. Each network of parks, such as Heartland, has its own multi-disciplinary team of scientists, support personnel, and seasonal field technicians whose system of online databases and reports make information and research results available to all. Greater efficiency is achieved through shared staff and funding as these core groups of professionals augment work done by individual park staff. Through this type of integration and partnership, network parks are able to accomplish more than a single park could on its own.

The mission of the Heartland Network is to collaboratively develop and conduct scientifically credible inventories and long-term monitoring of park “vital signs” and to distribute this information for use by park staff, partners, and the public, thus enhancing understanding which leads to sound decision making in the preservation of natural resources and cultural history held in trust by the National Park Service.

www.nature.nps.gov/im/units/htln/



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

National Park Service
U.S. Department of the Interior



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