



Breeding Bird Monitoring Protocol for the Heartland Inventory and Monitoring Network

Narrative, Version 3.0

Natural Resource Report NPS/HTLN/NRR—2023/2543



ON THE COVER

Herbert Hoover birthplace cottage at Herbert Hoover National Historic Site, prescribed fire at Tallgrass Prairie National Preserve, aquatic invertebrate monitoring at George Washington Carver National Monument, the Mississippi River at Effigy Mounds National Monument.

Photography by NPS/Heartland I&M Network

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Heartland Inventory and Monitoring Network

National Park Service
Republic, Missouri

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Abstract

Birds are an important component of park ecosystems. They also have a tremendous following among the public, and many parks provide information on the status and long-term trends of bird populations through their interpretive programs. With habitat vanishing, ecosystems being altered, and bird populations declining, we proposed monitoring bird communities on National Park Service lands within the Heartland Inventory and Monitoring Network. Monitoring breeding birds helps park managers protect birds by providing them with information about the current status and long-term trends in bird populations.

This monitoring protocol consists of a protocol narrative (this document) and 10 standard operating procedures for monitoring breeding birds in Heartland Inventory and Monitoring Network parks. The overall goals of the network breeding bird monitoring are (1) to identify significant temporal changes in the species composition and abundance of bird communities that occur on parks during the breeding season and (2) to improve our understanding of relationships between breeding birds and their habitat and the effects of management actions (such as prairie restoration or prescribed fire) on bird populations by examining potential correlations between changes in specific habitat variables (e.g., vegetation structure, ground cover) and changes in bird community composition and abundance.

This protocol narrative describes the sampling design for breeding birds, including the response design (data collection methods), spatial design (the park and survey plots within a park), and revisit design (timing and frequency of park visits). It also outlines field methods for establishing survey plots, counting birds, and measuring habitat variables. Details can be found in the Standard Operating Procedures, which are listed in this report and available in the [NPS DataStore](https://irma.nps.gov) (<https://irma.nps.gov>). This protocol narrative also summarizes procedures for data management and reporting, personnel and operating requirements, and instructions for how to revise the protocol.

Acknowledgments

The National Park Service Inventory and Monitoring Program provided funding for the development of this bird monitoring protocol and continues to fund monitoring of the resource in network parks. Numerous NPS personnel and volunteers have contributed in-kind support to the development of this protocol and continue to assist with annual surveys. This protocol in an earlier version (Version 1.0) benefited from comments by Dr. John Sauer (USGS Patuxent Wildlife Research Center), Dr. Rich Camp (USGS Pacific Island Ecosystems Research Center) and Dr. Rodney Siegel (Institute for Bird Populations). In 2008, the protocol was revised (Version 2.0) to reflect the network's expansion of its bird monitoring efforts into additional parks and the turning over of Agate Fossil Beds National Monument, Nebraska, to the Northern Great Plains Inventory and Monitoring Network.

Revision History Log

Revision history log

Prev Version #	Revision Date	Author(s)	Changes Made	Reason for Changes	New Version #
1.0	May 2008	D.G. Peitz	Updated throughout to reflect the addition of ten Park Service units to the Heartland Inventory and Monitoring Network bird monitoring efforts, and the transitioning of one unit, Agate Fossil Beds National Monument, to the Northern Great Plains Inventory and Monitoring Network. Also reflected in this revision is the reduction in the number of habitat subplots sampled from four to one.	Edited to reflect the expansion of the Heartland Network breeding bird monitoring efforts to 10 additional Park Service units.	2.0
2.0	May 2019	D.G. Peitz	Updated throughout to NRR format per NRSS guidelines. Moved SOPs from Narrative to stand alone documents. Added a Quality Assurance Plan (QAP) to the protocol. Minor edits throughout the documents.	Edited to meet I&M Division Guidance. Made Narrative NRSS compliant.	3.0

Version numbers increase incrementally by hundredths (e.g., version 1.01, version 1.02, etc.) for minor changes. Major revisions will be designated with the next whole number (e.g., version 2.0, 3.0, 4.0...). The previous version number, date of revision, author of the revision, and the reason for making the changes are recorded along with the new version number. The first version of this protocol was published in 2003.

List of Standard Operating Procedures (SOPs) and Supplemental Documents

The following standard operating procedures (SOPs) and Supplemental Documents are associated with this narrative. Each document is a stand-alone document and can be found in the [NPS DataStore](https://irma.nps.gov) (<https://irma.nps.gov>).

SOP 1. Preparations and Equipment Setup Prior to the Field Season

SOP 2. Training Observers

SOP 3. Establishing and Marking Sampling Plots

SOP 4. Conducting the Variable Circular Plot Count

SOP 5. Documenting Habitat Variables

SOP 6. Data Management

SOP 7. Data Summary and Analysis

SOP 8. Reporting

SOP 9. Procedures and Equipment Storage after the Field Season

SOP 10. Revising the Protocol

Supplemental Document 1. Analysis of Species Accumulation Curves, Species Richness Estimators, and Suggested Changes in Grid Size for Bird Community Sampling

Supplemental Document 2. Evaluation of Habitat Data as Correlates of Bird Community Metrics and Species Occurrence

Supplemental Document 3. Quality Assurance Plan for Breeding Bird Monitoring in the Heartland Inventory and Monitoring Network

Background and Objectives

Issue Being Addressed and Rationale for Monitoring Bird Populations

Birds are an important component of park ecosystems. Their high body temperature, rapid metabolism, and high ecological position in most food webs make them good indicators of the effects of local and regional changes in ecosystems. It has been suggested that management activities aimed at preserving habitat for bird populations (e.g., habitat for neotropical migrants) can have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991; Maurer 1993). Birds also have a tremendous following among the public, and many parks provide information on the status and trends of bird populations through their interpretive programs.

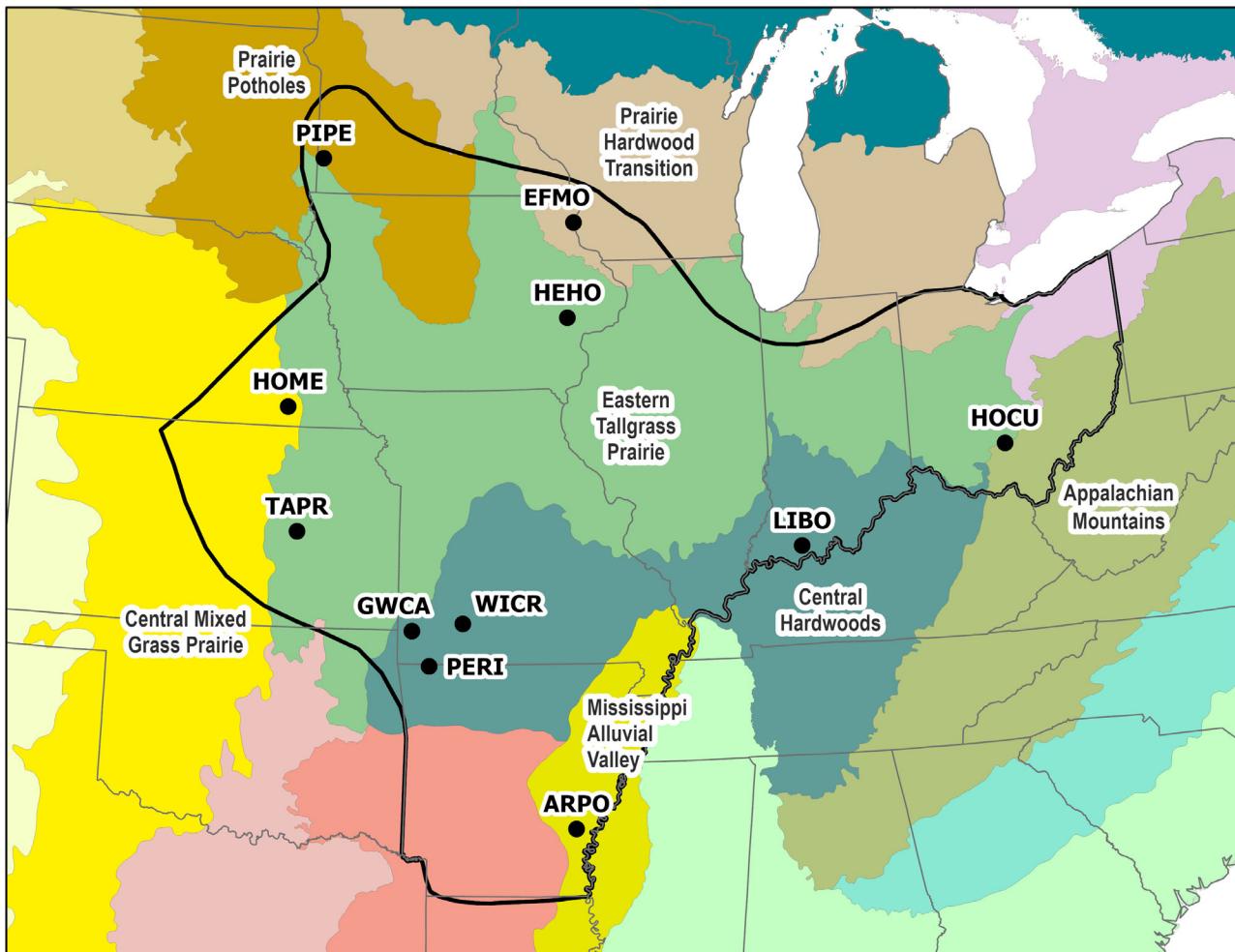
Native Great Plains grasslands and their constituent avian fauna once covered vast areas of the North American continent where the Heartland Inventory and Monitoring Network now resides. In fact, 10 of the 11 parks with bird populations monitored by the Heartland Inventory and Monitoring Network have

significant grassland components in their landscape. However, during the last century, large portions of grassland landscapes were plowed for cropland or converted to livestock pasture (29% of shortgrass, 41% of mixed-grass, and 99% of tallgrass prairies; Knopf and Samson 1997). Remaining grasslands have been altered further through continued fragmentation and isolation, changing agricultural practices, forest encroachment, interruption of ecological drivers like periodic wildfire, and loss of significant faunal species, including bison (*Bison bison*), elk (*Cervus elaphus*), and wolves (*Canis lupus*). Therefore, most bird communities are being monitored on a landscape that is far different from the landscape they evolved in.

Parts of seven bird conservation regions identified by the North American Bird Conservation Initiative are found within the Heartland Inventory and Monitoring Network (Figure 1). Started in 1999, the North American Bird Conservation Initiative is a coalition of government agencies and private organizations in Canada, Mexico, and the United



Great Egret at Arkansas Post National Memorial. NPS/Heartland Inventory and Monitoring Network



- Parks
- States
- Heartland Network

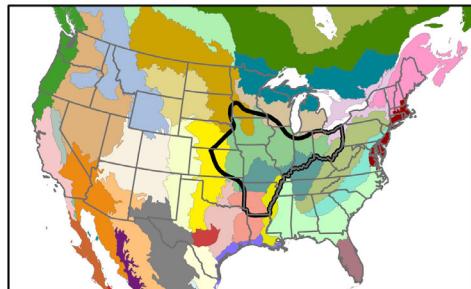


Figure 1. Bird Conservation Regions in the Heartland Inventory and Monitoring Network.

States working to ensure the long-term health of North America's native bird populations (North American Bird Conservation Initiative 2019). Each bird conservation region has a unique habitat and suite of birds in need of conservation.

Hopewell Culture National Historical Park, Ohio, is located on the border of two bird conservation regions, the Eastern Tallgrass Prairie and Appalachian Mountains (Figure 1). The Eastern Tallgrass Prairie Bird Conservation Region historically consisted of

the tallest and lushest grasslands of the Great Plains (North American Bird Conservation Initiative 2019). However, forests dominate the region in the east creating an oak-savanna ecotone between the eastern woodlands and the western prairie. The Appalachian Mountains Bird Conservation Region has a rugged terrain dominated by oak-hickory and other deciduous forest types at lower elevations and by various combinations of pine, hemlock, spruce, and fir in higher areas.

Flatter portions are used for agriculture; however, most of this region is forested. High priority birds common to both regions include Peregrine Falcon (*Falco peregrinus*), Upland Sandpiper (*Bartramia longicauda*), Eastern Whip-poor-will (*Antrostomus vociferus*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Loggerhead Shrike (*Lanius ludovicianus*), Bewick's Wren (*Thryomanes bewickii*), Wood Thrush (*Hylocichla mustelina*), Blue-winged Warbler (*Vermivora cyanoptera*), Cerulean Warbler (*Setophaga cerulea*), Kentucky Warbler (*Geothlypis formosa*), and Henslow's Sparrow (*Ammodramus henslowii*; U.S. Fish and Wildlife Service 2008). Approximately 126 species of breeding birds can be found in the habitats of the Eastern Tallgrass Prairie and Appalachian Mountains bird conservation regions around Hopewell Culture National Historical Park (Peterjohn 2001).

Herbert Hoover National Historic Site, Iowa, is in the north-central section of the Eastern Tallgrass Prairie Bird Conservation Region (Figure 1). Threats to the habitat of this region include urbanization, recreational development, and agriculture.

Approximately 124 species of breeding birds can be found in the tallgrass prairie habitat in and around Herbert Hoover National Historic Site (Jackson et al. 1996). Some species in the region, including American Coot (*Fulica americana*), Savannah Sparrow (*Passerculus sandwichensis*), Western Meadowlark (*Sturnella neglecta*), and Eastern Whip-poor-will (*Antrostomus vociferus*), are declining at alarming rates.

Tallgrass Prairie National Preserve, Kansas, is in the west-central section of the Eastern Tallgrass Prairie Bird Conservation Region, which consists of the Flint Hills and its remnant native tallgrass prairie (Figure 1; Fitzgerald et al. 2000). The rocky, rolling terrain of the Flint Hills has been largely untouched by the plow. Threats to the upland and wetland habitats of this region include urbanization, recreational development, and agricultural expansion. High priority grassland birds that persist in some areas include Greater Prairie-Chicken (*Tympanuchus cupido*) and Henslow's Sparrow (*Ammodramus henslowii*). Cerulean Warblers (*Setophaga cerulea*) are found in some wooded areas, and Red-headed Woodpecker (*Melanerpes erythrocephalus*) leads the list of savanna specialists (North American Bird Conservation Initiative 2019). Approximately 120 species of breeding birds can be found in the habitat

of the Flint Hills around Tallgrass Prairie National Preserve (Thompson et al. 2011).

Lincoln Boyhood National Memorial, Indiana, is in the Interior Low Plateaus section of the Central Hardwoods Bird Conservation Region (Figure 1; North American Bird Conservation Initiative 2019). The area is dominated by an oak-hickory deciduous forest inhabited by interior forest species, such as Cerulean Warbler (*Setophaga cerulea*), Worm-eating Warbler (*Helmitheros vermivorum*), and Louisiana Waterthrush (*Parkesia motacilla*). The region includes some of the most extensive forests in the middle of the continent and is likely a source for many bird populations continent-wide. Threats to the region include deforestation for agriculture and urbanization. Like other parks in the region (Pea Ridge National Military Park, Arkansas, Wilson's Creek National Battlefield, Missouri, and George Washington Carver National Monument, Missouri), high priority birds found there include Bell's Vireo (*Vireo bellii*), Bewick's Wren (*Thryomanes bewickii*), Blue-winged Warbler (*Vermivora cyanoptera*), Cerulean Warbler (*Setophaga cerulea*), Henslow's Sparrow (*Ammodramus henslowii*), Kentucky Warbler (*Geothlypis formosa*), Prairie Warbler (*Setophaga discolor*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Sedge Wren (*Cistothorus platensis*), Eastern Whip-poor-will (*Antrostomus vociferus*), Wood Thrush (*Hylocichla mustelina*), and Worm-eating Warbler (*Helmitheros vermivorum*; U.S. Fish and Wildlife Service 2008). Approximately 119 species of breeding birds can be found in the habitat of the Central Hardwoods around Lincoln Boyhood National Memorial (Mumford and Keller 1984).

Pea Ridge National Military Park, Arkansas, is in the western edge of the Ozark Highland section of the Central Hardwoods Bird Conservation Region (Figure 1). Topography of the area in and around the park is dissected, with local relief commonly over 100 meters (Fitzgerald et al. 2000). However, broad flat ridges can be found throughout. The landscape historically contained a habitat of oak-hickory forest with a prairie grass understory in ravines and grass savanna habitat on ridges. Widespread habitat loss to agriculture and urban and industrial development threatens the integrity of the area for birds.

Approximately 113 species of breeding birds can be found in the area (James and Neal 1986).

Wilson's Creek National Battlefield and George Washington Carver National Monument, Missouri, are also in the western edge of the Ozark Highland section of the Central Hardwoods Bird Conservation Region (Figure 1). However, they occupy a northern section of this bird conservation region that is commonly referred to as oak savanna. Historically, it consisted of the transition zone between the northern and western tallgrass prairie and southern and eastern pine-hardwood forest. Topography of the areas in and around Wilson's Creek National Battlefield and George Washington Carver National Monument is less dissected than other portions of the Ozark Highlands but more dissected than areas of the Osage Plains further north and west (Fitzgerald et al. 2000). This landscape contains a rich mix of forested plant communities and grasslands. Widespread habitat loss to agriculture and urban and industrial development threatens the integrity of bird habitat in the area. Approximately 116 species of breeding birds can be found in and around these parks (Robbins and Easterla 1992).

Arkansas Post National Memorial, Arkansas, is in the Lower Mississippi Alluvial Valley Bird Conservation Region (Figure 1). This bird conservation region consists of millions of acres of alluvial floodplain south of the Mississippi River's confluence with the Ohio River (North American Bird Conservation Initiative 2019). Historically, it was the greatest bottomland hardwood forest on earth and was subject to massive annual flood events of the Mississippi River and its tributaries. Threats to the region include flood control and deforestation for agriculture. Today, less than 25% of the region remains forested, and flooding has been reduced by about 90 percent. Some of the high priority birds of the region recorded in the park include Bald Eagle (*Haliaeetus leucocephalus*), Orchard Oriole (*Icterus spurius*), Prothonotary Warbler (*Protonotaria citrea*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), and Wood Thrush (*Hylocichla mustelina*; U.S. Fish and Wildlife Service 2008). Approximately 113 species of breeding birds can be found in the habitat of the Lower Mississippi Alluvial Valley around Arkansas Post National Memorial (James and Neal 1986).

Effigy Mounds National Monument, Iowa, is in the south-central section of the Prairie Hardwood Transition Bird Conservation Region (Figure 1). This Bird Conservation Region was once dominated

by prairies in the west and south and beech-maple forests in the north and east, with an oak savanna separating the two sections (North American Bird Conservation Initiative 2019). Glaciation has resulted in numerous pothole-type wetlands, shallow lakes, and the coastal estuaries of the Great Lakes. Many rivers can be found in this region, with the Mississippi River being the largest. This region is second only to the Prairie Potholes region in terms of high densities of breeding waterfowl. Both early successional and mature woodlands provide habitat to numerous bird species as well. Habitat on the park lacks the extensive prairie component found in parts of the region, but the mix of deciduous trees, shrubs, permanent and seasonally flooded areas, and brushy openings (Hop et al. 2005) is like other parts of the region. The diverse mix of habitat (structural composition) on the park is important for the species of regional concern, as their microhabitat requirements vary (Pashley and Barrow 1993). Some of the high priority birds of the region recorded in the park include Bald Eagle (*Haliaeetus leucocephalus*), Black-billed Cuckoo (*Coccyzus erythrophthalmus*), Blue-winged Warbler (*Vermivora cyanoptera*), Brown Thrasher (*Toxostoma rufum*), Cerulean Warbler (*Setophaga cerulea*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), and Willow Flycatcher (*Empidonax traillii*; U.S. Fish and Wildlife Service 2008). Approximately 133 species of breeding birds can be found in the habitat of the Prairie Hardwood Transition around Effigy Mounds National Monument (Jackson et al. 1996).

Pipestone National Monument, Minnesota, is on the southeastern edge of the Prairie Potholes Bird Conservation Region (Figure 1). This bird conservation region is a glaciated area of mixed-grass prairie in the west and tallgrass prairie in the east (North American Bird Conservation Initiative 2019). This is the most important waterfowl production area on the North American continent despite extensive wetland drainage and tillage of native grasslands. The region comprises the core of the breeding range of most dabbling duck and several diving duck species and provides critical breeding and migration habitat for over 200 other bird species, including many species of continental concern. Some of the high priority birds of the region recorded in the park include Black Tern (*Chlidonias niger*), Dickcissel (*Spiza americana*), Grasshopper Sparrow (*Ammodramus savannarum*), Least Bittern

(*Ixobrychus exilis*), and Upland Sandpiper (*Bartramia longicauda*; U.S. Fish and Wildlife Service 2008). Approximately 105 species of breeding birds can be found in the habitat in and around Pipestone National Monument (Janssen et al. 2003). Continued wetland degradation, widespread habitat loss to agriculture and urban and industrial development, and fragmentation of remaining grasslands threaten many species in the region.

Homestead National Historical Park, Nebraska, is in the northeast section of the Central Mixed Grass Prairie Bird Conservation Region (Figure 1). This bird conservation region extends from the edge of the shortgrass prairie to the west to the beginning of the tallgrass prairie and savanna-like habitat to the east (North American Bird Conservation Initiative 2019). Large areas in the center of this region have been converted to agriculture. However, extensive areas of high-quality grassland in the Nebraska Sandhills and shrublands in Texas remain. High priority birds of the region recorded in the park include Bell's Vireo (*Vireo bellii*) and Lark Sparrow (*Chondestes grammacus*; U.S. Fish and Wildlife Service 2008). Approximately 125 species of breeding birds can be found in the Central Mixed Grass Prairie habitat around Homestead National Historical Park (Sharpe et al. 2001).

While not to the extent of large native ungulates and mammalian predators, many avian species have demonstrated declines as habitat loss continues. Data collected during the U.S. Geological Survey's annual North American Breeding Bird Surveys between 1966 and 1999 indicate that 70% of 29 grassland bird species show evidence of population declines (Sauer et al. 2000). Many prairie species, such as the Grasshopper Sparrow (*Ammodramus savannarum*), Eastern Meadowlark (*Sturnella magna*), Horned Lark (*Eremophila alpestris*), Bobolink (*Dolichonyx oryzivorus*), Lark Bunting (*Calamospiza melanocorys*), and Dickcissel (*Spiza americana*), have declined at alarming rates (Sauer et al. 2003). The destruction and fragmentation of prairie landscapes along with the structural degradation resulting from fire suppression and changes in grazing regimes of remaining prairie habitats contribute to these declines. Woodland bird species, especially neotropical warblers, have undergone even more precipitous declines related to habitat loss. Like grassland bird species, many woodland species that

breed in one or more bird conservation regions within the Heartland Inventory and Monitoring Network require conservation action because of low populations and/or threats to the unique habitats they require. National Park Service lands are well suited for avian species conservation as they are often managed to preserve unique habitats that are under-represented at the landscape scale but are vital to species survival.

It is against a backdrop of vanishing and altered ecosystems, declining bird populations, and the unique role that National Park Service lands can play in conserving threatened bird species that we proposed monitoring avian communities on parks within the Heartland Inventory and Monitoring Network. Long-term trends in the community composition and abundance of breeding bird populations provide one measure for assessing the ecological integrity and sustainability of ecosystems. Long-term patterns in community composition and species abundance in relation to changes in the structural diversity of vegetation will improve our understanding of the effects of various management actions.

Historical Development of Bird Monitoring in Network Parks

In prairies, trends in the composition and abundance of grassland bird populations have been proposed as long-term indicators of ecosystem integrity, which is defined as the capability to support and maintain a balanced, integrated, and adaptive community of organisms having a community composition, diversity, and functional organization comparable to that of natural habitat of the region (Karr and Dudley 1981). As part of the design phase (1998–1999) of the Prairie Cluster Prototype Long-term Ecological Monitoring Program led by the U.S. Geological Survey, bird inventories and pilot monitoring work were conducted in eight prairie parks by Dr. Abby Powell to identify the species present at each park and assess the feasibility of using grassland birds as indicators of ecosystem integrity (Powell 2000). Work was conducted at Agate Fossil Beds National Monument, Nebraska; Badlands National Park, South Dakota; Homestead National Monument of America, Nebraska (this park is now Homestead National Historical Park); Pipestone National Monument, Minnesota; Scotts Bluff National Monument, Nebraska; Tallgrass Prairie National

Preserve, Kansas; Theodore Roosevelt National Park, North Dakota; and Wilson's Creek National Battlefield, Missouri.

As a follow-up to work done by Dr. Powell, the Prairie Cluster Prototype Long-term Ecological Monitoring Program initiated a pilot bird monitoring project in the spring of 2001 to monitor avian communities at Agate Fossil Beds National Monument and Tallgrass Prairie National Preserve. A culmination of this pilot project was a bird monitoring protocol completed in July 2003 (Peitz et al. 2003), and a bird monitoring program for the Prairie Cluster Prototype Long-term Ecological Monitoring Program. With the merger of the Prairie Cluster Prototype program and the Heartland Inventory and Monitoring Network, bird monitoring was expanded to include Herbert Hoover National Historic Site, Iowa, and Hopewell Culture National Historical Park, Ohio, in 2005; Arkansas Post National Memorial, Arkansas, and Lincoln Boyhood National Memorial, Indiana, in 2007; George Washington Carver National Monument, Missouri, Pea Ridge National Military Park, Arkansas, and Wilson's Creek National Battlefield, Missouri, in 2008; and Effigy Mounds National Monument, Iowa, Homestead National Monument of America, Nebraska (now known as Homestead National Historical Park), and Pipestone National Monument,

Minnesota, in 2009. With the transfer of Agate Fossil Beds National Monument to the Northern Great Plains Network, bird monitoring by the Heartland Inventory and Monitoring Network at this park ceased in 2006.

Initially, habitat data were collected on four subplots per variable circular plot surveyed. To facilitate the expansion of bird monitoring across network parks, we reduced the number of subplots sampled from four to one in 2008.

Measurable Objectives

There are two primary objectives for the monitoring described in this protocol:

- Identify significant temporal changes in the species composition and abundance of bird communities that occur on parks during the breeding season.
- Improve our understanding of relationships between breeding birds and their habitat and the effects of management actions (such as prairie restoration or prescribed fire) on bird populations by examining potential correlations between changes in specific habitat variables (e.g., vegetation structure, ground cover) and changes in bird community composition and abundance.

Sampling Design

Rationale for Selecting This Sampling Design over Others

Hundreds of different sampling approaches have been used to quantify the status of bird populations and dozens of different monitoring programs are currently in place throughout North America to determine local, regional, or national trends in bird populations. Most common survey methods allow simultaneous collection of information about species that share a common life history or habitat, but no single method will adequately sample the diversity of habitats that birds occupy or life history groups such as seabirds, songbirds, raptors, and shorebirds.

The sampling design described in this protocol involves a series of sampling stations laid out on a systematic grid that are sampled during 5-minute counts using the variable circular plot methodology (Reynolds et al. 1980; Scott et al. 1986; Buckland et al. 1993, 2001; Fancy 1997; Nelson and Fancy 1999). Variable circular plots and line transect sampling are two types of distance sampling. Distance sampling has been used for more than 30 years to estimate animal abundance and is the best omnibus method currently available for determining relative abundance or trends for birds in most sampling situations. In practice, the method documented in this protocol is basically the same as point counts, such as those used in the National Breeding Bird Survey, except that for each bird heard or seen during the count, its horizontal distance from the observer is estimated or measured. In the case of line transect sampling, the observer walks down a transect and records either the perpendicular distance to each bird heard or seen or records the sighting angle and sighting distance. Line transects are usually more efficient than variable circular plot counts because the observer collects data continuously while walking along the transect, whereas during variable circular plot counts the observer only records birds detected during 3- to 10-minute sampling periods from stations located along a transect or on a systematic grid. However, variable circular plot counts are the preferred approach in patchy habitats where correlations between bird data and vegetation or other habitat information are sought, and in dense, rugged, or hazardous terrain where you need to watch your footing as you traverse the landscape. Another advantage of variable circular plot counts is

that data can be directly compared to historical point count data such as those obtained during National Breeding Bird Survey counts and can contribute to ongoing programs such as the National Point Count Database. A summary of the advantages and disadvantages of the variable circular plot method in relation to other techniques can be found in Bibby et al. (2000).

An important benefit of using the variable circular plot method is the ability to accommodate a wide range of bird species, each of which possesses a different singing style and each of which may occur in a variety of acoustically different habitats (British Columbia Resource Inventory Branch 1999). Variable circular plot counts operate by essentially allowing the habitat to determine the size of the area being surveyed. The maximum detectable distance to a bird may change between different habitats, but the radius of the survey will also change. For example, surveys of grassland birds usually cover a larger area per plot because of the absence of a screen of trees and because bird species may be flushed at greater distances in open habitats (British Columbia Resource Inventory Branch 1999).

In addition to the rationale for variable circular plot counts given above, this protocol uses variable circular plot counts arranged in a systematic grid to address the two objectives for bird monitoring in parks for the following reasons:

- A primary objective is to associate changes in bird community composition and abundance with long-term changes in vegetation that occur because of natural succession or various management actions (e.g., prescribed fire, grazing). We cannot (prior to the first year of the long-term sampling scheme) stratify the park into areas that will be subjected to different management regimes (e.g., grazed versus ungrazed) because the location and timing of future management will be based on feedback from adaptive management and other factors and cannot be predicted. Thus, the approach is to sample birds on a systematic grid that will allow inferences to be made to the entire park and to later post-stratify the data to investigate changes in bird community composition and numbers as a result of different management regimes.

- Unadjusted point counts, such as those used in the National Breeding Bird Survey, do not account for the number of birds missed during the counting interval. The number of birds that are counted at a sampling station is a combination of the number of birds that are actually there and the proportion of them detected. Use of unadjusted point counts to calculate trends in abundance assumes that the proportion of birds detected is the same among species, observers, and counting conditions, which is usually not the case. Without a measure of detectability, bird counts are an unreliable measure of differences in the actual number of birds present (see Burnham 1981; Barker and Sauer 1995; Nelson and Fancy 1999). To obtain credible long-term trend data and to allow comparisons among bird species and habitat types where detectability is expected to differ, we will incorporate distance measures to improve the quality of the data.
- By recording distances and by keeping track of whether a bird was detected during the first 3 minutes of the count or between minutes 3–5, we will be able to make direct comparisons between our data and those collected by others using the National Breeding Bird Survey or Ralph et al. (1995) methods.
- Our approach allows data from repeated surveys of the same area or areas with similar habitat characteristics to be combined to increase sample sizes. By combining surveys, it is possible to develop detection functions for uncommon species for which few detections are recorded during any single survey.

Occasionally, there are detectability issues in bird sampling that variable circular plot and other estimation procedures cannot address. For example, there may be unobservable portions of the population (such as cryptic and silent females or nocturnal birds) that are not detected during counting, or it may be impossible to estimate detectability at the appropriate scale (e.g., when habitat-specific detectability exists in a rare species). In structurally complex habitats (e.g., forests in the northwest U.S. with very tall trees and multiple shrub and tree layers that make it impossible to see birds high up in the canopy directly above the observer) it may be difficult or impossible to detect birds at close horizontal distances to the observer. Thus, even with

a measure of detectability factored into estimates derived from bird counts, such estimates may still be an unreliable measure of differences in the actual number of birds present in some situations. However, it is important to note that although data may be less reliable for species encountered at low rates, it is still valuable to collect the data, and pooling of data over time may allow certain limited analyses. Interpretation of survey data requires sensitivity to these extra-statistical limitations of the estimation procedures.

Site Selection

Sampling locations or “plots” are selected as described in SOP #3 “Establishing and Marking Sampling Plots.” Briefly, permanent sampling locations were selected by overlaying systematic grids (originating from a random starting point) on park maps (see Appendix A and B). Systematic sampling across the park will allow us to make park-wide inferences concerning the avian community.

The orientation of the systematic grid was rotated 45° from north at Arkansas Post National Memorial (ARPO), George Washington Carver National Monument (GWCA), Homestead National Historical Park (HOME; previously known as Homestead National Monument of America), Lincoln Boyhood National Memorial (LIBO), Pea Ridge National Military Park (PERI), Pipestone National Monument (PIPE), and Wilson’s Creek National Battlefield (WICR) to prevent sampling sites from being influenced by man-made features (roads, fences, etc.) oriented along cardinal directions. The systematic grids at Effigy Mounds National Monument (EFMO) and Herbert Hoover National Historic Site (HEHO) were rotated from north 8° and 52° degrees, respectively, to match existing vegetation grids. The angle of the sampling grid at Tallgrass Prairie National Preserve (TAPR) was selected randomly and equals 34° from north. The unique shapes of the different units at Hopewell Culture National Historical Park (HOCU) dictated that the systematic grid be oriented in cardinal directions.

At Tallgrass Prairie National Preserve, the riparian corridor was identified as a separate stratum, with sampling extending 125 m on either side of the stream channel (Palmer and Fox Creeks). The riparian stratum makes up 5.3% of the total park area (4,398 ha) at Tallgrass Prairie National Preserve. Within the riparian stratum, plots were located at

250-m intervals along the extent of the stream. Any plots from the overall park grid that fell within the riparian stratum were discarded.

A total of 771 plots were established in parks across the Heartland Inventory and Monitoring Network with 749 plots available for sampling (Table 1). Sampling locations are not physically marked on the ground; rather, UTM coordinates are maintained and located in the field with a GNSS unit. Refer to SOP #3 “Establishing and Marking Sampling Plots” for navigation between sampling plots and plot establishment instructions.

This systematic approach to selecting sampling sites allows flexibility to choose the appropriate reference frame to answer different monitoring questions. For example, when making park-wide inferences at Tallgrass Prairie National Preserve, the results from each stratum on the park may be weighted by area, and then combined to give an overall park mean and variance. At the same time, more intensive sampling in the riparian corridor will ensure an adequate sample to describe habitat relationships specific to this less common, but important, stratum. The systematic grid will also allow us to limit the reference frame appropriately when asking more specific monitoring questions (e.g., only those sampling plots within particular management units would be used to compare the avian response to different fire or grazing regimes, etc.).

Table 1. Sampling schedule for breeding bird surveys in Heartland Inventory and Monitoring Network (HTLN) parks, 2020 through 2029. Parks are visited on a [1–3] sampling schedule, meaning HTLN samples the plots every fourth year, and volunteers sample the plots in the interim three-year period. Numbers represent the number of plots on a park sampled by HTLN in that respective year. TOTAL represents the total number of plots sampled per total number of parks visited.

Park (Plots)	2020*	2021*	2022	2023	2024	2025	2026	2027	2028	2029
ARPO (36)	–	–	–	–	36	–	–	–	36	–
EFMO (36)	–	–	36	–	–	–	36	–	–	–
GWCA (70)	70	–	–	–	–	70	–	–	–	70
HEHO (38)	–	–	38	–	–	–	38	–	–	–
HOCU (27)	–	–	–	–	27	–	–	–	27	–
HOME (44)	–	–	44	–	–	–	44	–	–	–
LIBO (35)	–	–	–	–	35	–	–	–	35	–
PERI (99)	–	99	–	–	–	99	–	–	–	99
PIPE (68)	–	–	68	–	–	–	68	–	–	–
TAPR (259)	–	–	–	259	–	–	–	259	–	–
WICR (37)	37	–	–	–	–	37	–	–	–	37
TOTAL	107/2	99/1	186/4	259/1	98/3	206/3	186/4	259/1	98/3	206/3

*Travel restrictions related to a global pandemic required that plots sample at GWCA, PERI, and WICR (generally sampled in the same year) be sampled over a two-year period. Thus, the sampling schedule was delayed by one year.

Population Being Monitored

Sampling will be limited to the bird breeding season (early May through mid-June), and sampling will include those species that may potentially breed in the park (see Appendix C). Thus, the population being sampled includes breeding bird species within the park boundary that are present during the survey period.

Sampling Frequency and Replication

For all parks included in the bird monitoring program, Heartland Inventory and Monitoring Network staff will survey birds on a four-year rotating cycle (Table 1). Each individual bird plot will be visited once during a network staff visit. Additional monitoring by park staff and volunteer birders will occur in the interim years. To facilitate the assistance of park staff and volunteer birders, all individual bird plots may not be visited during a survey year. However, every attempt should be made to sample all plots or at least a subset of plots systematically distributed across all habitats on a park. If only a subset of plots is sampled, the same plots should be sampled in each reoccurring interim year to help identify trends in bird populations.

Field Methods

Field Season Preparations, Field Schedule, and Equipment Setup

Prior to the field season each year, usually beginning in March or April, the observer(s) should review this entire protocol, including all the SOPs. The observer(s) should pay special attention to the tasks described in SOP #1 “Before the Field Season” and SOP #2 “Training Observers.” Review of bird identification by sight and sound (SOP #2 “Training Observers”) is particularly important each year as the misidentification of a species is perhaps the most serious error one can make during a bird count, with greater consequences than errors in estimating distances or double counting a bird. All the equipment and supplies listed in SOP #1 “Before the Field Season” should be organized and made ready for the field season. Copies of the field data forms in SOP #4 “Conducting the Variable Circular Plot Count” and SOP #5 “Documenting Habitat Variables” should be made, 25% of which should be on Rite in the Rain paper.

Staff workloads and unpredictable weather (e.g., delays in the onset of spring, periods of rain, spring storms) necessitate maintaining some flexibility in scheduling the sequence and duration of sampling trips. Sampling dates should be scheduled, and logistics organized prior to the start of each field season. Twelve to 30 variable circular plot counts should be scheduled for completion each field day, depending on grid size. Larger grids (400 x 400 m) take longer to navigate between plots, so fewer plots can be sampled in a day than on smaller grids (100 x 100 m or 200 x 200 m). Field trips up to 12 days in length will be necessary to complete bird surveys within the breeding season. To accommodate differences in vegetation phenology, parks should be visited in a south to north progression if possible.

Sampling Methods

The protocol generates two data sets collected concurrently, bird abundance (variable circular plot) and habitat measures. The bird crew should arrive at the park the afternoon prior to the first day of sampling to familiarize themselves with the area and the birds present. Each night, the group discusses the next day’s plans and establishes the route for visiting bird plots. The birding crew arrives at the

first plot each day before sunrise and begins sampling as soon as it is light enough to do so. In years when both bird and habitat data are collected, the habitat crew follows the route of the bird observer, being careful to avoid walking to the next plot until bird observations are completed and the observer has moved on. Habitat sampling on a plot commences after bird observations are complete. Loud voices, motion, or walking through a plot may disrupt the birds and bias survey results. The bird observer completes counts approximately four hours after local sunrise and then joins the habitat crew. Each day, the habitat crew attempts to complete habitat work on all plots sampled for birds that morning. However, this is not always possible, and some plots may need to be sampled later. No habitat sampling should be scheduled after June 30. Refer to SOP #4 “Conducting the Variable Circular Plot Count” for conducting bird counts and SOP #5 “Documenting Habitat Variables” for measuring habitat work.

Before leaving the field each day, data sheets are checked for completeness and readability. All information pertinent to the plots sampled that day is recorded to avoid repeating or skipping sampling plots. The project manager is responsible for the safekeeping and organization of the data sheets and ensuring that data are entered into the database.

Conducting the Variable Circular Plot Count

Variable circular plot counts are a point count methodology that incorporates a measure of detectability into population estimates (Buckland et al. 2001). Details on how to conduct variable circular plot counts during the breeding season and for filling in data forms are given in SOP #4 “Conducting the Variable Circular Plot Count” and are summarized here. All birds seen or heard at each plot are recorded during a five-minute sampling period. Bird observations are separated into two time segments: those detected during the first three minutes of the count (to allow comparisons with Breeding Bird Survey data) and any new birds detected during the final two minutes of the count. All birds, regardless of distance detected from the observer, are counted and recorded. For most species, each individual bird will be recorded as a separate observation. For

species that usually occur in clusters or flocks, the appropriate unit to record is the cluster or flock size, not the individual bird.

When we conduct a variable circular plot count, we are attempting to get an instantaneous count of birds present. Birds flushed from the plot when approached by the observer should be recorded and the count started as soon as the observer is at plot center. The method considers the fact that birds close to the observer have a higher probability of being detected (if they are 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 100% probability of being detected, and that there is a high probability of detecting birds within the first 5–10 m of the plot center. The most important birds to detect are those very close to the observer (within the first 5–10 m), and it is highly desirable that estimated or measured (using a laser rangefinder) distances be within 1–2 m of actual distances for any bird within 20 m of the observer. However, all birds seen or heard should be recorded with an estimate or measure of distance from the observer. Distances should be estimated or measured to the nearest meter in the field (during subsequent data analysis, distances will be grouped into intervals to lessen the effect of errors in estimating distances), and distances should not be rounded to the nearest 5 or 10 m. Birds far from the center of the plot usually have little effect on the resulting distance function. During data analysis, 5–10% of the farthest detection distances for each species will be truncated before a detection function is calculated.

Once a count is completed at a plot and the data sheet is filled out, the observer uses a GNSS unit to navigate to the next plot. Depending on grid size, 12 to 30 plots can be sampled each morning during a period between when it is light enough to observe birds to four hours post sunrise. Larger grids (400 x 400 m) take longer to navigate between plots, so fewer plots can be sampled in a day than on smaller grids (100 x 100 m or 200 x 200 m).

Collecting Habitat Data

Habitat data are collected in a 50-m radius plot centered on each bird sampling plot and in one 5-m radius nested subplot and one 1.78-m radius nested subplot. SOP #5 “Documenting Habitat Variables” gives a detailed description of how habitat data are collected; a summary is presented here.

Habitat data are collected to meet several objectives. Large-scale plot attributes such as vegetation type, slope, and water cover are relevant to bird community composition and place the plot in a landscape context. Canopy structure and horizontal vegetation profile data (collected at the 5-m radius scale) characterize habitat structure available to birds and link bird data to park vegetation types. Similarly, ground cover and foliar cover of vegetation guilds (collected at the 1.78-m radius scale) allow us to integrate bird monitoring with more in-depth vegetation data collected as part of plant community monitoring. Integrating these monitoring projects will allow us to provide feedback on how management actions influence vegetation, which in turn may affect bird community composition and abundance.

In years when both bird and habitat data are collected, and the sampling occurs simultaneously, the collection of habitat data starts each morning after the first variable circular plot count is complete. The habitat crew samples variable circular plots in the same order as the bird observer to avoid disturbing birds on plots where the bird count has not been conducted. The habitat crew navigates to the plots using one or more of the following: a GNSS unit, a compass ,and field map that includes compass bearings for the grid if the plots have been flagged by the birder or directions from the bird observer. Once the habitat crew arrives at a plot, they set up the subplots at plot center and complete all habitat measures for the subplots and for the 50-m radius plot.

Data Management

General Procedures

Data management procedures are an important part of any long-term monitoring program in that they provide data consistency, data security, and availability over time. Therefore, care must be taken to ensure that adequate time and personnel are available for accurate data recording, data entry and verification, and analysis.

Data processing typically involves the following steps: data entry, data verification, data validation, and backups/storage (see SOP #6 “Data Management” for details on each step). Data entry consists of transferring field data from field sheets into a monitoring database using data-entry forms. Data verification immediately follows data entry and involves checking the accuracy of computerized records against the original source, usually paper field records. Validation procedures seek to identify generic errors, such as missing, mismatched, or duplicate records, as well as logical errors specific to a particular project.

The HTLN_Landbirds Database

The breeding bird monitoring database is implemented in the Microsoft SQL Server. The database is called HTLN_Landbirds. The database backend is located on the Washington Office (WASO) Integrated Resource Management Applications (IRMA) production instance. Database users will need to become familiar with the web-based data entry/edit tools, while database administrators will need to use web-based tools for look-up tables and the SQL Server Management Studio backend. Changes in data-values can only be made through the web-based user interface and data access through SQL Server Management Studio is read-only. A local copy of SQL Server Express is necessary to view the database backend. General familiarity with SQL queries is required to download data from HTLN_Landbirds.

Quality Assurance and Quality Control

Quality Assurance (QA) includes all activities designed to ensure that data, products, or services meet specified requirements. Quality Assurance focuses on built-in quality to prevent defects. Quality

Control (QC) includes procedures for checking whether data meet standards and annotating or qualifying data that do not (DeVivo 2016). QA/QC procedures and design elements occur throughout data collection, processing, and reporting. The Quality Assurance Plan for Monitoring Breeding Birds in the Heartland Inventory and Monitoring Network fully describes all QA/QC elements for this protocol. The database design includes fields to document the completion and results of QA/QC procedures and assessments.

The Inventory and Monitoring Division Database Standards (Frakes et al. 2015) requires every datum to be unambiguously traceable to a specific version of a monitoring protocol, a quality assurance plan where available, and a suite of standard operating procedures. The certification guidelines for I&M data products (National Park Service 2016) and Minimum Implementation Standards for Network Projects v. 3.0 (Frakes and Kingston 2017) call for every datum to have an associated QA/QC processing level (e.g., raw, provisional, certified). An annual operational review is required for all active monitoring protocols (Mitchell et al. 2018). Completion of an operational review, a summary of any flagged data, and a link to the review report are stored in the monitoring database.

Metadata Procedures

The Federal Geographic Data Committee now provides a range of options as guidance for metadata of spatial and non-spatial federal agency data. Most recommendations are variations of the ISO191xx standard which is typically used for natural resource datasets. Creation of ISO metadata has been greatly facilitated by ESRI ArcGIS utilities that automatically generate spatial metadata. Once metadata are created, they should be saved in XML format following ISO metadata standards. Metadata are archived in the geodatabase and by WASO Inventory and Monitoring (I&M) Division (in IRMA). Metadata are archived by WASO with the submission of the monitoring protocol and should be updated with each protocol revision.

Data Archival Procedures

HTLN_LandBirds is a transaction database that resides on the IRMA production data instance, which is backed up daily. Redundant backups are stored at the NPS Denver Service Center and are accessible through virtual servers in Fort Collins. Backup copies are available on request to the WASO I&M IT support staff. In addition, the Heartland Inventory and Monitoring Network (HTLN) provides an

annual copy of HTLN_Landbirds in machine readable format (currently .csv) in IRMA Data Store as part of WASO IT Application Inventory Registry (AIR) requirements. Please direct specific questions about HTLN_LandBirds to the following address.

Data Manager
Heartland Inventory and Monitoring Network
Wilson's Creek National Battlefield
Farm Road 182, Republic MO 65738

Data Summary, Analysis, and Reporting

A critical component of any long-term monitoring protocol is a consistent and systematic way of analyzing and reporting on information (data) collected. The goals of this protocol are to (1) identify significant temporal changes in the species composition and abundance of bird communities that occur on parks during the breeding season and (2) improve our understanding of relationships between breeding birds and their habitat and the effects of management actions on bird populations. Therefore, analyses must be able to identify changes in breeding bird communities through time and relate these changes to those seen in the measured habitat parameters (see SOP #7 “Data Summary and Analysis”).

As a first step, annual reporting on breeding bird data collected will be completed as a method to QA/QC the data. Reports generated annually need to be sent to their appropriate park and birder(s) for review to ensure that the species reported are in fact the ones observed and that the counts are correct. Annual reports include a list of all birds seen or heard, residency status (migrant, permanent resident, summer resident, winter resident) of each species based on local authorities, number of individuals encountered per plot visit, and proportion of plots occupied by a species (total number of plots occupied by a species/number of plots surveyed).

Bird Data Trend Analysis

Prior to trend analysis, the residency status of each bird species recorded needs to be determined. Identifying the residency of each species helps to exclude migrants from analysis of breeding bird trends within a park. Like annual reports, proportion of plots occupied by each bird species should be calculated and reported for each year. For species with greater than 60 observations, the statistical package “rDistance” (built under R version 3.6.3) should be used to determine the park-wide abundance of each (Buckland et al. 2001). RD^{istance} is the R version of the widely used Distance software package for determining population abundances. For species with fewer than 60 observations, park-wide abundance is calculated by first deriving a species density from observations recorded within a radius around each plot center, a radius that equals

half the distance between plots on a park, and then calculating abundance based on average plot densities.

For species with adequate abundance (those with greater than 60 observations) trends were calculated by regressing abundance against survey years in the statistical package “rtrim” (built under R version 3.6.3). Rtrim is the R version of the statistical software package “TRIM,” a program developed for the analysis of count data obtained from the monitoring of wildlife populations (Pannekoek and Van Strien 2005). It analyzes time series of counts using Poisson regression and produces estimates of yearly indices and trends. We employ a linear trend model with changepoints selected by a stepwise procedure. Serial correlation in count data among years and over-dispersion are taken into account with this software. Although rtrim has the capacity to estimate missing data, we restrict our regression analysis to plots sampled in most years. By doing this we can analyze a consistent ratio of plots across years.

For reports, regional breeding bird trends are obtained for the Bird Conservation Region that the park is located in during a period that most closely matches the years data are collected on a park. Regional breeding bird trends can be obtained from the Breeding Bird Survey website of the U.S. Geological Survey (USGS) Patuxent Wildlife Research Center. It is possible to determine trends for many bird species and many regions of interest for periods ranging from 1966 to present by using the [interactive calculator available on the USGS Regional Trend Analysis Form site](https://www.mbr-pwrc.usgs.gov/bbs/trend/tf15.html) (<https://www.mbr-pwrc.usgs.gov/bbs/trend/tf15.html>). Regional trends may then be compared with those calculated using rtrim for the park.

Trends in the diversity, richness, and species distribution evenness of the breeding bird community on a park are assessed by regressing each metric against survey years. Because not all species occurring in an area may be observed in a survey (i.e., rare species may be missed), recorded species richness is often an underestimate. Statistical species richness estimators utilize the information in species distribution and abundance patterns to

produce an estimate of true species richness. Reese et al. (2014) recently reviewed nonparametric species richness estimators and found that two coverage-based estimators, the Abundance Coverage-based Estimator (ACE) and Incidence Coverage-based Estimator (ICE), provided less biased and more accurate estimates than many of the others. We evaluated the use of ACE, ICE, and two other species richness estimators (Jackknife 2 and Chao 2) for a range of sample sizes (see Supplemental Document 1 “Analysis of Species Accumulation Curves, Species Richness Estimators, and Suggested Changes in Grid Size for Bird Community Sampling” and Morrison and Peitz 2020). Based on these results, the standard procedure will be to report estimated species richness using ACE and ICE along with observed species richness.

Habitat Data Analysis

Summaries of habitat attributes at the 50-m plot level are required for “permanent” and “semi-permanent” features. For permanent features, the values for slope, aspect, and topographic position are measured, reported, and assigned to a permanent locations table within the database only once. Semi-permanent plot features (those not expected to change much, including percent cover of coarse habitat types, road, and water cover) are recorded each time a survey is conducted, and these changes are reported.

The bulk of habitat data are collected at the 5-m subplot level using a single subplot (see Supplemental Document 2 “Evaluation of Habitat Data as Correlates of Bird Community Metrics and Species Occurrence”). Like permanent attributes measured on plots, permanent features for subplots (i.e., slope and aspects) are measured only once, and stored in a table within the database. Subplot features reported each time a survey is conducted include the average (\pm std dev) tree tallies (stems/ha), canopy height, canopy cover, basal area, ground and foliar cover,

horizontal vegetation cover, and structural diversity. Ground cover includes deciduous and grass litter, bare soil, rock, woody debris (>2.50 cm DBH), and unvegetated. Foliar cover, determined by guilds, includes warm-season and cool-season grasses, forbs, mosses and lichens, shrubs and vines, tree seedlings, and total foliar cover (<1.50 m tall).

To further evaluate relationships between bird metrics and habitat variables, inferential statistical methods can be applied. These should be hypothesis-driven and focus on observed patterns in the bird metrics or questions posed by park managers. A wide variety of statistical approaches are available depending upon the time scale of interest and structure of the underlying data, and we do not attempt to anticipate the most appropriate methods. A qualified analyst should always be consulted in the context of any bird-habitat interaction analyses.

Reporting

Annual reporting updates should be completed by March 31 of the year following the year data are collected. Annual reporting requirements include an informal trip report, an operational review report, and an annual update. The annual updates are a species list that reports on all birds seen or heard, residency status (migrant, permanent resident, summer resident, winter resident) of each species based on local authorities, number of individuals encountered per plot visit, and proportion of plots occupied by a species (total number of plots occupied by a species/plots surveyed). Trend reports explore correlations between breeding bird populations and habitat measures. Trend reports are published as Natural Resource Reports in the NPS Natural Resource Publication Series and uploaded to IRMA. See SOP #8 “Reporting” for details on reporting requirements.

Personnel Requirements and Training

Roles and Responsibilities

The project manager is the lead ecologist for implementing this monitoring protocol and is supervised by the Program Manager for the Heartland Inventory and Monitoring Network. The data management aspect of the monitoring effort is the shared responsibility of the project manager, data manager, and the NPS Inventory and Monitoring Division data management staff. Typically, the data manager is responsible for database design and working with the NPS Inventory and Monitoring Division data management staff in implementing the database. The project manager is responsible for data entry, data verification, and data validation, as well as data summary, analysis, and reporting. The data manager is responsible for data archiving, data security, and data dissemination. The data manager, in collaboration with the project manager and the NPS Inventory and Monitoring Division data management staff, develops data entry forms and other database features as part of quality assurance and automates report generation. The data manager is ultimately responsible for assuring that adequate QA/QC procedures are built into the database management system and appropriate data handling procedures are followed.

Qualifications and Training

The most essential component for the collection of credible, high-quality data is competent observers. This cannot be overemphasized. Various studies have shown that observer bias is one of the most noteworthy bias factors in trend analysis of songbird populations (Scott et al. 1986; Sauer et al. 1994; Kendall et al. 1996). The quality of the observer will determine the quality of the data. Therefore, all individuals will meet data quality standards as outlined in SOP #2 “Training Observers” and Supplemental Document 3 “Quality Assurance

Plan for Breeding Bird Monitoring in the Heartland Inventory and Monitoring Network” document prior to surveying birds.

As well as being able to visually identify birds, field observers must be proficient at identifying species by their songs and calls. Therefore, recordings of birds in the study area, especially for the less common or unexpected species, should be provided for surveyors. Observers should be tested frequently on their ability to identify bird calls. Good hearing ability is essential because many birds, particularly in forested habitats, are detected by sound only. Differences in hearing ability between observers may strongly affect survey results (Ramsey and Scott 1981).

The quality of the observer will determine the quality of the data. Time should also be invested in training personnel to estimate the distance from themselves to singing birds within different habitats. This will require training in the field (see SOP #2 “Training Observers”) to become proficient with the use of a laser rangefinder and to gain experience with estimating distances to different species in different habitat types.

The project manager and a staff botanist will assist in training the bird crew to conduct habitat monitoring. Habitat observers should familiarize themselves with the Heartland Inventory and Monitoring Network standard cover classes and vegetation guilds described in SOP #5 “Documenting Habitat Variables.” Prior to the field season, observers should practice estimating cover of different vegetation guilds and ground cover categories within 1.78-m radius practice plots. If habitat monitoring cannot be practiced prior to the field season, a staff botanist will accompany the bird crew on the first field trip of the year.

Operational Requirements

Field Schedule

Breeding bird surveys will begin no sooner than the first full week of May and extend no later than the second full week of June, a period that coincides with the peak-breeding activity of most birds. Inclement weather and personnel workloads will preclude the scheduling of sampling events to specific annual dates. Bird surveys may be scheduled for the third week of June if spring green-up is unusually late. Habitat monitoring should be completed no later than June 30 for habitat measures to accurately reflect conditions experienced by breeding birds. Monitoring efforts will require a three- to four-person crew. Approximately two to seven field days are required to complete bird sampling at most parks. However, 10–12 days are required for Tallgrass Prairie National Preserve. Twelve to 30 variable circular plot counts should be scheduled for completion each field day, depending on grid size. Larger grids (400 x 400 m) take longer to navigate between plots, so fewer plots can be sampled in a day than on smaller grids (100 x 100 m or 200 x 200 m).

Facility and Equipment Needs

The nature of bird survey work does not require special facilities beyond normal office space and equipment storage needs. Table 1.0 in SOP #3 “Preparations and Equipment Setup Prior to the Field Season” is a list of field equipment needs for one crew. If two or more crews work simultaneously, equipment requirements will increase accordingly.

Budget Considerations

Personnel expenses for field work are based on a crew of three people: an ecologist (project leader) to conduct the bird counts, a biologist to lead habitat sampling, and a biological science technician to assist with habitat sampling. Field days should be planned by referencing field notes from previous sampling events in each park under consideration for sampling that year. Field costs will vary from year to year depending on the skill level and training required to adequately prepare the seasonal biological science technician for surveying habitat (usually four to six hours at Wilson’s Creek National Battlefield). Data management personnel expenses include staff time of the biological science technician, project leader, and data manager. The project leader also invests time in preparation for field trips and data evaluation and reporting. These steps can include a month or more of the project leader’s time per report, not including the peer reviewer’s time. Additional shared support staff includes the Quantitative Ecologist.

Procedure for Revising the Protocol and Archiving Previous Versions

Over time, revisions to both the protocol narrative and to specific SOPs are to be expected. Careful documentation of changes to the protocol and a library of previous protocol versions are essential for maintaining consistency in data collection and for appropriate treatment of the data during data summary and analysis. Mitchell et al. (2018) describe the necessary review and documentation for modifying the monitoring protocol (SOP #10 “Revising the Protocol”).

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Appendix A. Park Maps with Bird Plot Locations

Figures A1–A11 are park maps with bird monitoring locations for the Heartland Inventory and Monitoring Network.

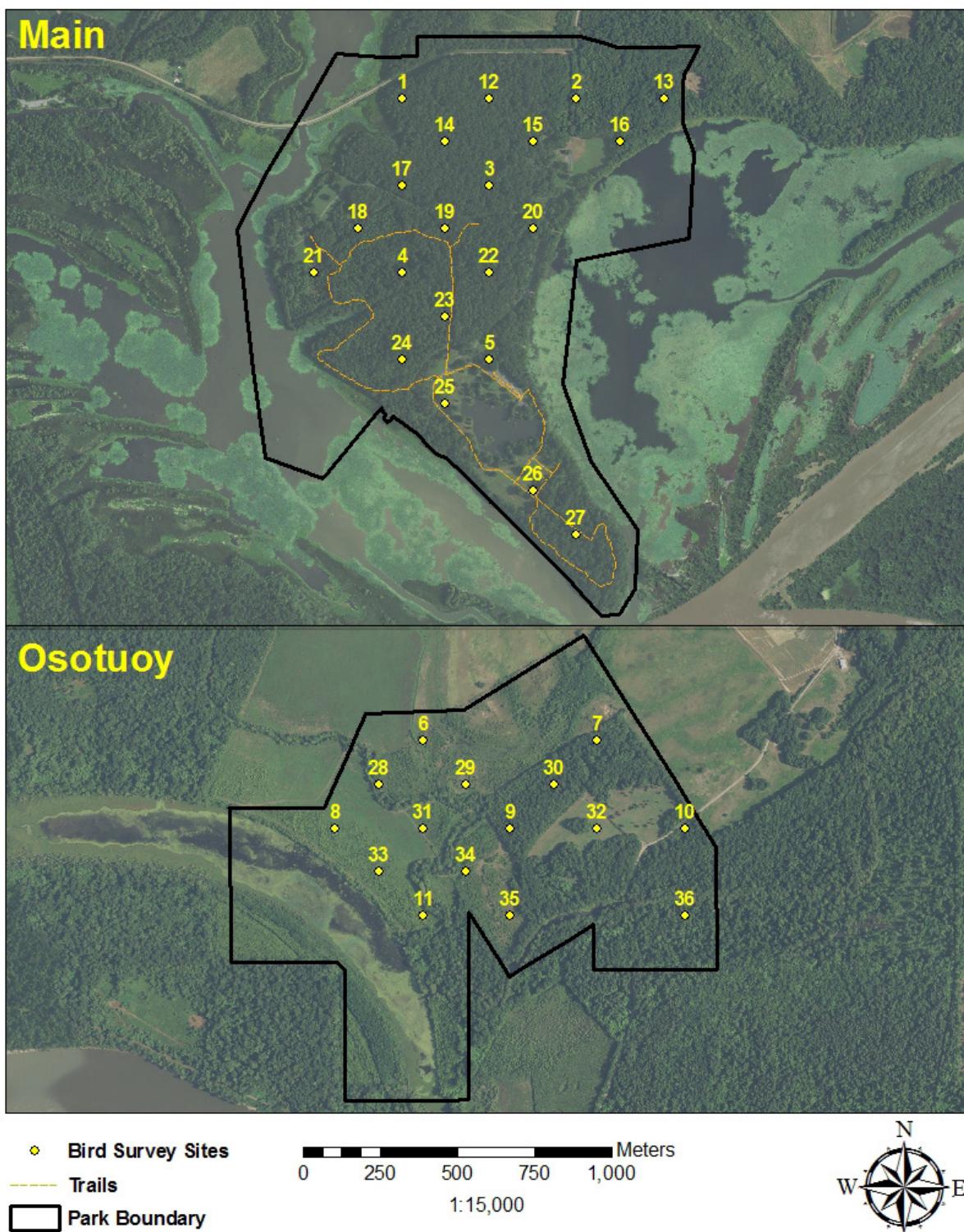


Figure A1. Heartland Inventory and Monitoring Network bird monitoring sites at Arkansas Post National Memorial, Arkansas.

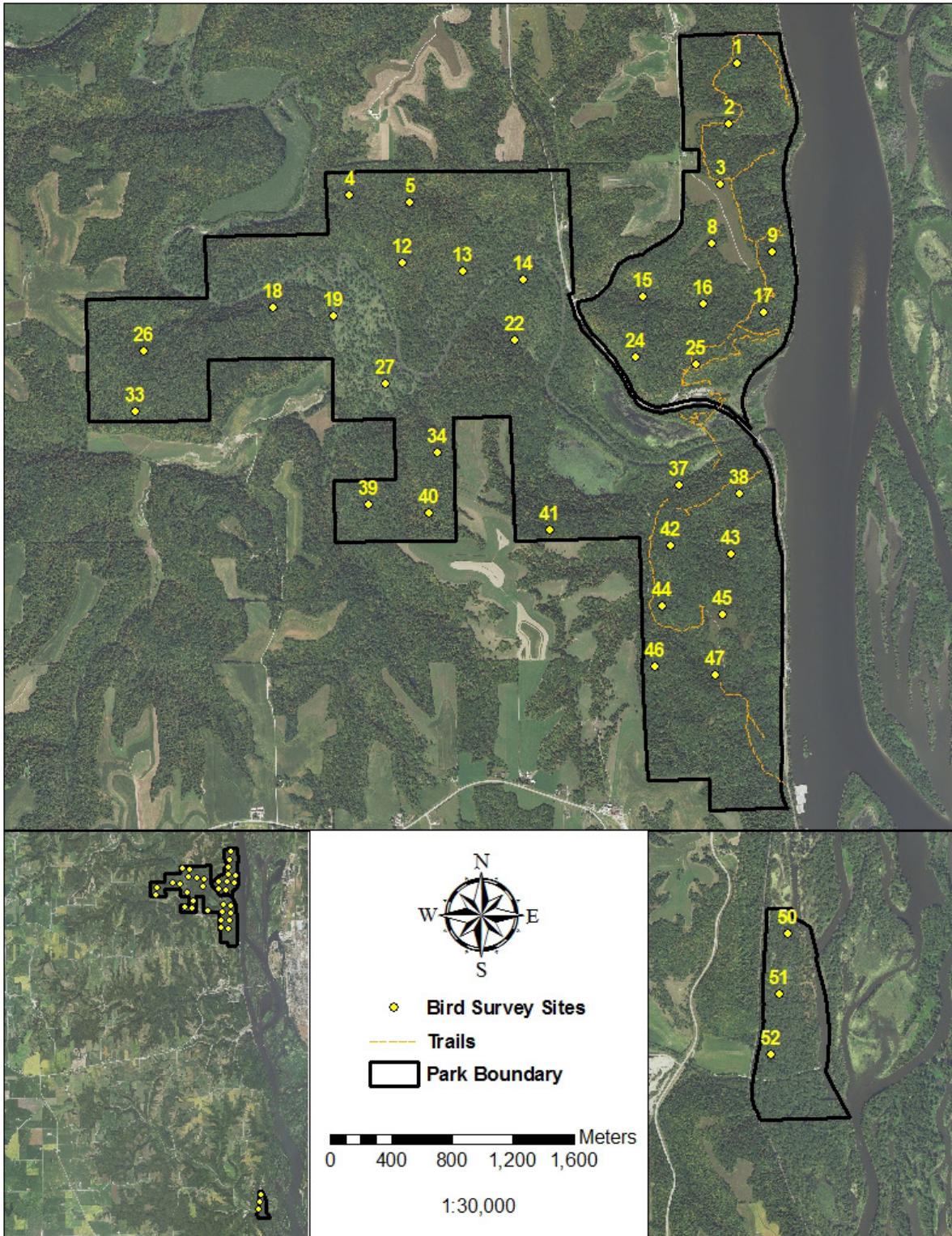


Figure A2. Heartland Inventory and Monitoring Network bird monitoring sites at Effigy Mounds National Monument, Iowa.

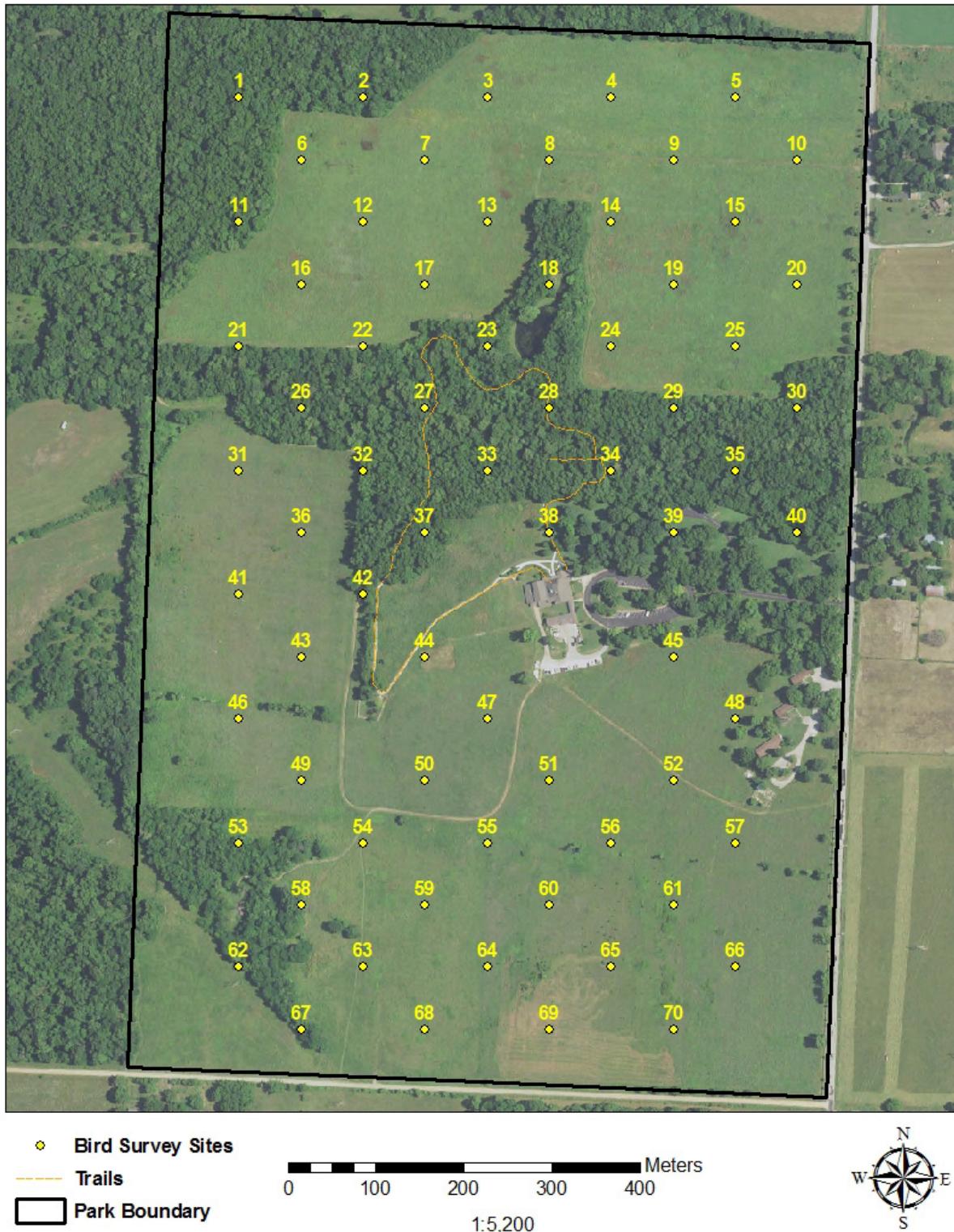


Figure A3. Heartland Inventory and Monitoring Network bird monitoring sites at George Washington Carver National Monument, Missouri.

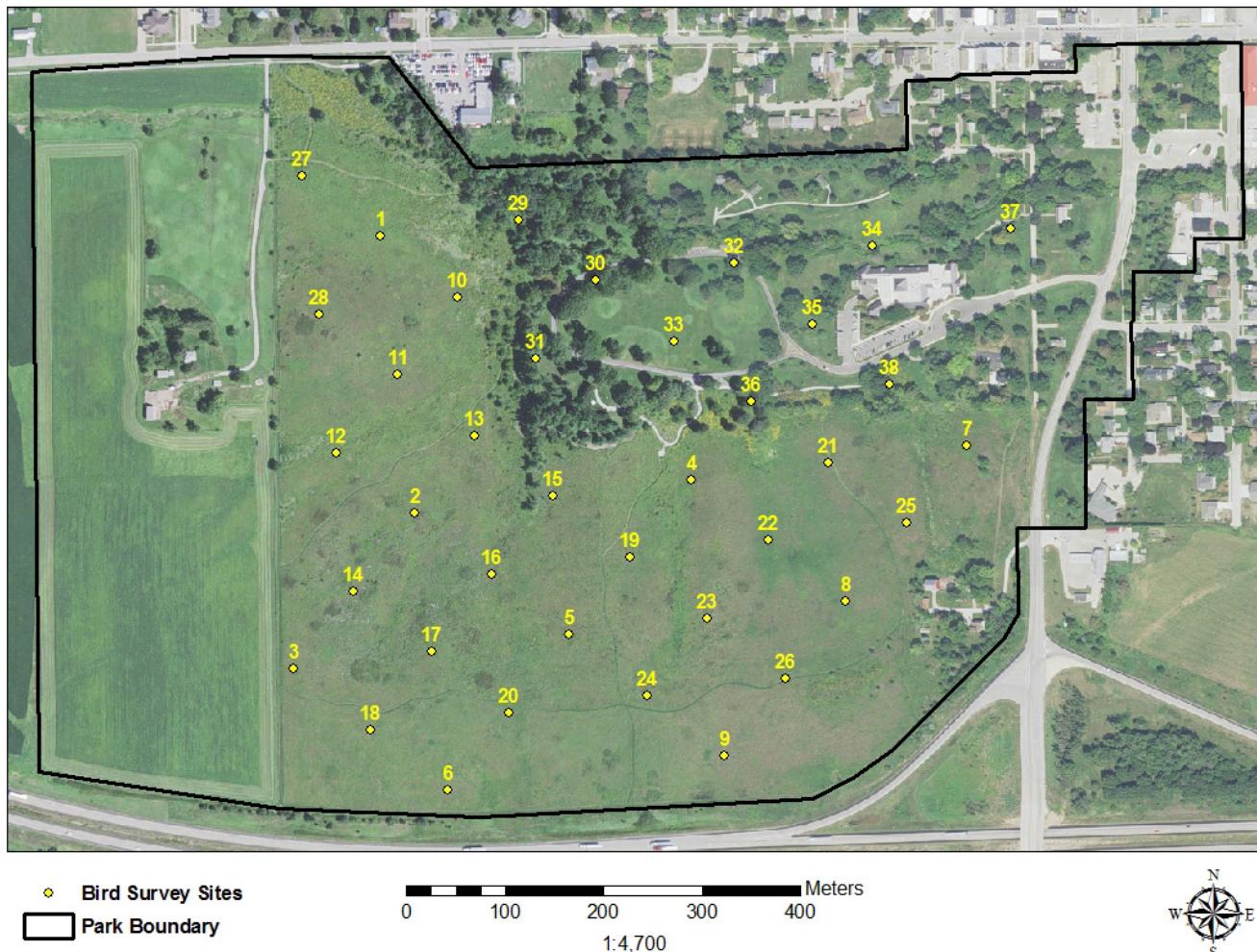


Figure A4. Heartland Inventory and Monitoring Network bird monitoring sites at Herbert Hoover National Historic Site, Iowa.

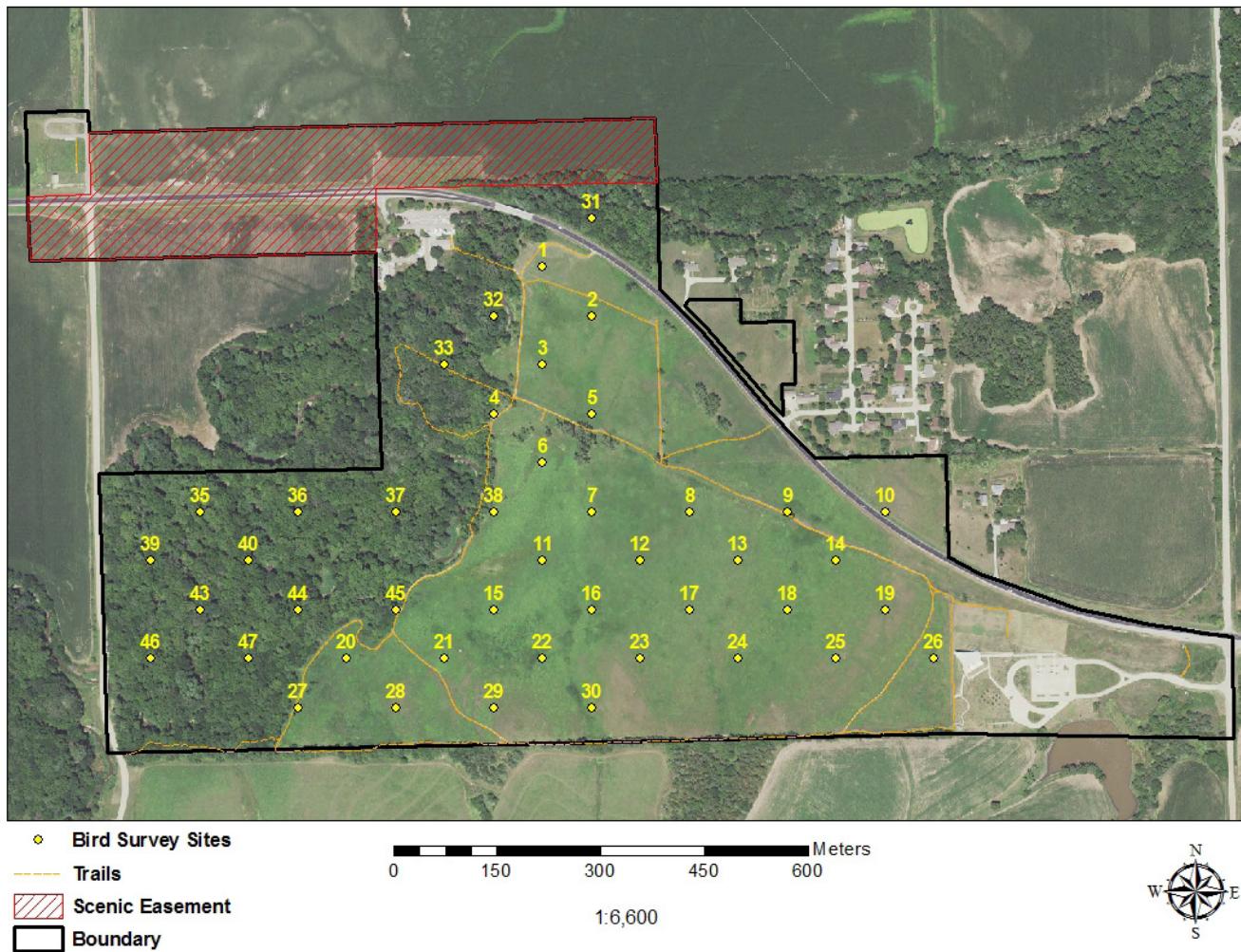


Figure A5. Heartland Inventory and Monitoring Network bird monitoring sites at Homestead National Historical Park, Nebraska.

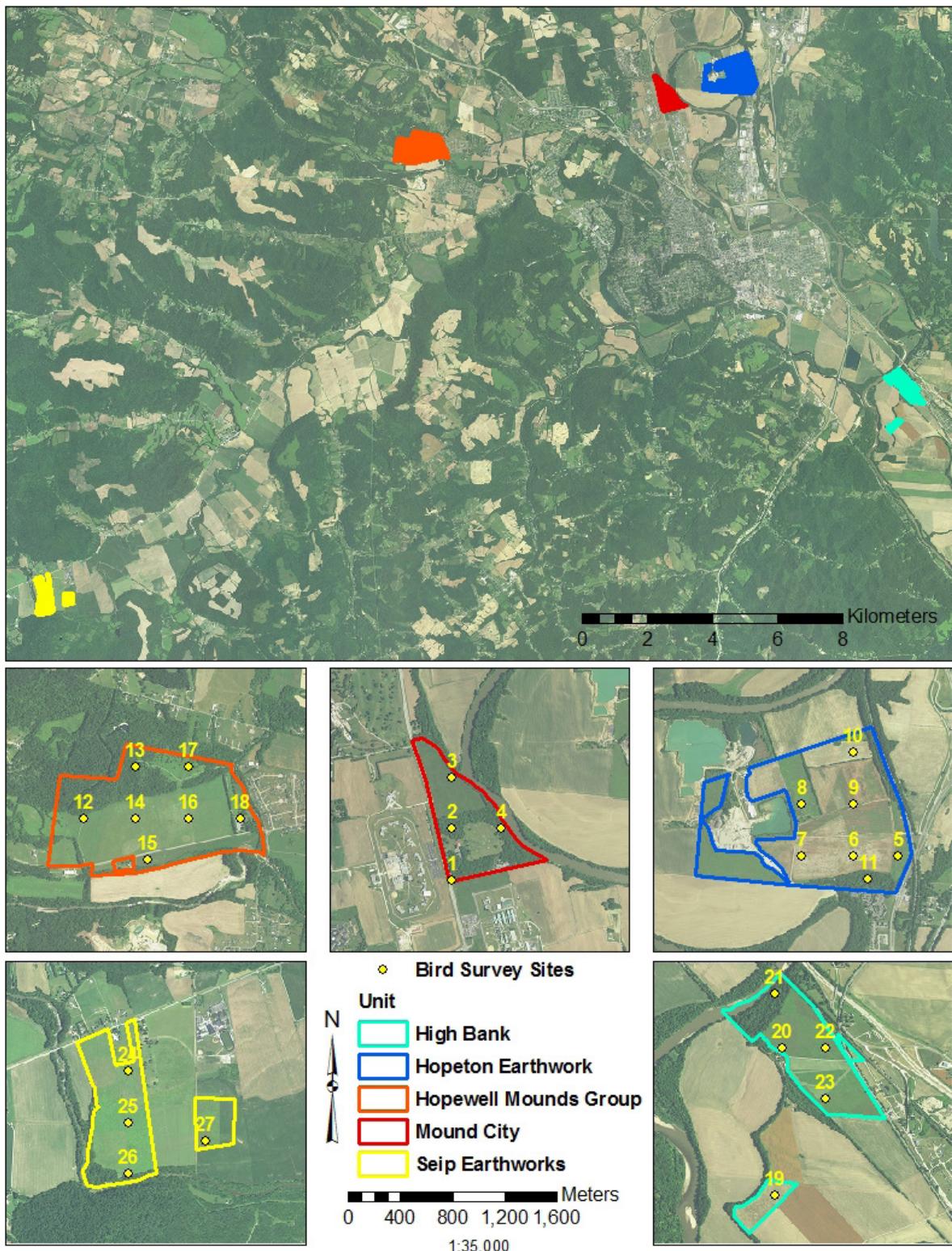


Figure A6. Heartland Inventory and Monitoring Network bird monitoring sites at Hopewell Culture National Historical Park, Ohio.

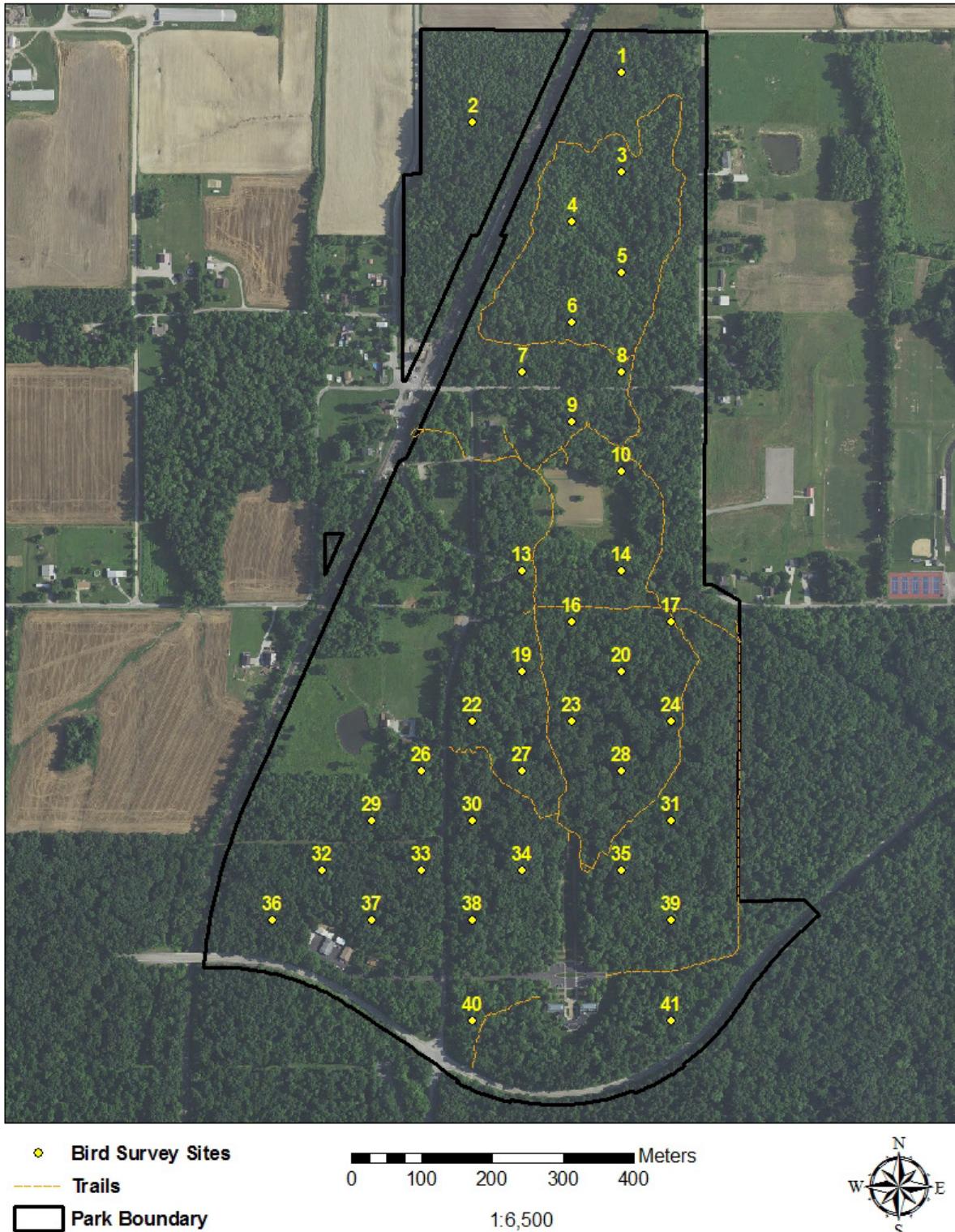


Figure A7. Heartland Inventory and Monitoring Network bird monitoring sites at Lincoln Boyhood National Memorial, Indiana.

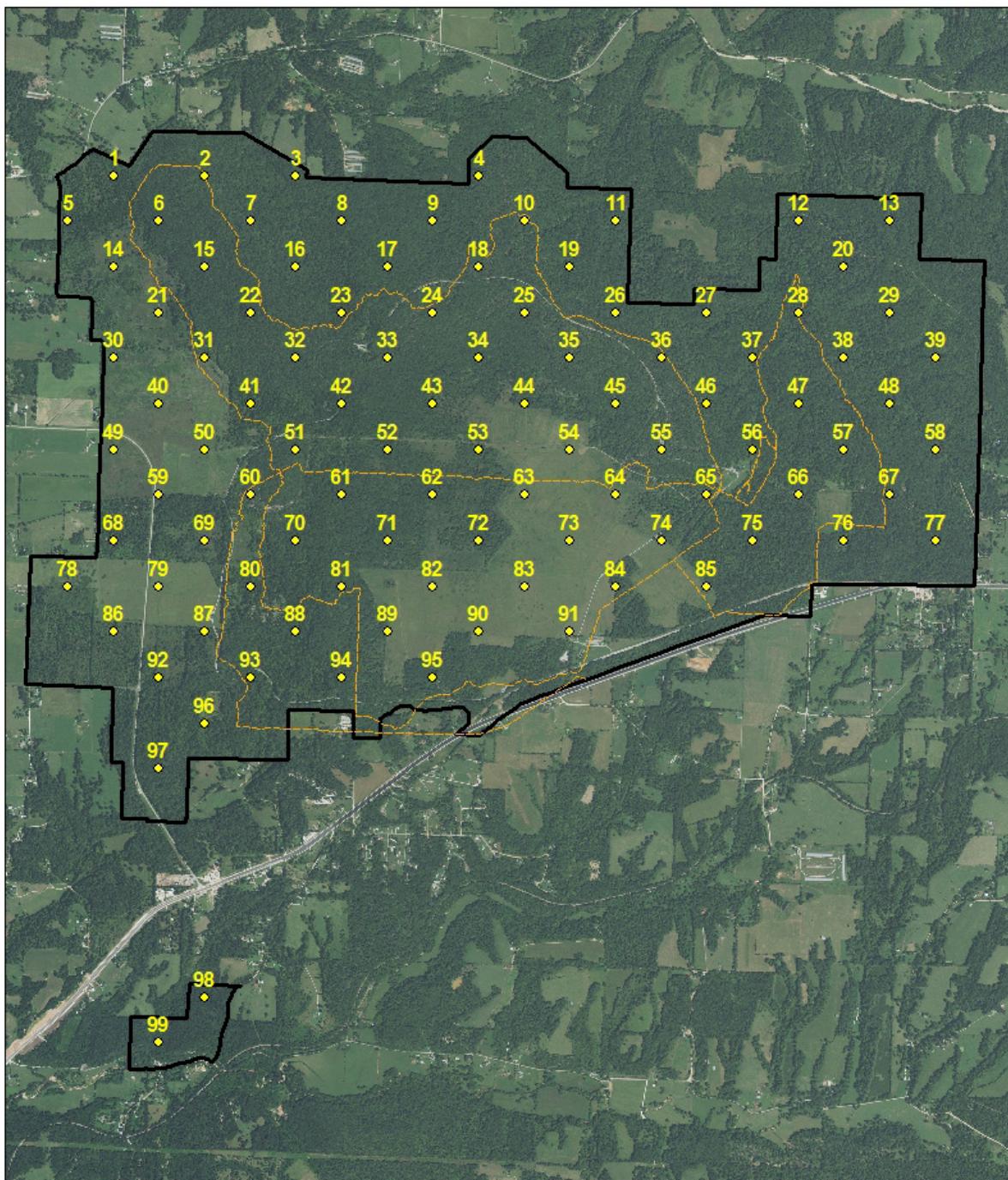


Figure A8. Heartland Inventory and Monitoring Network bird monitoring sites at Pea Ridge National Military Park, Arkansas.

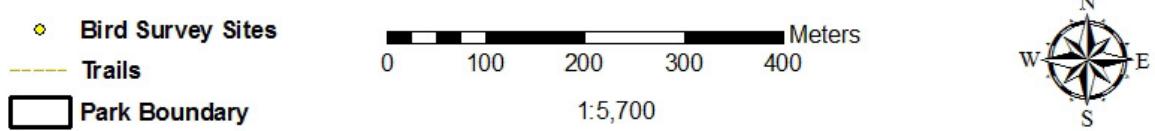
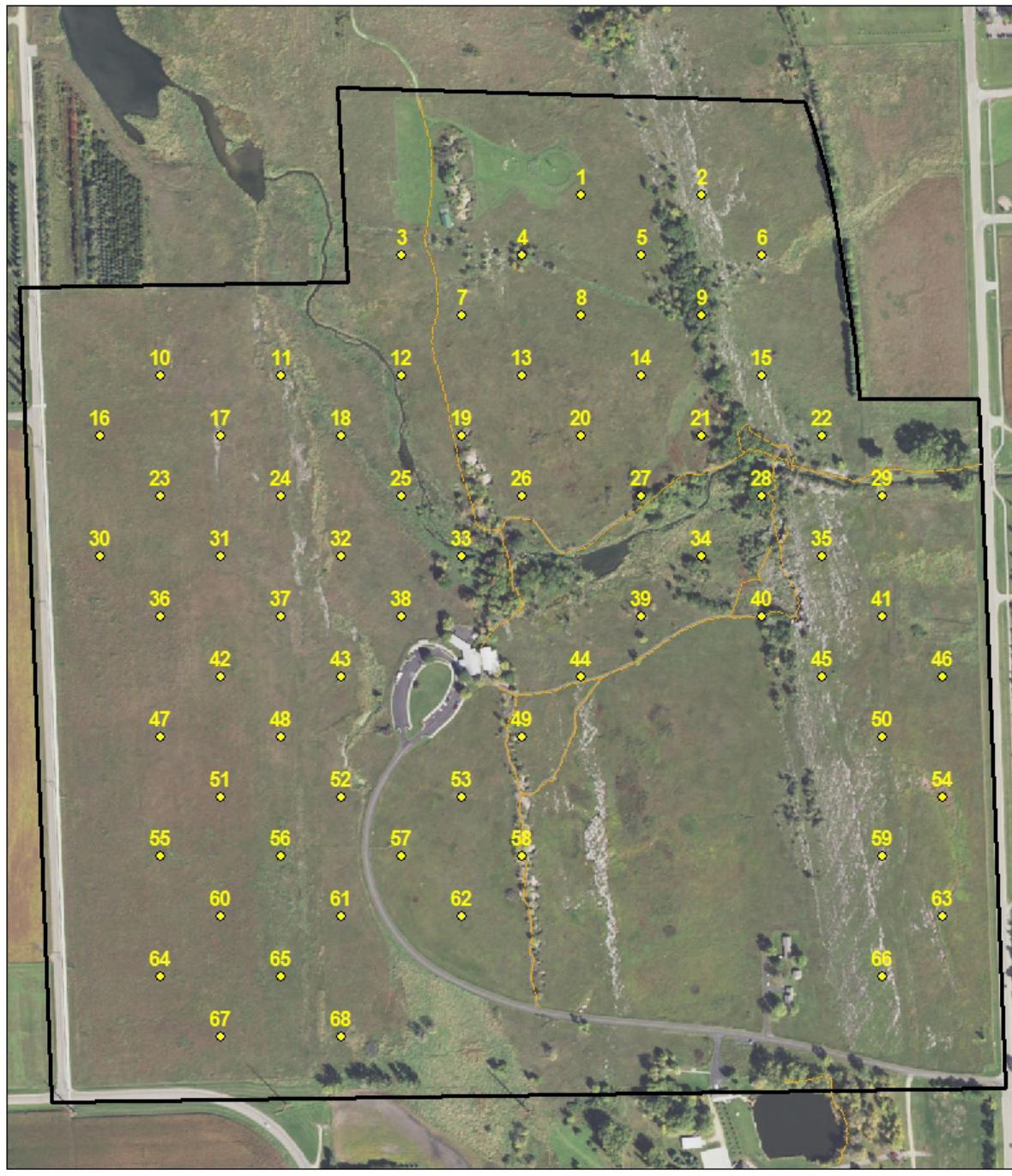


Figure A9. Heartland Inventory and Monitoring Network bird monitoring sites at Pipestone National Monument, Minnesota.

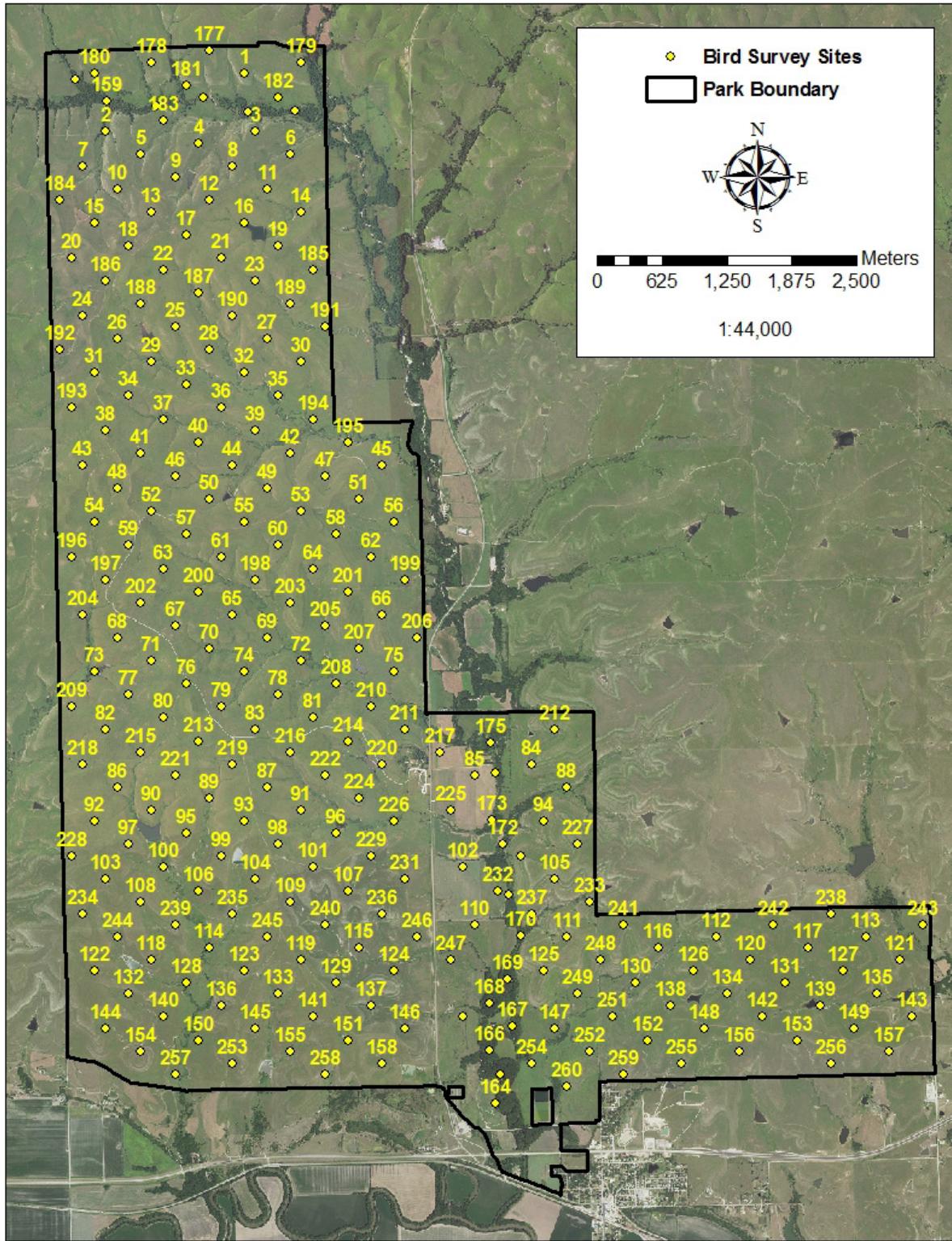


Figure A10. Heartland Inventory and Monitoring Network bird monitoring sites at Tallgrass Prairie National Preserve, Kansas.

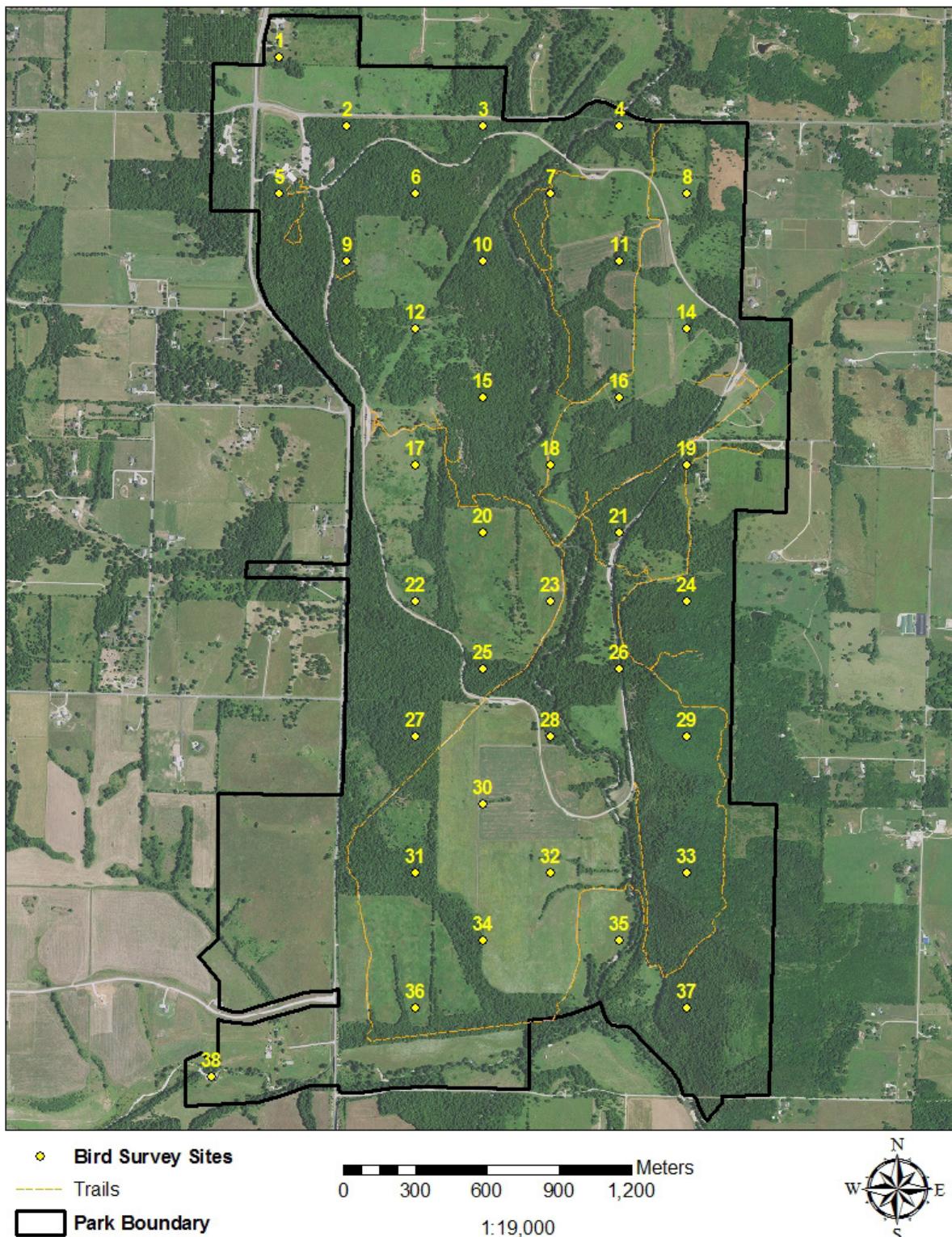


Figure A11. Heartland Inventory and Monitoring Network bird monitoring sites at Wilson's Creek National Battlefield, Missouri.

Appendix B. Waypoints for Bird Monitoring Sites

Tables B1–B11 contain the waypoints for Heartland Inventory and Monitoring Network bird monitoring sites at each park.

Table B1. Waypoints for Arkansas Post National Memorial, Arkansas—UTM Zone 15 North Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
ARPOTweety1	652413.656	3766221.835	ARPO_1
ARPOTweety2	652979.342	3766221.835	ARPO_2
ARPOTweety3	652696.499	3765938.992	ARPO_3
ARPOTweety4	652413.656	3765656.149	ARPO_4
ARPOTweety5	652696.499	3765373.306	ARPO_5
ARPOTweety6	660050.410	3761979.194	ARPO_6
ARPOTweety7	660616.095	3761979.194	ARPO_7
ARPOTweety8	659767.567	3761696.351	ARPO_8
ARPOTweety9	660333.252	3761696.351	ARPO_9
ARPOTweety10	660898.938	3761696.351	ARPO_10
ARPOTweety11	660050.410	3761413.508	ARPO_11
ARPOTweety12	652696.499	3766221.835	ARPO_12
ARPOTweety13	653262.184	3766221.835	ARPO_13
ARPOTweety14	652555.078	3766080.413	ARPO_14
ARPOTweety15	652837.920	3766080.413	ARPO_15
ARPOTweety16	653120.763	3766080.413	ARPO_16
ARPOTweety17	652413.656	3765938.992	ARPO_17
ARPOTweety18	652272.235	3765797.571	ARPO_18
ARPOTweety19	652555.078	3765797.571	ARPO_19
ARPOTweety20	652837.920	3765797.571	ARPO_20
ARPOTweety21	652130.814	3765656.149	ARPO_21
ARPOTweety22	652696.499	3765656.149	ARPO_22
ARPOTweety23	652555.078	3765514.728	ARPO_23
ARPOTweety24	652413.656	3765373.306	ARPO_24
ARPOTweety25	652555.078	3765231.885	ARPO_25
ARPOTweety26	652837.920	3764949.042	ARPO_26
ARPOTweety27	652979.342	3764807.621	ARPO_27
ARPOTweety28	659908.988	3761837.773	ARPO_28
ARPOTweety29	660191.831	3761837.773	ARPO_29
ARPOTweety30	660474.674	3761837.773	ARPO_30
ARPOTweety31	660050.410	3761696.351	ARPO_31
ARPOTweety32	660616.095	3761696.351	ARPO_32
ARPOTweety33	659908.988	3761554.930	ARPO_33
ARPOTweety34	660191.831	3761554.930	ARPO_34
ARPOTweety35	660333.252	3761413.508	ARPO_35
ARPOTweety36	660898.938	3761413.508	ARPO_36

Table B2. Waypoints for Effigy Mounds National Monument, Iowa—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D Number
EFMOTweety1	647837.313	4774424.000	EFMO_1
EFMOTweety2	647783.375	4774027.500	EFMO_2
EFMOTweety3	647729.438	4773631.000	EFMO_3
EFMOTweety4	645297.438	4773558.500	EFMO_4
EFMOTweety5	645693.813	4773504.500	EFMO_5
EFMOTweety6 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_6
EFMOTweety7 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_7
EFMOTweety8	647675.563	4773235.000	EFMO_8
EFMOTweety9	648071.875	4773181.000	EFMO_9
EFMOTweety10 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_10
EFMOTweety11 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_11
EFMOTweety12	645639.875	4773108.000	EFMO_12
EFMOTweety13	646036.250	4773054.000	EFMO_13
EFMOTweety14	646432.563	4773000.000	EFMO_14
EFMOTweety15	647225.313	4772892.500	EFMO_15
EFMOTweety16	647621.625	4772838.500	EFMO_16
EFMOTweety17	648018.000	4772784.500	EFMO_17
EFMOTweety18	644793.250	4772819.500	EFMO_18
EFMOTweety19	645189.625	4772765.500	EFMO_19
EFMOTweety20 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_20
EFMOTweety21 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_21
EFMOTweety22	646378.688	4772604.000	EFMO_22
EFMOTweety23 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_23
EFMOTweety24	647171.375	4772496.000	EFMO_24
EFMOTweety25	647567.750	4772442.000	EFMO_25
EFMOTweety26	643946.688	4772531.000	EFMO_26
EFMOTweety27	645532.063	4772315.500	EFMO_27
EFMOTweety28 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_28
EFMOTweety29 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_29
EFMOTweety30 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_30
EFMOTweety31 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_31
EFMOTweety32 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_32
EFMOTweety33	643892.750	4772134.500	EFMO_33
EFMOTweety34	645874.500	4771865.000	EFMO_34
EFMOTweety35 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_35
EFMOTweety36 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_36
EFMOTweety37	647459.938	4771649.500	EFMO_37
EFMOTweety38	647856.250	4771595.500	EFMO_38
EFMOTweety39	645424.250	4771522.500	EFMO_39
EFMOTweety40	645820.625	4771468.500	EFMO_40
EFMOTweety41	646613.313	4771361.000	EFMO_41

^a Denotes plots that were dropped from sampling consideration in 2009 because they were in the Yellow River, in Founders Pond, on slopes > 40%, or in culturally sensitive areas.

Table B2 (continued). Waypoints for Effigy Mounds National Monument, Iowa—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D Number
EFMOTweety42	647406.000	4771253.000	EFMO_42
EFMOTweety43	647802.375	4771199.000	EFMO_43
EFMOTweety44	647352.063	4770856.500	EFMO_44
EFMOTweety45	647748.438	4770803.000	EFMO_45
EFMOTweety46	647298.188	4770460.500	EFMO_46
EFMOTweety47	647694.563	4770406.500	EFMO_47
EFMOTweety48 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_48
EFMOTweety49 ^a	Not Sampled ^a	Not Sampled ^a	EFMO_49
EFMOTweety50	649428.607	4756445.473	EFMO_50
EFMOTweety51	649374.693	4756049.123	EFMO_51
EFMOTweety52	649320.780	4755652.773	EFMO_52

^a Denotes plots that were dropped from sampling consideration in 2009 because they were in the Yellow River, in Founders Pond, on slopes > 40%, or in culturally sensitive areas.

Table B3. Waypoints for George Washington Carver National Monument, Missouri—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
GWCATweety1	379070.421	4094759.924	GWCA_1
GWCATweety2	379211.842	4094759.924	GWCA_2
GWCATweety3	379353.263	4094759.924	GWCA_3
GWCATweety4	379494.685	4094759.924	GWCA_4
GWCATweety5	379636.106	4094759.924	GWCA_5
GWCATweety6	379141.131	4094689.214	GWCA_6
GWCATweety7	379282.553	4094689.214	GWCA_7
GWCATweety8	379423.974	4094689.214	GWCA_8
GWCATweety9	379565.395	4094689.214	GWCA_9
GWCATweety10	379706.817	4094689.214	GWCA_10
GWCATweety11	379070.421	4094618.503	GWCA_11
GWCATweety12	379211.842	4094618.503	GWCA_12
GWCATweety13	379353.263	4094618.503	GWCA_13
GWCATweety14	379494.685	4094618.503	GWCA_14
GWCATweety15	379636.106	4094618.503	GWCA_15
GWCATweety16	379141.131	4094547.792	GWCA_16
GWCATweety17	379282.553	4094547.792	GWCA_17
GWCATweety18	379423.974	4094547.792	GWCA_18
GWCATweety19	379565.395	4094547.792	GWCA_19
GWCATweety20	379706.817	4094547.792	GWCA_20
GWCATweety21	379070.421	4094477.082	GWCA_21
GWCATweety22	379211.842	4094477.082	GWCA_22
GWCATweety23	379353.263	4094477.082	GWCA_23
GWCATweety24	379494.685	4094477.082	GWCA_24
GWCATweety25	379636.106	4094477.082	GWCA_25
GWCATweety26	379141.131	4094406.371	GWCA_26
GWCATweety27	379282.553	4094406.371	GWCA_27
GWCATweety28	379423.974	4094406.371	GWCA_28
GWCATweety29	379565.395	4094406.371	GWCA_29
GWCATweety30	379706.817	4094406.371	GWCA_30
GWCATweety31	379070.421	4094335.660	GWCA_31
GWCATweety32	379211.842	4094335.660	GWCA_32
GWCATweety33	379353.263	4094335.660	GWCA_33
GWCATweety34	379494.685	4094335.660	GWCA_34
GWCATweety35	379636.106	4094335.660	GWCA_35
GWCATweety36	379141.131	4094264.949	GWCA_36
GWCATweety37	379282.553	4094264.949	GWCA_37
GWCATweety38	379423.974	4094264.949	GWCA_38
GWCATweety39	379565.395	4094264.949	GWCA_39
GWCATweety40	379706.817	4094264.949	GWCA_40
GWCATweety41	379070.421	4094194.239	GWCA_41

Table B3 (continued). Waypoints for George Washington Carver National Monument, Missouri—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
GWCATweety42	379211.842	4094194.239	GWCA_42
GWCATweety43	379141.131	4094123.528	GWCA_43
GWCATweety44	379282.553	4094123.528	GWCA_44
GWCATweety45	379565.395	4094123.528	GWCA_45
GWCATweety46	379070.421	4094052.817	GWCA_46
GWCATweety47	379353.263	4094052.817	GWCA_47
GWCATweety48	379636.106	4094052.817	GWCA_48
GWCATweety49	379141.131	4093982.107	GWCA_49
GWCATweety50	379282.553	4093982.107	GWCA_50
GWCATweety51	379423.974	4093982.107	GWCA_51
GWCATweety52	379565.395	4093982.107	GWCA_52
GWCATweety53	379070.421	4093911.396	GWCA_53
GWCATweety54	379211.842	4093911.396	GWCA_54
GWCATweety55	379353.263	4093911.396	GWCA_55
GWCATweety56	379494.685	4093911.396	GWCA_56
GWCATweety57	379636.106	4093911.396	GWCA_57
GWCATweety58	379141.131	4093840.685	GWCA_58
GWCATweety59	379282.553	4093840.685	GWCA_59
GWCATweety60	379423.974	4093840.685	GWCA_60
GWCATweety61	379565.395	4093840.685	GWCA_61
GWCATweety62	379070.421	4093769.975	GWCA_62
GWCATweety63	379211.842	4093769.975	GWCA_63
GWCATweety64	379353.263	4093769.975	GWCA_64
GWCATweety65	379494.685	4093769.975	GWCA_65
GWCATweety66	379636.106	4093769.975	GWCA_66
GWCATweety67	379141.131	4093699.264	GWCA_67
GWCATweety68	379282.553	4093699.264	GWCA_68
GWCATweety69	379423.974	4093699.264	GWCA_69
GWCATweety70	379565.395	4093699.264	GWCA_70

Table B4. Waypoints for Herbert Hoover National Historic Site, Iowa—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
HEHOTweety1	636971.393	4614410.700	HEHO_1
HEHOTweety2	637005.863	4614129.966	HEHO_2
HEHOTweety3	636882.731	4613972.364	HEHO_3
HEHOTweety4	637286.597	4614164.436	HEHO_4
HEHOTweety5	637163.465	4614006.834	HEHO_5
HEHOTweety6	637040.333	4613849.232	HEHO_6
HEHOTweety7	637567.332	4614198.906	HEHO_7
HEHOTweety8	637444.200	4614041.303	HEHO_8
HEHOTweety9	637321.067	4613883.701	HEHO_9
HEHOTweety10	637050.194	4614349.134	HEHO_10
HEHOTweety11	636988.628	4614270.333	HEHO_11
HEHOTweety12	636927.062	4614191.532	HEHO_12
HEHOTweety13	637067.429	4614208.767	HEHO_13
HEHOTweety14	636944.297	4614051.165	HEHO_14
HEHOTweety15	637146.230	4614147.201	HEHO_15
HEHOTweety16	637084.664	4614068.400	HEHO_16
HEHOTweety17	637023.098	4613989.599	HEHO_17
HEHOTweety18	636961.532	4613910.798	HEHO_18
HEHOTweety19	637225.031	4614085.635	HEHO_19
HEHOTweety20	637101.899	4613928.033	HEHO_20
HEHOTweety21	637426.965	4614181.671	HEHO_21
HEHOTweety22	637365.399	4614102.870	HEHO_22
HEHOTweety23	637303.832	4614024.069	HEHO_23
HEHOTweety24	637242.266	4613945.268	HEHO_24
HEHOTweety25	637505.766	4614120.105	HEHO_25
HEHOTweety26	637382.633	4613962.502	HEHO_26
HEHOTweety27	636892.592	4614472.267	HEHO_27
HEHOTweety28	636909.827	4614331.899	HEHO_28
HEHOTweety29	637111.760	4614427.935	HEHO_29
HEHOTweety30	637190.561	4614366.369	HEHO_30
HEHOTweety31	637128.995	4614287.568	HEHO_31
HEHOTweety32	637330.929	4614383.604	HEHO_32
HEHOTweety33	637269.363	4614304.803	HEHO_33
HEHOTweety34	637471.296	4614400.839	HEHO_34
HEHOTweety35	637409.730	4614322.038	HEHO_35
HEHOTweety36	637348.164	4614243.237	HEHO_36
HEHOTweety37	637611.663	4614418.074	HEHO_37
HEHOTweety38	637488.531	4614260.472	HEHO_38

Table B5. Waypoints for Homestead National Historical Park, Nebraska—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
HOMETweety1	684124.165	4462295.543	HOME_1
HOMETweety2	684194.876	4462224.832	HOME_2
HOMETweety3	684124.165	4462154.122	HOME_3
HOMETweety4	684053.455	4462083.411	HOME_4
HOMETweety5	684194.876	4462083.411	HOME_5
HOMETweety6	684124.165	4462012.701	HOME_6
HOMETweety7	684194.876	4461941.990	HOME_7
HOMETweety8	684336.297	4461941.990	HOME_8
HOMETweety9	684477.719	4461941.990	HOME_9
HOMETweety10	684619.140	4461941.990	HOME_10
HOMETweety11	684124.165	4461871.279	HOME_11
HOMETweety12	684265.587	4461871.279	HOME_12
HOMETweety13	684407.008	4461871.279	HOME_13
HOMETweety14	684548.430	4461871.279	HOME_14
HOMETweety15	684053.455	4461800.568	HOME_15
HOMETweety16	684194.876	4461800.568	HOME_16
HOMETweety17	684336.297	4461800.568	HOME_17
HOMETweety18	684477.719	4461800.568	HOME_18
HOMETweety19	684619.140	4461800.568	HOME_19
HOMETweety20	683841.323	4461729.858	HOME_20
HOMETweety21	683982.744	4461729.858	HOME_21
HOMETweety22	684124.165	4461729.858	HOME_22
HOMETweety23	684265.587	4461729.858	HOME_23
HOMETweety24	684407.008	4461729.858	HOME_24
HOMETweety25	684548.429	4461729.858	HOME_25
HOMETweety26	684689.851	4461729.858	HOME_26
HOMETweety27	683770.612	4461659.147	HOME_27
HOMETweety28	683912.033	4461659.147	HOME_28
HOMETweety29	684053.455	4461659.147	HOME_29
HOMETweety30	684194.876	4461659.147	HOME_30
HOMETweety31	684194.876	4462366.254	HOME_31
HOMETweety32	684053.455	4462224.832	HOME_32
HOMETweety33	683982.744	4462154.122	HOME_33
HOMETweety34 ^a	Not Sampled ^a	Not Sampled ^a	HOME_34
HOMETweety35	683629.191	4461941.990	HOME_35
HOMETweety36	683770.612	4461941.990	HOME_36
HOMETweety37	683912.033	4461941.990	HOME_37
HOMETweety38	684053.455	4461941.990	HOME_38
HOMETweety39	683558.480	4461871.279	HOME_39
HOMETweety40	683699.901	4461871.279	HOME_40
HOMETweety41 ^a	Not Sampled ^a	Not Sampled ^a	HOME_41
HOMETweety42 ^a	Not Sampled ^a	Not Sampled ^a	HOME_42

^a Denotes plots that were dropped from sampling consideration in 2009 because they are in Cub Creek.

Table B5 (continued). Waypoints for Homestead National Historical Park, Nebraska—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
HOMETweety43	683629.191	4461800.568	HOME_43
HOMETweety44	683770.612	4461800.568	HOME_44
HOMETweety45	683912.033	4461800.568	HOME_45
HOMETweety46	683558.480	4461729.858	HOME_46
HOMETweety47	683699.901	4461729.858	HOME_47
HOMETweety48 ^a	Not Sampled ^a	Not Sampled ^a	HOME_48

^a Denotes plots that were dropped from sampling consideration in 2009 because they are in Cub Creek.

Table B6. Waypoints for Hopewell Cultural National Historical Park, Ohio—UTM Zone 17 North, Datum 1983 (Conus).

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

Table B7. Waypoints for Lincoln Boyhood National Memorial, Indiana—UTM Zone 16 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
LIBOTweety1	500432.278	4219695.381	LIBO_1
LIBOTweety2	500220.146	4219624.671	LIBO_2
LIBOTweety3	500432.278	4219553.960	LIBO_3
LIBOTweety4	500361.567	4219483.249	LIBO_4
LIBOTweety5	500432.278	4219412.539	LIBO_5
LIBOTweety6	500361.567	4219341.828	LIBO_6
LIBOTweety7	500290.856	4219271.117	LIBO_7
LIBOTweety8	500432.278	4219271.117	LIBO_8
LIBOTweety9	500361.567	4219200.407	LIBO_9
LIBOTweety10	500432.278	4219129.696	LIBO_10
LIBOTweety11 ^a	Not Sampled ^a	Not Sampled ^a	LIBO_11
LIBOTweety12 ^a	Not Sampled ^a	Not Sampled ^a	LIBO_12
LIBOTweety13	500290.856	4218988.274	LIBO_13
LIBOTweety14	500432.278	4218988.274	LIBO_14
LIBOTweety15 ^a	Not Sampled ^a	Not Sampled ^a	LIBO_15
LIBOTweety16	500361.567	4218917.564	LIBO_16
LIBOTweety17	500502.988	4218917.564	LIBO_17
LIBOTweety18 ^a	Not Sampled ^a	Not Sampled ^a	LIBO_18
LIBOTweety19	500290.856	4218846.853	LIBO_19
LIBOTweety20	500432.278	4218846.853	LIBO_20
LIBOTweety21 ^a	Not Sampled ^a	Not Sampled ^a	LIBO_21
LIBOTweety22	500220.146	4218776.142	LIBO_22
LIBOTweety23	500361.567	4218776.142	LIBO_23
LIBOTweety24	500502.988	4218776.142	LIBO_24
LIBOTweety25 ^a	Not Sampled ^a	Not Sampled ^a	LIBO_25
LIBOTweety26	500149.435	4218705.432	LIBO_26
LIBOTweety27	500290.856	4218705.432	LIBO_27
LIBOTweety28	500432.278	4218705.432	LIBO_28
LIBOTweety29	500078.724	4218634.721	LIBO_29
LIBOTweety30	500220.146	4218634.721	LIBO_30
LIBOTweety31	500502.988	4218634.721	LIBO_31
LIBOTweety32	500008.014	4218564.010	LIBO_32
LIBOTweety33	500149.435	4218564.010	LIBO_33
LIBOTweety34	500290.856	4218564.010	LIBO_34
LIBOTweety35	500432.278	4218564.010	LIBO_35
LIBOTweety36	499937.303	4218493.300	LIBO_36
LIBOTweety37	500078.724	4218493.300	LIBO_37
LIBOTweety38	500220.146	4218493.300	LIBO_38
LIBOTweety39	500502.988	4218493.300	LIBO_39
LIBOTweety40	500220.146	4218351.878	LIBO_40
LIBOTweety41	500502.988	4218351.878	LIBO_41

^a Denotes plots that were dropped from sampling consideration in 2007 because they are in culturally sensitive areas.

Table B8. Waypoints for Pea Ridge National Military Park, Arkansas—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
PERITweety1	405072.520	4036536.798	PERI_1
PERITweety2	405638.205	4036536.798	PERI_2
PERITweety3	406203.891	4036536.798	PERI_3
PERITweety4	407335.262	4036536.798	PERI_4
PERITweety5	404789.677	4036253.955	PERI_5
PERITweety6	405355.363	4036253.955	PERI_6
PERITweety7	405921.048	4036253.955	PERI_7
PERITweety8	406486.733	4036253.955	PERI_8
PERITweety9	407052.419	4036253.955	PERI_9
PERITweety10	407618.104	4036253.955	PERI_10
PERITweety11	408183.790	4036253.955	PERI_11
PERITweety12	409315.161	4036253.955	PERI_12
PERITweety13	409880.846	4036253.955	PERI_13
PERITweety14	405072.520	4035971.112	PERI_14
PERITweety15	405638.205	4035971.112	PERI_15
PERITweety16	406203.891	4035971.112	PERI_16
PERITweety17	406769.576	4035971.112	PERI_17
PERITweety18	407335.262	4035971.112	PERI_18
PERITweety19	407900.947	4035971.112	PERI_19
PERITweety20	409598.003	4035971.112	PERI_20
PERITweety21	405355.363	4035688.269	PERI_21
PERITweety22	405921.048	4035688.269	PERI_22
PERITweety23	406486.733	4035688.269	PERI_23
PERITweety24	407052.419	4035688.269	PERI_24
PERITweety25	407618.104	4035688.269	PERI_25
PERITweety26	408183.790	4035688.269	PERI_26
PERITweety27	408749.475	4035688.269	PERI_27
PERITweety28	409315.161	4035688.269	PERI_28
PERITweety29	409880.846	4035688.269	PERI_29
PERITweety30	405072.520	4035405.427	PERI_30
PERITweety31	405638.205	4035405.427	PERI_31
PERITweety32	406203.891	4035405.427	PERI_32
PERITweety33	406769.576	4035405.427	PERI_33
PERITweety34	407335.262	4035405.427	PERI_34
PERITweety35	407900.947	4035405.427	PERI_35
PERITweety36	408466.632	4035405.427	PERI_36
PERITweety37	409032.318	4035405.427	PERI_37
PERITweety38	409598.003	4035405.427	PERI_38
PERITweety39	410163.689	4035405.427	PERI_39
PERITweety40	405355.363	4035122.584	PERI_40
PERITweety41	405921.048	4035122.584	PERI_41
PERITweety42	406486.733	4035122.584	PERI_42

Table B8 (continued). Waypoints for Pea Ridge National Military Park, Arkansas—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
PERITweety43	407052.419	4035122.584	PERI_43
PERITweety44	407618.104	4035122.584	PERI_44
PERITweety45	408183.790	4035122.584	PERI_45
PERITweety46	408749.475	4035122.584	PERI_46
PERITweety47	409315.161	4035122.584	PERI_47
PERITweety48	409880.846	4035122.584	PERI_48
PERITweety49	405072.520	4034839.741	PERI_49
PERITweety50	405638.205	4034839.741	PERI_50
PERITweety51	406203.891	4034839.741	PERI_51
PERITweety52	406769.576	4034839.741	PERI_52
PERITweety53	407335.262	4034839.741	PERI_53
PERITweety54	407900.947	4034839.741	PERI_54
PERITweety55	408466.632	4034839.741	PERI_55
PERITweety56	409032.318	4034839.741	PERI_56
PERITweety57	409598.003	4034839.741	PERI_57
PERITweety58	410163.689	4034839.741	PERI_58
PERITweety59	405355.363	4034556.899	PERI_59
PERITweety60	405921.048	4034556.899	PERI_60
PERITweety61	406486.733	4034556.899	PERI_61
PERITweety62	407052.419	4034556.899	PERI_62
PERITweety63	407618.104	4034556.899	PERI_63
PERITweety64	408183.790	4034556.899	PERI_64
PERITweety65	408749.475	4034556.899	PERI_65
PERITweety66	409315.161	4034556.899	PERI_66
PERITweety67	409880.846	4034556.899	PERI_67
PERITweety68	405072.520	4034274.056	PERI_68
PERITweety69	405638.205	4034274.056	PERI_69
PERITweety70	406203.891	4034274.056	PERI_70
PERITweety71	406769.576	4034274.056	PERI_71
PERITweety72	407335.262	4034274.056	PERI_72
PERITweety73	407900.947	4034274.056	PERI_73
PERITweety74	408466.632	4034274.056	PERI_74
PERITweety75	409032.318	4034274.056	PERI_75
PERITweety76	409598.003	4034274.056	PERI_76
PERITweety77	410163.689	4034274.056	PERI_77
PERITweety78	404789.677	4033991.213	PERI_78
PERITweety79	405355.363	4033991.213	PERI_79
PERITweety80	405921.048	4033991.213	PERI_80
PERITweety81	406486.733	4033991.213	PERI_81
PERITweety82	407052.419	4033991.213	PERI_82
PERITweety83	407618.104	4033991.213	PERI_83
PERITweety84	408183.790	4033991.213	PERI_84

Table B8 (continued). Waypoints for Pea Ridge National Military Park, Arkansas—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
PERITweety85	408749.475	4033991.213	PERI_85
PERITweety86	405072.520	4033708.370	PERI_86
PERITweety87	405638.205	4033708.370	PERI_87
PERITweety88	406203.891	4033708.370	PERI_88
PERITweety89	406769.576	4033708.370	PERI_89
PERITweety90	407335.262	4033708.370	PERI_90
PERITweety91	407900.947	4033708.370	PERI_91
PERITweety92	405355.363	4033425.528	PERI_92
PERITweety93	405921.048	4033425.528	PERI_93
PERITweety94	406486.733	4033425.528	PERI_94
PERITweety95	407052.419	4033425.528	PERI_95
PERITweety96	405638.205	4033142.685	PERI_96
PERITweety97	405355.363	4032859.842	PERI_97
PERITweety98	405638.205	4031445.629	PERI_98
PERITweety99	405355.363	4031162.786	PERI_99

Table B9. Waypoints for Pipestone National Monument, Minnesota—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
PIPETweety1	714523.683	4877379.195	PIPE_1
PIPETweety2	714665.105	4877379.195	PIPE_2
PIPETweety3	714311.551	4877308.484	PIPE_3
PIPETweety4	714452.973	4877308.484	PIPE_4
PIPETweety5	714594.394	4877308.484	PIPE_5
PIPETweety6	714735.815	4877308.484	PIPE_6
PIPETweety7	714382.262	4877237.774	PIPE_7
PIPETweety8	714523.683	4877237.774	PIPE_8
PIPETweety9	714665.105	4877237.774	PIPE_9
PIPETweety10	714028.708	4877167.063	PIPE_10
PIPETweety11	714170.130	4877167.063	PIPE_11
PIPETweety12	714311.551	4877167.063	PIPE_12
PIPETweety13	714452.973	4877167.063	PIPE_13
PIPETweety14	714594.394	4877167.063	PIPE_14
PIPETweety15	714735.815	4877167.063	PIPE_15
PIPETweety16	713957.998	4877096.352	PIPE_16
PIPETweety17	714099.419	4877096.352	PIPE_17
PIPETweety18	714240.841	4877096.352	PIPE_18
PIPETweety19	714382.262	4877096.352	PIPE_19
PIPETweety20	714523.683	4877096.352	PIPE_20
PIPETweety21	714665.105	4877096.352	PIPE_21
PIPETweety22	714806.526	4877096.352	PIPE_22
PIPETweety23	714028.708	4877025.642	PIPE_23
PIPETweety24	714170.130	4877025.642	PIPE_24
PIPETweety25	714311.551	4877025.642	PIPE_25
PIPETweety26	714452.973	4877025.642	PIPE_26
PIPETweety27	714594.394	4877025.642	PIPE_27
PIPETweety28	714735.815	4877025.642	PIPE_28
PIPETweety29	714877.237	4877025.642	PIPE_29
PIPETweety30	713957.998	4876954.931	PIPE_30
PIPETweety31	714099.419	4876954.931	PIPE_31
PIPETweety32	714240.841	4876954.931	PIPE_32
PIPETweety33	714382.262	4876954.931	PIPE_33
PIPETweety34	714665.105	4876954.931	PIPE_34
PIPETweety35	714806.526	4876954.931	PIPE_35
PIPETweety36	714028.708	4876884.220	PIPE_36
PIPETweety37	714170.130	4876884.220	PIPE_37
PIPETweety38	714311.551	4876884.220	PIPE_38
PIPETweety39	714594.394	4876884.220	PIPE_39
PIPETweety40	714735.815	4876884.220	PIPE_40
PIPETweety41	714877.237	4876884.220	PIPE_41
PIPETweety42	714099.419	4876813.510	PIPE_42

Table B9 (continued). Waypoints for Pipestone National Monument, Minnesota—UTM Zone 14 North, Datum 1983 (Conus). (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
PIPETweety43	714240.841	4876813.510	PIPE_43
PIPETweety44	714523.683	4876813.510	PIPE_44
PIPETweety45	714806.526	4876813.510	PIPE_45
PIPETweety46	714947.947	4876813.510	PIPE_46
PIPETweety47	714028.708	4876742.799	PIPE_47
PIPETweety48	714170.130	4876742.799	PIPE_48
PIPETweety49	714452.973	4876742.799	PIPE_49
PIPETweety50	714877.237	4876742.799	PIPE_50
PIPETweety51	714099.419	4876672.088	PIPE_51
PIPETweety52	714240.841	4876672.088	PIPE_52
PIPETweety53	714382.262	4876672.088	PIPE_53
PIPETweety54	714947.947	4876672.088	PIPE_54
PIPETweety55	714028.708	4876601.378	PIPE_55
PIPETweety56	714170.130	4876601.378	PIPE_56
PIPETweety57	714311.551	4876601.378	PIPE_57
PIPETweety58	714452.973	4876601.378	PIPE_58
PIPETweety59	714877.237	4876601.378	PIPE_59
PIPETweety60	714099.419	4876530.667	PIPE_60
PIPETweety61	714240.841	4876530.667	PIPE_61
PIPETweety62	714382.262	4876530.667	PIPE_62
PIPETweety63	714947.947	4876530.667	PIPE_63
PIPETweety64	714028.708	4876459.956	PIPE_64
PIPETweety65	714170.130	4876459.956	PIPE_65
PIPETweety66	714877.237	4876459.956	PIPE_66
PIPETweety67	714099.419	4876389.245	PIPE_67
PIPETweety68	714240.841	4876389.245	PIPE_68

Table B10. Waypoints for Tallgrass Prairie National Preserve, Kansas—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
TAPRTweety1	711444.688	4263461.000	TAPR_1
TAPRTweety2	710113.438	4262906.000	TAPR_2
TAPRTweety3	711555.625	4262906.000	TAPR_3
TAPRTweety4	711000.938	4262795.500	TAPR_4
TAPRTweety5	710446.250	4262684.500	TAPR_5
TAPRTweety6	711888.438	4262684.500	TAPR_6
TAPRTweety7	709891.563	4262573.500	TAPR_7
TAPRTweety8	711333.750	4262573.500	TAPR_8
TAPRTweety9	710779.063	4262462.500	TAPR_9
TAPRTweety10	710224.375	4262351.500	TAPR_10
TAPRTweety11	711666.563	4262351.500	TAPR_11
TAPRTweety12	711111.875	4262240.500	TAPR_12
TAPRTweety13	710557.188	4262129.500	TAPR_13
TAPRTweety14	711999.375	4262129.500	TAPR_14
TAPRTweety15	710002.500	4262018.500	TAPR_15
TAPRTweety16	711444.688	4262018.500	TAPR_16
TAPRTweety17	710890.000	4261907.500	TAPR_17
TAPRTweety18	710335.313	4261797.000	TAPR_18
TAPRTweety19	711777.500	4261797.000	TAPR_19
TAPRTweety20	709780.563	4261686.000	TAPR_20
TAPRTweety21	711222.813	4261686.000	TAPR_21
TAPRTweety22	710668.125	4261575.000	TAPR_22
TAPRTweety23	711555.625	4261464.000	TAPR_23
TAPRTweety24	709891.563	4261131.000	TAPR_24
TAPRTweety25	710779.063	4261020.000	TAPR_25
TAPRTweety26	710224.375	4260909.500	TAPR_26
TAPRTweety27	711666.563	4260909.500	TAPR_27
TAPRTweety28	711111.875	4260798.500	TAPR_28
TAPRTweety29	710557.188	4260687.500	TAPR_29
TAPRTweety30	711999.375	4260687.500	TAPR_30
TAPRTweety31	710002.500	4260576.500	TAPR_31
TAPRTweety32	711444.688	4260576.500	TAPR_32
TAPRTweety33	710890.000	4260465.500	TAPR_33
TAPRTweety34	710335.313	4260354.500	TAPR_34
TAPRTweety35	711777.500	4260354.500	TAPR_35
TAPRTweety36	711222.813	4260243.500	TAPR_36
TAPRTweety37	710668.125	4260132.500	TAPR_37
TAPRTweety38	710113.438	4260022.000	TAPR_38
TAPRTweety39	711555.625	4260022.000	TAPR_39
TAPRTweety40	711000.938	4259911.000	TAPR_40
TAPRTweety41	710446.250	4259800.000	TAPR_41
TAPRTweety42	711888.438	4259800.000	TAPR_42

Table B10 (continued). Waypoints for Tallgrass Prairie National Preserve, Kansas—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
TAPRTweety43	709891.563	4259689.000	TAPR_43
TAPRTweety44	711333.750	4259689.000	TAPR_44
TAPRTweety45	712776.000	4259689.000	TAPR_45
TAPRTweety46	710779.063	4259578.000	TAPR_46
TAPRTweety47	712221.250	4259578.000	TAPR_47
TAPRTweety48	710224.375	4259467.000	TAPR_48
TAPRTweety49	711666.563	4259467.000	TAPR_49
TAPRTweety50	711111.875	4259356.000	TAPR_50
TAPRTweety51	712554.063	4259356.000	TAPR_51
TAPRTweety52	710557.188	4259245.000	TAPR_52
TAPRTweety53	711999.375	4259245.000	TAPR_53
TAPRTweety54	710002.500	4259134.000	TAPR_54
TAPRTweety55	711444.688	4259134.000	TAPR_55
TAPRTweety56	712886.938	4259134.000	TAPR_56
TAPRTweety57	710890.000	4259023.500	TAPR_57
TAPRTweety58	712332.188	4259023.500	TAPR_58
TAPRTweety59	710335.313	4258912.500	TAPR_59
TAPRTweety60	711777.500	4258912.500	TAPR_60
TAPRTweety61	711222.813	4258801.500	TAPR_61
TAPRTweety62	712665.063	4258801.500	TAPR_62
TAPRTweety63	710668.125	4258690.500	TAPR_63
TAPRTweety64	712110.313	4258690.500	TAPR_64
TAPRTweety65	711333.750	4258246.500	TAPR_65
TAPRTweety66	712776.000	4258246.500	TAPR_66
TAPRTweety67	710779.063	4258136.000	TAPR_67
TAPRTweety68	710224.375	4258025.000	TAPR_68
TAPRTweety69	711666.563	4258025.000	TAPR_69
TAPRTweety70	711111.875	4257914.000	TAPR_70
TAPRTweety71	710557.188	4257803.000	TAPR_71
TAPRTweety72	711999.375	4257803.000	TAPR_72
TAPRTweety73	710002.500	4257692.000	TAPR_73
TAPRTweety74	711444.688	4257692.000	TAPR_74
TAPRTweety75	712886.938	4257692.000	TAPR_75
TAPRTweety76	710890.000	4257581.000	TAPR_76
TAPRTweety77	710335.313	4257470.000	TAPR_77
TAPRTweety78	711777.500	4257470.000	TAPR_78
TAPRTweety79	711222.813	4257359.000	TAPR_79
TAPRTweety80	710668.125	4257248.500	TAPR_80
TAPRTweety81	712110.313	4257248.500	TAPR_81
TAPRTweety82	710113.438	4257137.500	TAPR_82
TAPRTweety83	711555.625	4257137.500	TAPR_83
TAPRTweety84	714218.188	4256804.500	TAPR_84

Table B10 (continued). Waypoints for Tallgrass Prairie National Preserve, Kansas—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
TAPRTweety85	713663.500	4256693.500	TAPR_85
TAPRTweety86	710224.375	4256582.500	TAPR_86
TAPRTweety87	711666.563	4256582.500	TAPR_87
TAPRTweety88	714551.000	4256582.500	TAPR_88
TAPRTweety89	711111.875	4256471.500	TAPR_89
TAPRTweety90	710557.188	4256360.500	TAPR_90
TAPRTweety91	711999.375	4256360.500	TAPR_91
TAPRTweety92	710002.500	4256250.000	TAPR_92
TAPRTweety93	711444.688	4256250.000	TAPR_93
TAPRTweety94	714329.125	4256250.000	TAPR_94
TAPRTweety95	710890.000	4256139.000	TAPR_95
TAPRTweety96	712332.188	4256139.000	TAPR_96
TAPRTweety97	710335.313	4256028.000	TAPR_97
TAPRTweety98	711777.500	4256028.000	TAPR_98
TAPRTweety99	711222.813	4255917.000	TAPR_99
TAPRTweety100	710668.125	4255806.000	TAPR_100
TAPRTweety101	712110.313	4255806.000	TAPR_101
TAPRTweety102	713552.563	4255806.000	TAPR_102
TAPRTweety103	710113.438	4255695.000	TAPR_103
TAPRTweety104	711555.625	4255695.000	TAPR_104
TAPRTweety105	714440.063	4255695.000	TAPR_105
TAPRTweety106	711000.938	4255584.000	TAPR_106
TAPRTweety107	712443.125	4255584.000	TAPR_107
TAPRTweety108	710446.250	4255473.000	TAPR_108
TAPRTweety109	711888.438	4255473.000	TAPR_109
TAPRTweety110	713663.500	4255251.500	TAPR_110
TAPRTweety111	714551.000	4255140.500	TAPR_111
TAPRTweety112	715993.250	4255140.500	TAPR_112
TAPRTweety113	717435.438	4255140.500	TAPR_113
TAPRTweety114	711111.875	4255029.500	TAPR_114
TAPRTweety115	712554.063	4255029.500	TAPR_115
TAPRTweety116	715438.563	4255029.500	TAPR_116
TAPRTweety117	716880.750	4255029.500	TAPR_117
TAPRTweety118	710557.188	4254918.500	TAPR_118
TAPRTweety119	711999.375	4254918.500	TAPR_119
TAPRTweety120	716326.063	4254918.500	TAPR_120
TAPRTweety121	717768.250	4254918.500	TAPR_121
TAPRTweety122	710002.500	4254807.500	TAPR_122
TAPRTweety123	711444.688	4254807.500	TAPR_123
TAPRTweety124	712886.938	4254807.500	TAPR_124
TAPRTweety125	714329.125	4254807.500	TAPR_125
TAPRTweety126	715771.375	4254807.500	TAPR_126

Table B10 (continued). Waypoints for Tallgrass Prairie National Preserve, Kansas—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
TAPRTweety127	717213.563	4254807.500	TAPR_127
TAPRTweety128	710890.000	4254696.500	TAPR_128
TAPRTweety129	712332.188	4254696.500	TAPR_129
TAPRTweety130	715216.625	4254696.500	TAPR_130
TAPRTweety131	716658.875	4254696.500	TAPR_131
TAPRTweety132	710335.313	4254585.500	TAPR_132
TAPRTweety133	711777.500	4254585.500	TAPR_133
TAPRTweety134	716104.188	4254585.500	TAPR_134
TAPRTweety135	717546.375	4254585.500	TAPR_135
TAPRTweety136	711222.813	4254475.000	TAPR_136
TAPRTweety137	712665.063	4254475.000	TAPR_137
TAPRTweety138	715549.500	4254475.000	TAPR_138
TAPRTweety139	716991.688	4254475.000	TAPR_139
TAPRTweety140	710668.125	4254364.000	TAPR_140
TAPRTweety141	712110.313	4254364.000	TAPR_141
TAPRTweety142	716437.000	4254364.000	TAPR_142
TAPRTweety143	717879.188	4254364.000	TAPR_143
TAPRTweety144	710113.438	4254253.000	TAPR_144
TAPRTweety145	711555.625	4254253.000	TAPR_145
TAPRTweety146	712997.875	4254253.000	TAPR_146
TAPRTweety147	714440.063	4254253.000	TAPR_147
TAPRTweety148	715882.313	4254253.000	TAPR_148
TAPRTweety149	717324.500	4254253.000	TAPR_149
TAPRTweety150	711000.938	4254142.000	TAPR_150
TAPRTweety151	712443.125	4254142.000	TAPR_151
TAPRTweety152	715327.625	4254142.000	TAPR_152
TAPRTweety153	716769.813	4254142.000	TAPR_153
TAPRTweety154	710446.250	4254031.000	TAPR_154
TAPRTweety155	711888.438	4254031.000	TAPR_155
TAPRTweety156	716215.125	4254031.000	TAPR_156
TAPRTweety157	717657.313	4254031.000	TAPR_157
TAPRTweety158	712776.000	4253920.000	TAPR_158
TAPRTweety159	710124.563	4263197.500	TAPR_159
TAPRTweety160	710595.688	4263155.500	TAPR_160
TAPRTweety161	711047.063	4263231.000	TAPR_161
TAPRTweety162	711485.500	4263098.000	TAPR_162
TAPRTweety163	711937.875	4263106.500	TAPR_163
TAPRTweety164	713868.747	4253532.017	TAPR_164
TAPRTweety165	713917.305	4253809.841	TAPR_165
TAPRTweety166	713812.750	4254043.000	TAPR_166
TAPRTweety167	714030.250	4254271.500	TAPR_167
TAPRTweety168	713809.000	4254492.500	TAPR_168

Table B10 (continued). Waypoints for Tallgrass Prairie National Preserve, Kansas—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
TAPRTweety169	713985.612	4254725.183	TAPR_169
TAPRTweety170	714108.110	4255143.297	TAPR_170
TAPRTweety171	714000.500	4255541.500	TAPR_171
TAPRTweety172	713937.750	4256031.000	TAPR_172
TAPRTweety173	713834.688	4256265.000	TAPR_173
TAPRTweety174	713867.938	4256715.000	TAPR_174
TAPRTweety175	713817.500	4257008.000	TAPR_175
TAPRTweety176	709815.813	4263404.000	TAPR_176
TAPRTweety177	711111.875	4263683.000	TAPR_177
TAPRTweety178	710557.188	4263572.000	TAPR_178
TAPRTweety179	711999.375	4263572.000	TAPR_179
TAPRTweety180	710002.500	4263461.000	TAPR_180
TAPRTweety181	710890.000	4263350.000	TAPR_181
TAPRTweety182	711777.500	4263239.000	TAPR_182
TAPRTweety183	710668.125	4263017.000	TAPR_183
TAPRTweety184	709669.625	4262240.500	TAPR_184
TAPRTweety185	712110.313	4261575.000	TAPR_185
TAPRTweety186	710113.438	4261464.000	TAPR_186
TAPRTweety187	711000.938	4261353.000	TAPR_187
TAPRTweety188	710446.250	4261242.000	TAPR_188
TAPRTweety189	711888.438	4261242.000	TAPR_189
TAPRTweety190	711333.750	4261131.000	TAPR_190
TAPRTweety191	712221.250	4261020.000	TAPR_191
TAPRTweety192	709669.625	4260798.500	TAPR_192
TAPRTweety193	709780.563	4260243.500	TAPR_193
TAPRTweety194	712110.313	4260132.500	TAPR_194
TAPRTweety195	712443.125	4259911.000	TAPR_195
TAPRTweety196	709780.563	4258801.500	TAPR_196
TAPRTweety197	710113.438	4258579.500	TAPR_197
TAPRTweety198	711555.625	4258579.500	TAPR_198
TAPRTweety199	712997.875	4258579.500	TAPR_199
TAPRTweety200	711000.938	4258468.500	TAPR_200
TAPRTweety201	712443.125	4258468.500	TAPR_201
TAPRTweety202	710446.250	4258357.500	TAPR_202
TAPRTweety203	711888.438	4258357.500	TAPR_203
TAPRTweety204	709891.563	4258246.500	TAPR_204
TAPRTweety205	712221.250	4258136.000	TAPR_205
TAPRTweety206	713108.813	4258025.000	TAPR_206
TAPRTweety207	712554.063	4257914.000	TAPR_207
TAPRTweety208	712332.188	4257581.000	TAPR_208
TAPRTweety209	709780.563	4257359.000	TAPR_209
TAPRTweety210	712665.063	4257359.000	TAPR_210

Table B10 (continued). Waypoints for Tallgrass Prairie National Preserve, Kansas—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
TAPRTweety211	712997.875	4257137.500	TAPR_211
TAPRTweety212	714440.063	4257137.500	TAPR_212
TAPRTweety213	711000.938	4257026.500	TAPR_213
TAPRTweety214	712443.125	4257026.500	TAPR_214
TAPRTweety215	710446.250	4256915.500	TAPR_215
TAPRTweety216	711888.438	4256915.500	TAPR_216
TAPRTweety217	713330.688	4256915.500	TAPR_217
TAPRTweety218	709891.563	4256804.500	TAPR_218
TAPRTweety219	711333.750	4256804.500	TAPR_219
TAPRTweety220	712776.000	4256804.500	TAPR_220
TAPRTweety221	710779.063	4256693.500	TAPR_221
TAPRTweety222	712221.250	4256693.500	TAPR_222
TAPRTweety223 ^a	Not Sampled ^a	Not Sampled ^a	TAPR_223
TAPRTweety224	712554.063	4256471.500	TAPR_224
TAPRTweety225	713441.625	4256360.500	TAPR_225
TAPRTweety226	712886.938	4256250.000	TAPR_226
TAPRTweety227	714661.938	4256028.000	TAPR_227
TAPRTweety228	709780.563	4255917.000	TAPR_228
TAPRTweety229	712665.063	4255917.000	TAPR_229
TAPRTweety230	714107.250	4255917.000	TAPR_230
TAPRTweety231	712997.875	4255695.000	TAPR_231
TAPRTweety232	713885.375	4255584.000	TAPR_232
TAPRTweety233	714772.875	4255473.000	TAPR_233
TAPRTweety234	709891.563	4255362.500	TAPR_234
TAPRTweety235	711333.750	4255362.500	TAPR_235
TAPRTweety236	712776.000	4255362.500	TAPR_236
TAPRTweety237	714218.188	4255362.500	TAPR_237
TAPRTweety238	717102.625	4255362.500	TAPR_238
TAPRTweety239	710779.063	4255251.500	TAPR_239
TAPRTweety240	712221.250	4255251.500	TAPR_240
TAPRTweety241	715105.688	4255251.500	TAPR_241
TAPRTweety242	716547.938	4255251.500	TAPR_242
TAPRTweety243	717990.125	4255251.500	TAPR_243
TAPRTweety244	710224.375	4255140.500	TAPR_244
TAPRTweety245	711666.563	4255140.500	TAPR_245
TAPRTweety246	713108.813	4255140.500	TAPR_246
TAPRTweety247	713441.625	4254918.500	TAPR_247
TAPRTweety248	714883.813	4254918.500	TAPR_248
TAPRTweety249	714661.938	4254585.500	TAPR_249
TAPRTweety250	713552.563	4254364.000	TAPR_250
TAPRTweety251	714994.750	4254364.000	TAPR_251

^a Denotes plot that was dropped from sampling in 2014 after the Visitor Center was constructed on its location.

Table B10 (continued). Waypoints for Tallgrass Prairie National Preserve, Kansas—UTM Zone 14 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
TAPRTweety252	714772.875	4254031.000	TAPR_252
TAPRTweety253	711333.750	4253920.000	TAPR_253
TAPRTweety254	714218.188	4253920.000	TAPR_254
TAPRTweety255	715660.438	4253920.000	TAPR_255
TAPRTweety256	717102.625	4253920.000	TAPR_256
TAPRTweety257	710779.063	4253809.000	TAPR_257
TAPRTweety258	712221.250	4253809.000	TAPR_258
TAPRTweety259	715105.688	4253809.000	TAPR_259
TAPRTweety260	714551.000	4253698.000	TAPR_260

Table B11. Waypoints for Wilson's Creek National Battlefield, Missouri—UTM Zone 15 North, Datum 1983 (Conus).

Plot I.D.	X Coordinate (Easting)	Y Coordinate (Northing)	Inventory I.D. Number
WICRTweety1	462677.994	4108243.010	WICR_1
WICRTweety2	462960.837	4107960.167	WICR_2
WICRTweety3	463526.522	4107960.167	WICR_3
WICRTweety4	464092.207	4107960.167	WICR_4
WICRTweety5	462677.994	4107677.325	WICR_5
WICRTweety6	463243.679	4107677.325	WICR_6
WICRTweety7	463809.365	4107677.325	WICR_7
WICRTweety8	464375.050	4107677.325	WICR_8
WICRTweety9	462960.837	4107394.482	WICR_9
WICRTweety10	463526.522	4107394.482	WICR_10
WICRTweety11	464092.207	4107394.482	WICR_11
WICRTweety12	463243.679	4107111.639	WICR_12
WICRTweety13 ^a	Not Sampled ^a	Not Sampled ^a	WICR_13
WICRTweety14	464375.050	4107111.639	WICR_14
WICRTweety15	463526.522	4106828.796	WICR_15
WICRTweety16	464092.207	4106828.796	WICR_16
WICRTweety17	463243.679	4106545.954	WICR_17
WICRTweety18	463809.365	4106545.954	WICR_18
WICRTweety19	464375.050	4106545.954	WICR_19
WICRTweety20	463526.522	4106263.111	WICR_20
WICRTweety21	464092.207	4106263.111	WICR_21
WICRTweety22	463243.679	4105980.268	WICR_22
WICRTweety23	463809.365	4105980.268	WICR_23
WICRTweety24	464375.050	4105980.268	WICR_24
WICRTweety25	463526.522	4105697.426	WICR_25
WICRTweety26	464092.207	4105697.426	WICR_26
WICRTweety27	463243.679	4105414.583	WICR_27
WICRTweety28	463809.365	4105414.583	WICR_28
WICRTweety29	464375.050	4105414.583	WICR_29
WICRTweety30	463526.522	4105131.740	WICR_30
WICRTweety31	463243.679	4104848.897	WICR_31
WICRTweety32	463809.365	4104848.897	WICR_32
WICRTweety33	464375.050	4104848.897	WICR_33
WICRTweety34	463526.522	4104566.055	WICR_34
WICRTweety35	464092.207	4104566.055	WICR_35
WICRTweety36	463243.679	4104283.212	WICR_36
WICRTweety37	464375.050	4104283.212	WICR_37
WICRTweety38	462395.151	4104000.369	WICR_38

^a Denotes plot that was dropped from sampling consideration in 2008 because it is in Wilson's Creek.

Appendix C. Lists of Potential Bird Species

Tables C1–C11 contain lists of potential birds species for each park in the Heartland Inventory and Monitoring Network.

Table C1. List of Possible Resident Bird Species for Arkansas Post National Memorial, Arkansas.

Common Name	AOU Code
Acadian Flycatcher ^a	ACFL
American Coot ^a	AMCO
American Crow ^a	AMCR
American Goldfinch	AMGO
American Kestrel ^a	AMKE
American Redstart ^a	AMRE
American Robin	AMRO
American Woodcock	AMWO
Anhinga ^a	ANHI
Bachman's Sparrow ^a	BACS
Bald Eagle ^a	BAEA
Baltimore Oriole ^a	BAOR
Barn Owl ^b	BNOW
Barn Swallow ^a	BARS
Barred Owl ^a	BDOW
Bell's Vireo	BEVI
Belted Kingfisher	BEKI
Bewick's Wren	BEWR
Black-and-White Warbler ^a	BAWW
Black-crowned Night Heron ^a	BCNH
Black Vulture ^a	BLVU
Blue-gray Gnatcatcher ^a	BGGN
Blue Grosbeak ^a	BLGR
Blue Jay ^a	BLJA
Broad-winged Hawk	BWHA
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Carolina Chickadee ^a	CACH
Carolina Wren ^a	CARW
Cattle Egret	CAEG
Cerulean Warbler	CERW
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C1 (continued). List of Possible Resident Bird Species for Arkansas Post National Memorial, Arkansas.

Common Name	AOU Code
Chuck-will's-widow	CWWI
Common Grackle ^a	COGR
Common Moorhen ^a	COMO
Common Nighthawk	CONI
Common Yellowthroat ^a	COYE
Dickcissel ^a	DICK
Downy Woodpecker ^a	DOWO
Eastern Bluebird ^a	EABL
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Wood-peewee ^a	EAWP
European Starling ^a	EUST
Field Sparrow	FISP
Fish Crow ^a	FICR
Grasshopper Sparrow ^b	GRSP
Gray Catbird ^a	GRCA
Great Blue Heron ^a	GBHE
Great Crested Flycatcher ^a	GCFL
Great Egret ^a	GREG
Great Horned Owl	GHOW
Green Heron ^a	GRHE
Hairy Woodpecker ^a	HAWO
Hooded Merganser	HOME
Hooded Warbler	HOWA
Horned Lark ^b	HOLA
House Sparrow ^a	HOSP
House Wren ^a	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler ^a	KEWA
Killdeer ^a	KILL
King Rail	KIRA
Least Bittern	LEBI
Least Tern ^a	LETE
Little Blue Heron ^a	LBHE
Loggerhead Shrike ^a	LOSH

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C1 (continued). List of Possible Resident Bird Species for Arkansas Post National Memorial, Arkansas.

Common Name	AOU Code
Mallard ^a	MALL
Mississippi Kite ^a	MIKI
Mourning Dove ^a	MODO
Northern Bobwhite ^a	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker	YSFL
Northern Mockingbird ^a	NOMO
Northern Parula ^a	NOPA
Northern Rough-winged Swallow	NRWS
Orchard Oriole ^a	OROR
Painted Bunting	PABU
Pied-billed Grebe ^a	PBGR
Pileated Woodpecker ^a	PIWO
Pine Warbler ^a	PIWA
Prairie Warbler	PRAW
Prothonotary Warbler ^a	PROW
Purple Gallinule ^a	PUGA
Purple Martin ^b	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker ^a	RHWO
Red-shouldered Hawk ^a	RSHA
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Rock Dove ^b	RODO
Ruby-throated Hummingbird ^a	RTHU
Scissor-tailed Flycatcher	STFL
Summer Tanager ^a	SUTA
Swainson's Warbler	SWWA
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Warbling Vireo	WAVI
White-breasted Nuthatch ^a	WBNU
White-eyed Vireo ^a	WEVI
Wild Turkey ^a	WITU
Wood Duck ^a	WODU
Wood Thrush ^a	WOTH
Worm-eating Warbler	WEWA
Yellow-billed Cuckoo ^a	YBCU
Yellow-breasted Chat ^a	YBCH

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C1 (continued). List of Possible Resident Bird Species for Arkansas Post National Memorial, Arkansas.

Common Name	AOU Code
Yellow-crowned Night Heron	YCNH
Yellow-throated Vireo ^a	YTVI
Yellow-throated Warbler ^a	YTWA
^a Denotes species observed as residents in the park as of 2019.	
^b Habitat on the park is not likely to support these species (also in bold).	

Table C2. List of Possible Resident Bird Species for Effigy Mounds National Monument, Iowa.

Common Name	AOU Code
Acadian Flycatcher ^a	ACFL
American Coot	AMCO
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
American Kestrel	AMKE
American Redstart ^a	AMRE
American Robin ^a	AMRO
American Wigeon	AMWI
American Woodcock	AMWO
Bald Eagle ^a	BAEA
Baltimore Oriole ^a	BAOR
Bank Swallow	BANS
Barn Swallow ^a	BARS
Barred Owl	BDOW
Bell's Vireo	BEVI
Belted Kingfisher ^a	BEKI
Black-billed Cuckoo ^a	BBCU
Black-capped Chickadee ^a	BCCH
Blue-gray Gnatcatcher ^a	BGGN
Blue Jay ^a	BLJA
Blue-winged Teal	BWTE
Blue-winged Warbler ^a	BWWA
Bobolink	BOBO
Broad-winged Hawk	BWHA
Brown Creeper ^a	BRCR
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Carolina Wren ^a	CARW
Cedar Waxwing ^a	CEDW

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C2 (continued). List of Possible Resident Bird Species for Effigy Mounds National Monument, Iowa.

Common Name	AOU Code
Cerulean Warbler ^a	CERW
Chestnut-sided Warbler	CSWA
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP
Cliff Swallow ^a	CLSW
Common Grackle ^a	COGR
Common Moorhen	COMO
Common Nighthawk	CONI
Common Yellowthroat ^a	COYE
Cooper's Hawk	COHA
Dickcissel	DICK
Double-crested Cormorant	DCCO
Downy Woodpecker ^a	DOWO
Eastern Bluebird ^a	EABL
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Whip-poor-will	EWPW
Eastern Wood-peewee ^a	EAWP
European Starling ^a	EUST
Field Sparrow ^a	FISP
Grasshopper Sparrow ^a	GRSP
Gray Catbird ^a	GRCA
Great Blue Heron ^a	GBHE
Great Crested Flycatcher ^a	GCFL
Great Egret	GREG
Great Horned Owl	GHOW
Green Heron	GRHE
Green-winged Teal	GWTE
Hairy Woodpecker ^a	HAWO
Hooded Merganser ^a	HOME
Hooded Warbler	HOWA
Horned Lark	HOLA
House Sparrow	HOSP
House Wren ^a	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler ^a	KEWA
Killdeer	KILL

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C2 (continued). List of Possible Resident Bird Species for Effigy Mounds National Monument, Iowa.

Common Name	AOU Code
King Rail	KIRA
Lark Sparrow	LASP
Least Flycatcher ^a	LEFL
Long-eared Owl	LEOW
Louisiana Waterthrush	LOWA
Mallard ^a	MALL
Marsh Wren	MAWR
Mourning Dove ^a	MODO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL
Northern Parula ^a	NOPA
Northern Rough-winged Swallow ^a	NRWS
Orchard Oriole	OROR
Ovenbird ^a	OVEN
Pied-billed Grebe	PBGR
Pileated Woodpecker ^a	PIWO
Prothonotary Warbler ^a	PROW
Purple Martin	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker ^a	RHWO
Red-shouldered Hawk ^a	RSHA
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Ring-necked Pheasant	RPHE
Rock Dove ^b	RODO
Rose-breasted Grosbeak ^a	RBGR
Ruby-throated Hummingbird ^a	RTHU
Ruffed Grouse	RUGR
Savannah Sparrow	SAVS
Scarlet Tanager ^a	SCTA
Sedge Wren	SEWR
Song Sparrow ^a	SOSP
Sora	SORA
Spotted Sandpiper	SPSA
Swamp Sparrow	SWSP
Tree Swallow ^a	TRES
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Upland Sandpiper ^b	UPSA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C2 (continued). List of Possible Resident Bird Species for Effigy Mounds National Monument, Iowa.

Common Name	AOU Code
Veery ^a	VEER
Vesper Sparrow	VESP
Virginia Rail	VIRA
Warbling Vireo ^a	WAVI
Western Meadowlark ^b	WEME
White-breasted Nuthatch ^a	WBNU
White-eyed Vireo	WEVI
Wild Turkey ^a	WITU
Willow Flycatcher ^a	WIFL
Wood Duck ^a	WODU
Wood Thrush ^a	WOTH
Yellow-bellied Sapsucker ^a	YBSA
Yellow-billed Cuckoo ^a	YBCU
Yellow-breasted Chat	YBCH
Yellow-headed Blackbird	YHBL
Yellow-throated Vireo ^a	YTVI
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C3. List of Possible Resident Bird Species for George Washington Carver National Monument, Missouri.

Common Name	AOU Code
Acadian Flycatcher ^a	ACFL
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
American Kestrel ^a	AMKE
American Redstart	AMRE
American Robin ^a	AMRO
American Woodcock ^a	AMWO
Bachman's Sparrow	BACS
Bald Eagle	BAEA
Baltimore Oriole ^a	BAOR
Bank Swallow ^a	BANS
Barn Owl ^b	BNOW
Barn Swallow ^a	BARS
Barred Owl ^a	BDOW
Bell's Vireo ^a	BEVI
Belted Kingfisher ^a	BEKI

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C3 (continued). List of Possible Resident Bird Species for George Washington Carver National Monument, Missouri.

Common Name	AOU Code
Bewick's Wren	BEWR
Black-and-White Warbler	BAWW
Black-billed Cuckoo	BBCU
Black Vulture	BLVU
Blue-gray Gnatcatcher ^a	BGGN
Blue Grosbeak ^a	BLGR
Blue Jay ^a	BLJA
Blue-winged Warbler ^b	BWWA
Broad-winged Hawk	BWHA
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Carolina Chickadee ^a	CACH
Carolina Wren ^a	CARW
Cedar Waxwing ^a	CEDW
Cerulean Warbler ^a	CERW
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP
Chuck-will's-widow	CWWI
Cliff Swallow ^a	CLSW
Common Grackle ^a	COGR
Common Nighthawk ^a	CONI
Common Yellowthroat ^a	COYE
Cooper's Hawk ^a	COHA
Dickcissel ^a	DICK
Downy Woodpecker ^a	DOWO
Eastern Bluebird ^a	EABL
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME
Eastern Phoebe ^a	EAPH
Eastern Screech-Owl	EASO
Eastern Towhee ^a	EATO
Eastern Whip-poor-will	EWPW
Eastern Wood-Pewee ^a	EAWP
European Starling ^a	EUST
Field Sparrow ^a	FISP
Grasshopper Sparrow ^a	GRSP
Gray Catbird ^a	GRCA
Great Blue Heron ^a	GBHE

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C3 (continued). List of Possible Resident Bird Species for George Washington Carver National Monument, Missouri.

Common Name	AOU Code
Great Crested Flycatcher ^a	GCFL
Great Horned Owl	GHOW
Greater Roadrunner ^b	GRRO
Green Heron ^a	GRHE
Hairy Woodpecker ^a	HAWO
Henslow's Sparrow ^a	HESP
Hooded Warbler	HOWA
Horned Lark	HOLA
House Finch ^a	HOFI
House Sparrow ^a	HOSP
House Wren ^a	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler	KEWA
Killdeer ^a	KILL
King Rail	KIRA
Lark Sparrow ^a	LASP
Loggerhead Shrike ^a	LOSH
Long-eared Owl	LEOW
Louisiana Waterthrush ^a	LOWA
Mallard	MALL
Mourning Dove ^a	MODO
Northern Bobwhite ^a	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL
Northern Harrier ^a	NOHA
Northern Mockingbird ^a	NOMO
Northern Parula ^a	NOPA
Northern Rough-winged Swallow	NRWS
Orchard Oriole ^a	OROR
Ovenbird ^b	OVEN
Painted Bunting ^b	PABU
Pied-billed Grebe	PBGR
Pileated Woodpecker ^a	PIWO
Prairie Warbler	PRAW
Prothonotary Warbler	PROW
Purple Martin ^a	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker ^a	RHWO

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C3 (continued). List of Possible Resident Bird Species for George Washington Carver National Monument, Missouri.

Common Name	AOU Code
Red-shouldered Hawk ^a	RSHA
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Rock Dove ^a	RODO
Ruby-throated Hummingbird ^a	RTHU
Scarlet Tanager	SCTA
Scissor-tailed Flycatcher ^a	STFL
Sharp-shinned Hawk	SSHA
Spotted Sandpiper	SPSA
Summer Tanager ^a	SUTA
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Warbling Vireo ^a	WAVI
White-breasted Nuthatch ^a	WBNU
White-eyed Vireo ^a	WEVI
Wild Turkey ^a	WITU
Willow Flycatcher ^b	WIFL
Worm-eating Warbler	WEWA
Yellow-billed Cuckoo ^a	YBCU
Yellow-breasted Chat ^a	YBCH
Yellow-throated Vireo ^a	YTVI
Yellow-throated Warbler ^a	YTWA
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C4. List of Possible Resident Bird Species for Herbert Hoover National Historic Site, Iowa.

Common Name	AOU Code
Acadian Flycatcher	ACFL
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
American Kestrel	AMKE
American Redstart ^a	AMRE
American Robin ^a	AMRO
American Woodcock	AMWO
Baltimore Oriole ^a	BAOR
Bank Swallow ^a	BANS

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C4 (continued). List of Possible Resident Bird Species for Herbert Hoover National Historic Site, Iowa.

Common Name	AOU Code
Barn Swallow ^a	BARS
Barred Owl ^a	BDOW
Bell's Vireo	BEVI
Belted Kingfisher	BEKI
Black-billed Cuckoo	BBCU
Black-capped Chickadee ^a	BCCH
Black-crowned Night Heron ^b	BCNH
Blue-gray Gnatcatcher ^a	BGNN
Blue Jay ^a	BLJA
Blue-winged Warbler ^a	BWWA
Bobolink	BOBO
Broad-winged Hawk	BWHA
Brown Creeper	BRCR
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Carolina Wren	CARW
Cedar Waxwing ^a	CEDW
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP
Cliff Swallow ^a	CLSW
Common Grackle ^a	COGR
Common Nighthawk ^a	CONI
Common Yellowthroat ^a	COYE
Cooper's Hawk	COHA
Dickcissel ^a	DICK
Downy Woodpecker ^a	DOWO
Eastern Bluebird ^a	EABL
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Wood-Pewee ^a	EAWP
European Starling ^a	EUST
Field Sparrow ^a	FISP
Grasshopper Sparrow ^a	GRSP
Gray Catbird ^a	GRCA
Gray Partridge	GRPA
Great Blue Heron ^a	GBHE

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C4 (continued). List of Possible Resident Bird Species for Herbert Hoover National Historic Site, Iowa.

Common Name	AOU Code
Great Crested Flycatcher ^a	GCFL
Great Egret	GREG
Great Horned Owl ^a	GHOW
Green Heron	GRHE
Hairy Woodpecker	HAWO
Henslow's Sparrow ^a	HESP
Horned Lark ^b	HOLA
House Finch ^a	HOFI
House Sparrow ^a	HOSP
House Wren ^a	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler	KEWA
Killdeer ^a	KILL
Lark Sparrow ^b	LASP
Loggerhead Shrike	LOSH
Mallard ^a	MALL
Mourning Dove ^a	MODO
Northern Bobwhite	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL
Northern Mockingbird ^a	NOMO
Northern Rough-winged Swallow	NRWS
Orchard Oriole	OROR
Ovenbird ^b	OVEN
Pileated Woodpecker	PIWO
Pine Siskin	PISI
Prothonotary Warbler	PROW
Purple Martin ^a	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo	REVI
Red-headed Woodpecker ^a	RHWO
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Ring-necked Pheasant ^a	RPHE
Rock Dove ^a	RODO
Rose-breasted Grosbeak ^a	RBGR
Ruby-throated Hummingbird ^a	RTHU
Savannah Sparrow	SAVS
Scarlet Tanager	SCTA
Sedge Wren ^a	SEWR

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C4 (continued). List of Possible Resident Bird Species for Herbert Hoover National Historic Site, Iowa.

Common Name	AOU Code
Song Sparrow ^a	SOSP
Spotted Sandpiper	SPSA
Summer Tanager	SUTA
Swamp Sparrow ^a	SWSP
Tree Swallow ^a	TRES
Tufted Titmouse	TUTI
Turkey Vulture ^a	TUVU
Veery ^b	VEER
Vesper Sparrow	VESP
Warbling Vireo ^a	WAVI
Western Meadowlark ^b	WEME
White-breasted Nuthatch	WBNU
Wild Turkey ^a	WITU
Willow Flycatcher ^a	WIFL
Wood Duck	WODU
Wood Thrush ^b	WOTH
Yellow-billed Cuckoo	YBCU
Yellow-throated Vireo ^a	YTVI
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C5. List of Possible Resident Bird Species for Homestead National Historical Park, Nebraska.

Common Name	AOU Code
Acadian Flycatcher	ACFL
American Coot ^b	AMCO
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
(American) Green-winged Teal ^b	GWTE
American Kestrel	AMKE
American Redstart ^a	AMRE
American Robin ^a	AMRO
American Woodcock ^a	AMWO
Bald Eagle ^b	BAEA
Baltimore Oriole ^a	BAOR
Bank Swallow ^a	BANS
Barn Swallow ^a	BARS
Barred Owl ^a	BDOW

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C5 (continued). List of Possible Resident Bird Species for Homestead National Historical Park, Nebraska.

Common Name	AOU Code
Bell's Vireo ^a	BEVI
Belted Kingfisher ^a	BEKI
Black-billed Cuckoo	BBCU
Black-capped Chickadee ^a	BCCH
Blue-gray Gnatcatcher ^a	BGGN
Blue Grosbeak	BLGR
Blue Jay ^a	BLJA
Blue-winged Teal ^b	BWTE
Broad-winged Hawk	BWHA
Brown Creeper ^a	BRCR
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Carolina Wren ^a	CARW
Cedar Waxwing ^a	CEDW
Cerulean Warbler	CERW
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP
Chuck-will's-widow	CWWI
Cliff Swallow ^a	CLSW
Common Grackle ^a	COGR
Common Moorhen ^b	COMO
Common Nighthawk	CONI
Common Snipe	COSN
Common Yellowthroat ^a	COYE
Cooper's Hawk ^a	COHA
Dickcissel ^a	DICK
Downy Woodpecker ^a	DOWO
Eastern Bluebird ^a	EABL
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Whip-poor-will	EWPW
Eastern Wood-Pewee ^a	EAWP
European Starling ^a	EUST
Field Sparrow ^a	FISP
Grasshopper Sparrow ^a	GRSP
Gray Catbird ^a	GRCA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C5 (continued). List of Possible Resident Bird Species for Homestead National Historical Park, Nebraska.

Common Name	AOU Code
Great Blue Heron ^a	GBHE
Great Crested Flycatcher ^a	GCFL
Great Horned Owl	GHOW
Great-tailed Grackle	GTGR
Green Heron	GRHE
Hairy Woodpecker ^a	HAWO
Horned Lark	HOLA
House Finch	HOFI
House Sparrow ^a	HOSP
House Wren ^a	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler	KEWA
Killdeer ^a	KILL
King Rail ^b	KIRA
Lark Sparrow ^a	LASP
Least Bittern ^b	LEBI
Loggerhead Shrike	LOSH
Long-eared Owl	LEOW
Louisiana Waterthrush	LOWA
Mallard	MALL
Mourning Dove ^a	MODO
Northern Bobwhite ^a	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL
Northern Harrier	NOHA
Northern Mockingbird	NOMO
Northern Parula	NOPA
Northern Pintail ^b	NOPI
Northern Rough-winged Swallow ^a	NRWS
Northern Shoveler ^a	NSHO
Orchard Oriole ^a	OROR
Ovenbird	OVEN
Pied-billed Grebe ^b	PBGR
Prothonotary Warbler	PROW
Purple Martin	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker ^a	RHWO
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C5 (continued). List of Possible Resident Bird Species for Homestead National Historical Park, Nebraska.

Common Name	AOU Code
Ring-necked Pheasant ^a	RPHE
Rock Dove	RODO
Rose-breasted Grosbeak ^a	RBGR
Ruby-throated Hummingbird ^a	RTHU
Scarlet Tanager	SCTA
Scissor-tailed Flycatcher	STFL
Sedge Wren	SEWR
Sharp-shinned Hawk	SSHA
Short-eared Owl	SEOW
Song Sparrow ^a	SOSP
Sora	SORA
Spotted Sandpiper	SPSA
Spotted Towhee ^a	SPTO
Summer Tanager ^a	SUTA
Swainson's Hawk	SWHA
Tree Swallow	TRES
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Upland Sandpiper	UPSA
Vesper Sparrow	VESP
Virginia Rail	VIRA
Warbling Vireo ^a	WAVI
Western Kingbird	WEKI
Western Meadowlark ^b	WEME
White-breasted Nuthatch ^a	WBNU
Wild Turkey ^a	WITU
Willow Flycatcher	WIFL
Wilson's Phalarope	WIPH
Wood Duck ^a	WODU
Wood Thrush	WOTH
Yellow-billed Cuckoo ^a	YBCU
Yellow-crowned Night Heron ^b	YCNH
Yellow-headed Blackbird ^b	YHBL
Yellow-throated Vireo ^a	YTVI
Yellow-throated Warbler	YTWA
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C6. List of Possible Resident Bird Species for Hopewell Culture National Historical Park, Ohio.

Common Name	AOU Code
Acadian Flycatcher ^a	ACFL
American Coot	AMCO
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
American Kestrel	AMKE
American Redstart ^a	AMRE
American Robin ^a	AMRO
American Woodcock ^a	AMWO
Bald Eagle ^a	BAEA
Baltimore Oriole ^a	BAOR
Bank Swallow ^a	BANS
Barn Owl ^b	BNOW
Barn Swallow ^a	BARS
Barred Owl	BDOW
Belted Kingfisher ^a	BEKI
Bewick's Wren ^a	BEWR
Black-and-White Warbler	BAWW
Black-billed Cuckoo	BBCU
Black-throated Green Warbler	BTNW
Black Vulture	BLVU
Blue-gray Gnatcatcher ^a	BGGN
Blue Grosbeak ^a	BLGR
Blue Jay ^a	BLJA
Blue-headed Vireo	BHVI
Blue-winged Warbler ^a	BWWA
Broad-winged Hawk	BWHA
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Carolina Chickadee ^a	CACH
Carolina Wren ^a	CARW
Cedar Waxwing ^a	CEDW
Cerulean Warbler	CERW
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP
Chuck-will's-widow	CWWI
Cliff Swallow ^a	CLSW
Common Grackle ^a	COGR
Common Moorhen	COMO
Common Yellowthroat ^a	COYE

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C6 (continued). List of Possible Resident Bird Species for Hopewell Culture National Historical Park, Ohio.

Common Name	AOU Code
Cooper's Hawk ^a	COHA
Dickcissel ^a	DICK
Downy Woodpecker ^a	DOWO
Eastern Bluebird ^a	EABL
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Whip-poor-will	EWPW
Eastern Wood-Pewee ^a	EAWP
European Starling ^a	EUST
Field Sparrow ^a	FISP
Grasshopper Sparrow ^a	GRSP
Gray Catbird ^a	GRCA
Great Blue Heron ^a	GBHE
Great Crested Flycatcher ^a	GCFL
Great Horned Owl	GHOW
Green Heron ^a	GRHE
Hairy Woodpecker	HAWO
Henslow's Sparrow ^a	HESP
Hooded Warbler	HOWA
Horned Lark ^a	HOLA
House Finch ^a	HOFI
House Sparrow ^a	HOSP
House Wren ^a	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler	KEWA
Killdeer ^a	KILL
Louisiana Waterthrush	LOWA
Mallard ^a	MALL
Mourning Dove ^a	MODO
Northern Bobwhite ^a	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL
Northern Mockingbird ^a	NOMO
Northern Parula ^a	NOPA
Northern Rough-winged Swallow ^a	NRWS
Orchard Oriole ^a	OROR
Ovenbird	OVEN

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C6 (continued). List of Possible Resident Bird Species for Hopewell Culture National Historical Park, Ohio.

Common Name	AOU Code
Pileated Woodpecker ^a	PIWO
Pine Warbler	PIWA
Prairie Warbler ^a	PRAW
Prothonotary Warbler ^a	PROW
Purple Martin ^a	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker	RHWO
Red-shouldered Hawk	RSHA
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Ring-necked Pheasant ^a	RPHE
Rock Dove ^a	RODO
Ruby-throated Hummingbird ^a	RTHU
Ruffed Grouse ^b	RUGR
Savannah Sparrow ^a	SAVS
Scarlet Tanager ^a	SCTA
Sharp-shinned Hawk	SSHA
Song Sparrow ^a	SOSP
Spotted Sandpiper	SPSA
Summer Tanager ^a	SUTA
Tree Swallow ^a	TRES
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Vesper Sparrow ^a	VESP
Warbling Vireo ^a	WAVI
White-breasted Nuthatch ^a	WBNU
White-eyed Vireo ^a	WEVI
Wild Turkey ^a	WITU
Willow Flycatcher ^a	WIFL
Wood Duck ^a	WODU
Wood Thrush ^a	WOTH
Worm-eating Warbler	WEWA
Yellow-billed Cuckoo ^a	YBCU
Yellow-breasted Chat ^a	YBCH
Yellow-crowned Night Heron	YCNH
Yellow-throated Vireo ^a	YTVI
Yellow-throated Warbler ^a	YTWA
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C7. List of Possible Resident Bird Species for Lincoln Boyhood National Memorial, Indiana.

Common Name	AOU Code
Acadian Flycatcher ^a	ACFL
American Coot ^b	AMCO
American Crow ^a	AMCR
American Goldfinch	AMGO
American Kestrel	AMKE
American Redstart	AMRE
American Robin ^a	AMRO
American Woodcock ^a	AMWO
Bachman's Sparrow	BACS
Baltimore Oriole ^a	BAOR
Bank Swallow	BANS
Barn Owl ^b	BNOW
Barn Swallow	BARS
Barred Owl	BDOW
Bell's Vireo	BEVI
Belted Kingfisher ^b	BEKI
Black-and-White Warbler	BAWW
Black-billed Cuckoo	BBCU
Black Vulture	BLVU
Blue-gray Gnatcatcher ^a	BGGN
Blue Grosbeak ^a	BLGR
Blue Jay ^a	BLJA
Blue-winged Teal	BWTE
Blue-winged Warbler	BWWA
Broad-winged Hawk	BWHA
Brown-headed Cowbird	BHCO
Brown Thrasher	BRTH
Canada Goose ^b	CAGO
Carolina Chickadee ^a	CACH
Carolina Wren ^a	CARW
Cedar Waxwing	CEDW
Cerulean Warbler	CERW
Chimney Swift ^a	CHSW
Chipping Sparrow	CHSP
Common Grackle ^a	COGR
Common Nighthawk	CONI
Common Yellowthroat	COYE
Cooper's Hawk	COHA
Dickcissel	DICK
Downy Woodpecker ^a	DOWO

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C7 (continued). List of Possible Resident Bird Species for Lincoln Boyhood National Memorial, Indiana.

Common Name	AOU Code
Eastern Bluebird ^a	EABL
Eastern Kingbird	EAKI
Eastern Meadowlark	EAME
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Whip-poor-will	EWPW
Eastern Wood-Pewee ^a	EAWP
European Starling	EUST
Field Sparrow	FISP
Grasshopper Sparrow ^b	GRSP
Gray Catbird ^a	GRCA
Great Blue Heron ^b	GBHE
Great Crested Flycatcher ^a	GCFL
Great Horned Owl	GHOW
Green Heron	GRHE
Hairy Woodpecker ^a	HAWO
Henslow's Sparrow	HESP
Hooded Merganser ^b	HOME
Hooded Warbler	HOWA
Horned Lark ^b	HOLA
House Sparrow ^a	HOSP
House Wren ^a	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler ^a	KEWA
Killdeer	KILL
King Rail	KIRA
Lark Sparrow ^b	LASP
Louisiana Waterthrush ^b	LOWA
Mallard ^b	MALL
Mourning Dove ^a	MODO
Northern Bobwhite ^a	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL
Northern Harrier ^b	NOHA
Northern Mockingbird ^a	NOMO
Northern Parula ^a	NOPA
Northern Rough-Winged Swallow	NRWS
Orchard Oriole	OROR
Ovenbird ^a	OVEN

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C7 (continued). List of Possible Resident Bird Species for Lincoln Boyhood National Memorial, Indiana.

Common Name	AOU Code
Pied-billed Grebe ^b	PBGR
Pileated Woodpecker ^a	PIWO
Prairie Warbler ^b	PRAW
Prothonotary Warbler ^a	PROW
Purple Martin	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker ^a	RHWO
Red-shouldered Hawk	RSHA
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^b	RWBL
Ring-billed Gull ^b	RBGU
Rock Dove	RODO
Ruby-throated Hummingbird	RTHU
Scarlet Tanager	SCTA
Sharp-shinned Hawk ^a	SSHA
Song Sparrow ^a	SOSP
Spotted Sandpiper ^b	SPSA
Summer Tanager ^a	SUTA
Tree Swallow	TRES
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Vesper Sparrow	VESP
Warbling Vireo	WAVI
White-breasted Nuthatch ^a	WBNU
White-eyed Vireo ^a	WEVI
Wild Turkey ^a	WITU
Willow Flycatcher	WIFL
Wood Duck	WODU
Wood Thrush ^a	WOTH
Worm-eating Warbler	WEWA
Yellow-billed Cuckoo ^a	YBCU
Yellow-breasted Chat	YBCH
Yellow-crowned Night Heron ^b	YCNH
Yellow-throated Vireo ^a	YTVI
Yellow-throated Warbler ^a	YTWA
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C8. List of Possible Resident Bird Species for Pea Ridge National Military Park, Arkansas.

Common Name	AOU Code
Acadian Flycatcher ^a	ACFL
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
American Kestrel ^a	AMKE
American Redstart ^a	AMRE
American Robin ^a	AMRO
American Woodcock ^a	AMWO
Baltimore Oriole ^a	BAOR
Barn Owl ^b	BNOW
Barn Swallow ^a	BARS
Barred Owl ^a	BDOW
Bell's Vireo	BEVI
Belted Kingfisher ^b	BEKI
Bewick's Wren ^a	BEWR
Black-and-white Warbler ^a	BAWW
Black-billed Cuckoo ^a	BBCU
Black Vulture ^a	BLVU
Blue-gray Gnatcatcher ^a	BGNN
Blue Grosbeak ^a	BLGR
Blue Jay ^a	BLJA
Blue-winged Warbler ^a	BWWA
Broad-winged Hawk ^a	BWHA
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Carolina Chickadee ^a	CACH
Carolina Wren ^a	CARW
Cattle Egret	CAEG
Cerulean Warbler	CERW
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP
Chuck-will's-widow	CWWI
Cliff Swallow ^a	CLSW
Common Grackle ^a	COGR
Common Nighthawk	CONI
Common Yellowthroat ^a	COYE
Dickcissel ^a	DICK
Downy Woodpecker ^a	DOWO
Eastern Bluebird ^a	EABL
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C8 (continued). List of Possible Resident Bird Species for Pea Ridge National Military Park, Arkansas.

Common Name	AOU Code
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Whip-poor-will ^a	EWPW
Eastern Wood-Pewee ^a	EAWP
European Starling ^a	EUST
Field Sparrow ^a	FISP
Fish Crow ^a	FICR
Grasshopper Sparrow ^a	GRSP
Gray Catbird ^a	GRCA
Great Blue Heron ^a	GBHE
Great Crested Flycatcher ^a	GCFL
Great Horned Owl ^a	GHOW
Great-tailed Grackle	GTGR
Greater Roadrunner ^b	GRRO
Green Heron ^b	GRHE
Hairy Woodpecker ^a	HAWO
Hooded Warbler	HOWA
Horned Lark ^a	HOLA
House Sparrow ^a	HOSP
House Wren	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler ^a	KEWA
Killdeer ^a	KILL
Lark Sparrow ^a	LASP
Little Blue Heron ^b	LBHE
Loggerhead Shrike	LOSH
Louisiana Waterthrush ^a	LOWA
Mallard ^b	MALL
Mourning Dove ^a	MODO
Northern Bobwhite ^a	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL
Northern Mockingbird ^a	NOMO
Northern Parula ^a	NOPA
Northern Rough-winged Swallow	NRWS
Orchard Oriole ^a	OROR
Ovenbird ^a	OVEN
Painted Bunting	PABU
Pileated Woodpecker ^a	PIWO

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C8 (continued). List of Possible Resident Bird Species for Pea Ridge National Military Park, Arkansas.

Common Name	AOU Code
Prairie Warbler ^a	PRAW
Purple Martin	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker ^a	RHWO
Red-shouldered Hawk ^a	RSHA
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Rock Dove ^b	RODO
Ruby-throated Hummingbird ^a	RTHU
Scarlet Tanager ^a	SCTA
Scissor-tailed Flycatcher ^a	STFL
Summer Tanager ^a	SUTA
Swainson's Warbler	SWWA
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Warbling Vireo ^a	WAVI
White-breasted Nuthatch ^a	WBNU
White-eyed Vireo ^a	WEVI
Wild Turkey ^a	WITU
Wood Duck ^b	WODU
Wood Thrush ^a	WOTH
Worm-eating Warbler ^a	WEWA
Yellow-billed Cuckoo ^a	YBCU
Yellow-breasted Chat ^a	YBCH
Yellow-crowned Night Heron ^b	YCNH
Yellow-throated Vireo ^a	YTVI
Yellow-throated Warbler ^a	YTWA
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C9. List of Possible Resident Bird Species for Pipestone National Monument, Minnesota.

Common Name	AOU Code
American Coot ^b	AMCO
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
American Kestrel	AMKE
American Redstart ^a	AMRE
American Robin ^a	AMRO
Baltimore Oriole	BAOR
Bank Swallow ^a	BANS
Barn Swallow ^a	BARS
Belted Kingfisher ^a	BEKI
Black-and-white Warbler ^a	BAWW
Black-billed Cuckoo	BBCU
Black-capped Chickadee ^a	BCCH
Black-crowned Night Heron ^b	BCNH
Blackpoll Warbler	BLPW
Black Tern ^a	BLTE
Blue-gray Gnatcatcher ^a	BGGN
Blue Grosbeak ^a	BLGR
Blue Jay ^a	BLJA
Blue-headed Vireo	BHVI
Blue-winged Teal ^a	BWTE
Bobolink ^a	BOBO
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Canvasback ^b	CANV
Cedar Waxwing ^a	CEDW
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP
Clay-colored Sparrow ^a	CCSP
Cliff Swallow	CLSW
Common Grackle ^a	COGR
Common Nighthawk ^a	CONI
Common Yellowthroat ^a	COYE
Cooper's Hawk ^a	COHA
Dickcissel ^a	DICK
Double-crested Cormorant ^a	DCCO
Downy Woodpecker ^a	DOWO
Eared Grebe ^b	EAGR
Eastern Bluebird	EABL

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C9 (continued). List of Possible Resident Bird Species for Pipestone National Monument, Minnesota.

Common Name	AOU Code
Eastern Kingbird ^a	EAKI
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Wood-Pewee	EAWP
European Starling ^a	EUST
Field Sparrow ^a	FISP
Forster's Tern ^b	FOTE
Gadwall	GADW
Grasshopper Sparrow ^a	GRSP
Gray Catbird ^a	GRCA
Gray Partridge	GRPA
Great Blue Heron ^a	GBHE
Great Crested Flycatcher ^a	GCFL
Great Horned Owl	GHOW
Green Heron ^a	GRHE
Hairy Woodpecker ^a	HAWO
Horned Lark ^a	HOLA
House Finch ^a	HOFI
House Sparrow ^a	HOSP
House Wren ^a	HOWR
Indigo Bunting	INBU
Killdeer ^a	KILL
Least Bittern ^a	LEBI
Least Flycatcher ^a	LEFL
Loggerhead Shrike	LOSH
Long-eared Owl	LEOW
Mallard ^a	MALL
Marsh Wren ^a	MAWR
Mourning Dove ^a	MODO
Nashville Warbler	NAWA
Northern Flicker ^a	YSFL
Northern Harrier ^a	NOHA
Northern Pintail	NOPI
Northern Rough-winged Swallow ^a	NRWS
Northern Shoveler ^a	NSHO
Orchard Oriole ^a	OROR
Pied-billed Grebe ^b	PBGR
Purple Martin	PUMA
Red-bellied Woodpecker	RBWO

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C9 (continued). List of Possible Resident Bird Species for Pipestone National Monument, Minnesota.

Common Name	AOU Code
Red-eyed Vireo	REVI
Redhead ^b	REDH
Red-headed Woodpecker	RHWO
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Ring-necked Pheasant ^a	RPHE
Rock Dove ^a	RODO
Rose-breasted Grosbeak	RBGR
Ruby-throated Hummingbird	RTHU
Ruddy Duck ^b	RUDU
Savannah Sparrow ^a	SAVS
Sedge Wren ^a	SEWR
Song Sparrow ^a	SOSP
Sora ^a	SORA
Spotted Sandpiper	SPSA
Swainson's Hawk ^a	SWHA
Swamp Sparrow	SWSP
Tennessee Warbler	TEWA
Tree Swallow ^a	TRES
Turkey Vulture ^a	TUVU
Upland Sandpiper ^a	UPSA
Vesper Sparrow ^a	VESP
Virginia Rail	VIRA
Warbling Vireo ^a	WAVI
Western Grebe ^b	WEGR
Western Kingbird ^a	WEKI
Western Meadowlark ^a	WEME
White-breasted Nuthatch	WBNU
White-crowned Sparrow	WCSP
Wild Turkey ^a	WITU
Willow Flycatcher ^a	WIFL
Wilson's Phalarope	WIPH
Wilson's Warbler	WIWA
Wood Duck ^a	WODU
Yellow-billed Cuckoo	YBCU
Yellow-headed Blackbird ^a	YHBL
Yellow-rumped Warbler ^a	MYWA
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C10. List of Possible Resident Bird Species for Tallgrass Prairie National Preserve, Kansas.

Common Name	AOU Code
American Coot ^a	AMCO
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
American Kestrel	AMKE
American Robin ^a	AMRO
American Woodcock	AMWO
Baltimore Oriole ^a	BAOR
Bank Swallow ^a	BANS
Barn Owl	BNOW
Barn Swallow ^a	BARS
Barred Owl ^a	BDOW
Bell's Vireo ^a	BEVI
Belted Kingfisher ^a	BEKI
Bewick's Wren ^a	BEWR
Black-and-white Warbler	BAWW
Black-billed Cuckoo ^a	BBCU
Black-capped Chickadee ^a	BCCH
Black-crowned Night Heron	BCNH
Blue-gray Gnatcatcher ^a	BGGN
Blue Grosbeak ^a	BLGR
Blue Jay ^a	BLJA
Blue-winged Teal ^a	BWTE
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Carolina Wren ^a	CARW
Cattle Egret ^a	CAEG
Cedar Waxwing ^a	CEDW
Chimney Swift	CHSW
Chipping Sparrow ^a	CHSP
Chuck-will's-widow	CWWI
Cliff Swallow ^a	CLSW
Common Grackle ^a	COGR
Common Nighthawk ^a	CONI
Common Poorwill	COPO
Common Yellowthroat ^a	COYE
Cooper's Hawk	COHA
Dickcissel ^a	DICK
Downy Woodpecker ^a	DOWO
Eastern Bluebird ^a	EABL

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C10 (continued). List of Possible Resident Bird Species for Tallgrass Prairie National Preserve, Kansas.

Common Name	AOU Code
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME
Eastern Phoebe ^a	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Wood-Pewee ^a	EAWP
Eurasian Collared-Dove ^a	ECDO
European Starling	EUST
Field Sparrow ^a	FISP
Grasshopper Sparrow ^a	GRSP
Gray Catbird ^a	GRCA
Great Blue Heron ^a	GBHE
Great Crested Flycatcher ^a	GCFL
Great Egret ^a	GREG
Great Horned Owl ^a	GHOW
Great-tailed Grackle ^a	GTGR
Greater Prairie Chicken ^a	GPCH
Green Heron	GRHE
Hairy Woodpecker ^a	HAWO
Henslow's Sparrow ^a	HESP
Horned Lark ^a	HOLA
House Finch ^a	HOFI
House Sparrow	HOSP
House Wren ^a	HOWR
Indigo Bunting ^a	INBU
Kentucky Warbler ^a	KEWA
Killdeer ^a	KILL
Lark Sparrow ^a	LASP
Least Bittern	LEBI
Little Blue Heron	LBHE
Loggerhead Shrike ^a	LOSH
Long-eared Owl	LEOW
Louisiana Waterthrush ^a	LOWA
Mallard ^a	MALL
Mississippi Kite	MIKI
Mourning Dove ^a	MODO
Northern Bobwhite ^a	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL
Northern Harrier ^a	NOHA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C10 (continued). List of Possible Resident Bird Species for Tallgrass Prairie National Preserve, Kansas.

Common Name	AOU Code
Northern Mockingbird ^a	NOMO
Northern Parula ^a	NOPA
Northern Rough-winged Swallow ^a	NRWS
Orchard Oriole ^a	OROR
Painted Bunting	PABU
Pileated Woodpecker ^a	PIWO
Prothonotary Warbler ^a	PROW
Purple Martin ^a	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker ^a	RHWO
Red-shouldered Hawk	RSHA
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Ring-necked Pheasant ^a	RPHE
Rock Dove	RODO
Rose-breasted Grosbeak	RBGR
Ruby-throated Hummingbird ^a	RTHU
Scarlet Tanager ^a	SCTA
Scissor-tailed Flycatcher ^a	STFL
Spotted Sandpiper ^a	SPSA
Summer Tanager ^a	SUTA
Swainson's Hawk	SWHA
Tree Swallow	TRES
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Upland Sandpiper ^a	UPSA
Virginia Rail	VIRA
Warbling Vireo ^a	WAVI
Western Kingbird ^a	WEKI
Western Meadowlark ^a	WEME
White-breasted Nuthatch ^a	WBNU
Wild Turkey ^a	WITU
Wood Duck ^a	WODU
Yellow-billed Cuckoo ^a	YBCU
Yellow-breasted Chat ^a	YBCH
Yellow-crowned Night Heron	YCNH
Yellow-throated Vireo ^a	YTVI
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C11. List of Possible Resident Bird Species for Wilson's Creek National Battlefield, Missouri.

Common Name	AOU Code
Acadian Flycatcher ^a	ACFL
American Crow ^a	AMCR
American Goldfinch ^a	AMGO
American Kestrel	AMKE
American Redstart ^a	AMRE
American Robin ^a	AMRO
American Woodcock	AMWO
Bachman's Sparrow	BACS
Bald Eagle	BAEA
Baltimore Oriole ^a	BAOR
Bank Swallow ^a	BANS
Barn Owl ^b	BNOW
Barn Swallow ^a	BARS
Barred Owl ^a	BDOW
Bell's Vireo ^a	BEVI
Belted Kingfisher ^a	BEKI
Bewick's Wren ^a	BEWR
Black-and-white Warbler ^a	BAWW
Black-billed Cuckoo ^a	BBCU
Black Vulture	BLVU
Blue-gray Gnatcatcher ^a	BGGN
Blue Grosbeak ^a	BLGR
Blue Jay ^a	BLJA
Blue-winged Warbler ^a	BWWA
Broad-winged Hawk ^a	BWHA
Brown-headed Cowbird ^a	BHCO
Brown Thrasher ^a	BRTH
Canada Goose ^a	CAGO
Carolina Chickadee ^a	CACH
Carolina Wren ^a	CARW
Cedar Waxwing ^a	CEDW
Cerulean Warbler	CERW
Chimney Swift ^a	CHSW
Chipping Sparrow ^a	CHSP
Chuck-will's-widow	CWWI
Cliff Swallow ^a	CLSW
Common Grackle ^a	COGR
Common Nighthawk	CONI
Common Yellowthroat ^a	COYE

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C11 (continued). List of Possible Resident Bird Species for Wilson's Creek National Battlefield, Missouri.

Common Name	AOU Code
Cooper's Hawk ^a	COHA
Dickcissel	DICK
Downy Woodpecker ^a	DOWO
Eastern Bluebird	EABL
Eastern Kingbird ^a	EAKI
Eastern Meadowlark ^a	EAME
Eastern Phoebe	EAPH
Eastern Screech Owl	EASO
Eastern Towhee ^a	EATO
Eastern Whip-poor-will	EWPW
Eastern Wood-Pewee ^a	EAWP
European Starling	EUST
Field Sparrow ^a	FISP
Grasshopper Sparrow ^a	GRSP
Gray Catbird	GRCA
Great Blue Heron ^a	GBHE
Great Crested Flycatcher ^a	GCFL
Great Horned Owl	GHOW
Greater Roadrunner	GRRO
Green Heron ^b	GRHE
Hairy Woodpecker ^a	HAWO
Henslow's Sparrow	HESP
Hooded Warbler ^a	HOWA
Horned Lark	HOLA
House Finch	HOFI
House Sparrow ^a	HOSP
House Wren ^a	HOWR
Indigo Bunting	INBU
Kentucky Warbler	KEWA
Killdeer ^a	KILL
King Rail	KIRA
Lark Sparrow ^a	LASP
Loggerhead Shrike	LOSH
Long-eared Owl	LEOW
Louisiana Waterthrush ^a	LOWA
Mallard	MALL
Mourning Dove ^a	MODO
Northern Bobwhite ^a	NOBO
Northern Cardinal ^a	NOCA
Northern Flicker ^a	YSFL

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Table C11 (continued). List of Possible Resident Bird Species for Wilson's Creek National Battlefield, Missouri.

Common Name	AOU Code
Northern Harrier ^a	NOHA
Northern Mockingbird ^a	NOMO
Northern Parula ^a	NOPA
Northern Rough-winged Swallow ^a	NRWS
Orchard Oriole ^a	OROR
Ovenbird ^a	OVEN
Painted Bunting	PABU
Pied-billed Grebe	PBGR
Pileated Woodpecker ^a	PIWO
Prairie Warbler ^a	PRAW
Prothonotary Warbler ^a	PROW
Purple Martin	PUMA
Red-bellied Woodpecker ^a	RBWO
Red-eyed Vireo ^a	REVI
Red-headed Woodpecker ^a	RHWO
Red-shouldered Hawk ^a	RSHA
Red-tailed Hawk ^a	RTHA
Red-winged Blackbird ^a	RWBL
Rock Dove ^b	RODO
Ruby-throated Hummingbird ^a	RTHU
Scarlet Tanager ^a	SCTA
Scissor-tailed Flycatcher ^a	STFL
Sharp-shinned Hawk	SSHA
Spotted Sandpiper ^b	SPSA
Summer Tanager ^a	SUTA
Tufted Titmouse ^a	TUTI
Turkey Vulture ^a	TUVU
Warbling Vireo ^a	WAVI
White-breasted Nuthatch ^a	WBNU
White-eyed Vireo ^a	WEVI
Wild Turkey ^a	WITU
Willow Flycatcher ^a	WIFL
Wood Duck	WODU
Wood Thrush ^a	WOTH
Worm-eating Warbler	WEWA
Yellow-billed Cuckoo ^a	YBCU
Yellow-breasted Chat ^a	YBCH
Yellow-throated Vireo ^a	YTVI
Yellow-throated Warbler ^a	YTWA
Yellow Warbler ^a	YEWA

^a Denotes species observed as residents in the park as of 2019.

^b Habitat on the park is not likely to support these species (also in bold).

Appendix D. List of Potential Woody Species for the Heartland Inventory and Monitoring Network

Table D1. Woody species data collection method designation. This list is not inclusive but should include the vast majority of species that have potential to cause confusion in the field.

Species Code	Species name	Plant type	SOP type
ACNE2	<i>Acer negundo</i>	tree	Overstory/regeneration
ACRU	<i>Acer rubrum</i>	tree	Overstory/regeneration
ACSA2	<i>Acer saccharinum</i>	tree	Overstory/regeneration
ACSA3	<i>Acer saccharum</i>	tree	Overstory/regeneration
AEGL	<i>Aesculus glabra</i>	tree	Overstory/regeneration
ALNUS	<i>Alnus spp.</i>	tree	Overstory/regeneration
AMELA	<i>Amelanchier spp.</i>	tree	Overstory/regeneration
AMAR3	<i>Amelanchier arborea</i>	tree	Overstory/regeneration
AMLA	<i>Amelanchier laevis</i>	tree	Overstory/regeneration
ARSP2	<i>Aralia spinosa</i>	shrub	Herbaceous
BETUL	<i>Betula spp.</i>	tree	Overstory/regeneration
BENI	<i>Betula nigra</i>	tree	Overstory/regeneration
BEPA	<i>Betula papyrifera</i>	tree	Overstory/regeneration
CACA18	<i>Carpinus caroliniana</i>	tree	Overstory/regeneration
CARYA	<i>Carya spp.</i>	tree	Overstory/regeneration
CAAL27	<i>Carya alba</i>	tree	Overstory/regeneration
CACO15	<i>Carya cordiformis</i>	tree	Overstory/regeneration
CAGL8	<i>Carya glabra</i>	tree	Overstory/regeneration
CAOV2	<i>Carya ovata</i>	tree	Overstory/regeneration
CATE9	<i>Carya texana</i>	tree	Overstory/regeneration
CAPUO	<i>Castanea pumila</i> var. <i>ozarkensis</i>	tree	Overstory/regeneration
CEOCC	<i>Celtis occidentalis</i>	tree	Overstory/Regeneration
CELTI	<i>Celtis spp.</i>	tree	Overstory/regeneration
CETE	<i>Celtis tenuifolia</i>	tree	Overstory/Regeneration
CECA4	<i>Cercis canadensis</i>	tree	Overstory/Regeneration
CORNU	<i>Cornus spp.</i>	shrub	Herbaceous
COAL2	<i>Cornus alternifolia</i>	tree	Overstory/Regeneration
CODR	<i>Cornus drummondii</i>	shrub	Herbaceous
COFL2	<i>Cornus florida</i>	tree	Overstory/Regeneration
COFO	<i>Cornus foemina</i> (ID likely <i>drummondii</i>)	shrub	Herbaceous
CORA6	<i>Cornus racemosa</i>	shrub	Herbaceous
CORU	<i>Cornus rugosa</i>	shrub	Herbaceous
CRATA	<i>Crataegus spp.</i>	tree	Overstory/Regeneration
DIV15	<i>Diospyros virginiana</i>	tree	Overstory/Regeneration
ELUM	<i>Elaeagnus umbellata</i>	shrub	Herbaceous
EUAT3/EUAT5	<i>Euonymus atropurpureus</i>	shrub	Herbaceous
FRCA13	<i>Frangula caroliniana</i>	tree	Overstory/Regeneration

Table D1 (continued). Woody species data collection method designation. This list is not inclusive but should include the vast majority of species that have potential to cause confusion in the field.

Species Code	Species name	Plant type	SOP type
FRAXI	<i>Fraxinus</i> spp.	tree	Overstory/Regeneration
FRAM2	<i>Fraxinus americana</i>	tree	Overstory/Regeneration
FRNI	<i>Fraxinus nigra</i>	tree	Overstory/Regeneration
FRPE	<i>Fraxinus pennsylvanica</i>	tree	Overstory/Regeneration
GLTR	<i>Gleditsia triacanthos</i>	Tree	Overstory/Regeneration
ILDE	<i>Ilex decidua</i>	tree	Overstory/Regeneration
ILOP	<i>Ilex opaca</i>	tree	Overstory/Regeneration
JUNI	<i>Juglans nigra</i>	tree	Overstory/Regeneration
JUNIP	<i>Juniperus</i> spp.	tree	Overstory/Regeneration
JUVI	<i>Juniperus virginiana</i>	tree	Overstory/Regeneration
LIVU	<i>Ligustrum vulgare</i>	Tree	Overstory/Regeneration
LIBE3	<i>Lindera benzoin</i>	shrub	Herbaceous
LIST2	<i>Liquidambar styraciflua</i>	Tree	Overstory/Regeneration
LITU	<i>Liriodendron tulipifera</i>	Tree	Overstory/Regeneration
MAPO	<i>Maclura pomifera</i>	tree	Overstory/Regeneration
MALUS	<i>Malus</i> spp.	tree	Overstory/Regeneration
MORUS	<i>Morus</i> spp.	tree	Overstory/Regeneration
MOAL	<i>Morus alba</i>	tree	Overstory/Regeneration
MORU	<i>Morus rubra</i>	tree	Overstory/Regeneration
NYSY	<i>Nyssa sylvatica</i>	tree	Overstory/Regeneration
OSVI	<i>Ostrya virginiana</i>	tree	Overstory/Regeneration
PIEC2	<i>Pinus echinata</i>	tree	Overstory/Regeneration
PIPO	<i>Pinus ponderosa</i>	tree	Overstory/Regeneration
PIST	<i>Pinus strobus</i>	tree	Overstory/Regeneration
PLOC	<i>Platanus occidentalis</i>	tree	Overstory/Regeneration
POPUL	<i>Populus</i> spp.	tree	Overstory/Regeneration
POGR4	<i>Populus grandidentata</i>	tree	Overstory/Regeneration
POTR5	<i>Populus tremuloides</i>	tree	Overstory/Regeneration
PRNUU	<i>Prunus</i> spp.	tree	Herbaceous
PRAM	<i>Prunus americana</i>	shrub	Herbaceous
PRHO	<i>Prunus hortulana</i>	tree	Overstory/Regeneration
PRPU3	<i>Prunus pumila</i>	shrub	Herbaceous
PRSE2	<i>Prunus serotina</i>	tree	Overstory/Regeneration
PRVI	<i>Prunus virginiana</i>	shrub	Herbaceous
PTTR	<i>Ptelea trifoliata</i>	tree	Overstory/Regeneration
QUERC	<i>Quercus</i> spp.	tree	Overstory/Regeneration
QUAL	<i>Quercus alba</i>	tree	Overstory/Regeneration
QUCO2	<i>Quercus coccinea</i>	tree	Overstory/Regeneration
QUEL	<i>Quercus ellipsoidalis</i>	tree	Overstory/Regeneration
QUIM	<i>Quercus imbricaria</i>	tree	Overstory/Regeneration
QUMA2	<i>Quercus macrocarpa</i>	tree	Overstory/Regeneration

Table D1 (continued). Woody species data collection method designation. This list is not inclusive but should include the vast majority of species that have potential to cause confusion in the field.

Species Code	Species name	Plant type	SOP type
QUMA3	<i>Quercus marilandica</i>	tree	Overstory/Regeneration
QUMU	<i>Quercus muehlenbergii</i>	tree	Overstory/Regeneration
QUPA2	<i>Quercus palustris</i>	tree	Overstory/Regeneration
QURU	<i>Quercus rubra</i>	tree	Overstory/Regeneration
QUSH	<i>Quercus shumardii</i>	tree	Overstory/Regeneration
QUST	<i>Quercus stellata</i>	tree	Overstory/Regeneration
QUVE	<i>Quercus velutina</i>	tree	Overstory/Regeneration
REDOAK	Red oak group	tree	Overstory/Regeneration
RHAMN	<i>Rhamnus</i> spp.	shrub	Herbaceous
RHCA3	<i>Rhamnus cathartica</i>	shrub	Herbaceous
RHLA	<i>Rhamnus lanceolata</i>	shrub	Herbaceous
RHCO	<i>Rhus copallina</i>	shrub	Herbaceous
RHGL	<i>Rhus glabra</i>	shrub	Herbaceous
ROPS	<i>Robinia pseudoacacia</i>	tree	Overstory/Regeneration
SANIC4	<i>Sambucus nigra</i> ssp. <i>canadensis</i>	shrub	Herbaceous
SAAL5	<i>Sassafras albidum</i>	tree	Overstory/Regeneration
SILAA4	<i>Sideroxylon lanuginosum</i> ssp. <i>albicans</i>	shrub	Herbaceous
SILAL3	<i>Sideroxylon lanuginosum</i> ssp. <i>lanuginosum</i>	shrub	Herbaceous
STTR	<i>Staphylea trifolia</i>	shrub	Herbaceous
TIAM	<i>Tilia americana</i>	tree	Overstory/Regeneration
ULMUS	<i>Ulmus</i> spp.	HOME and PIPE prairie:shrub Elsewhere: tree	HOME, PIPE prairie: herbaceous Elsewhere: Overstory/ Regeneration
ULAL	<i>Ulmus alata</i>	tree	Overstory/Regeneration
ULAM	<i>Ulmus americana</i>	tree	Overstory/Regeneration
ULPU	<i>Ulmus pumila</i>	tree	Overstory/Regeneration
ULRU	<i>Ulmus rubra</i>	tree	Overstory/Regeneration
VIBUR	<i>Viburnum</i> (both)	shrub	Herbaceous
VIDE	<i>Viburnum dentatum</i>	shrub	Herbaceous
VILE	<i>Viburnum lentago</i>	shrub	Herbaceous
VIPR	<i>Viburnum prunifolium</i>	shrub	Herbaceous
VIRU	<i>Viburnum rufidulum</i>	shrub	Herbaceous
WHTOAK	White oak group	tree	Overstory/Regeneration
ZAAM	<i>Zanthoxylum americanum</i>	shrub	Herbaceous

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.

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