

National Park Service
U.S. Department of the Interior

Northeast Region
Philadelphia, Pennsylvania



Petersburg National Battlefield Avian Inventory

Technical Report NPS/NER/NRTR—2008/108



ON THE COVER

Eastern kingbird, *Tyrannus tyrannus* (left), ovenbird, *Seiurus aurocapillus* (center top), hairy woodpecker, *Picoides villosus* (center bottom), hooded warbler, *Wilsonia citrine*, (right).

Photographs by: Dana Bradshaw and Larry Lynch (birder6@juno.com).

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March 2008

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Please cite this publication as:

Bradshaw, Dana. March 2008. Petersburg National Battlefield Avian Inventory. Technical Report NPS/NER/NRTR—2008/108. National Park Service. Philadelphia, PA.

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Abstract

A comprehensive, year-round inventory of birds was conducted at Petersburg National Battlefield (PETE) in 2003 and 2004. The inventory yielded 129 species documenting over 90% of the species expected to occur. Only one threatened or endangered species was detected; the bald eagle (*Haliaeetus leucocephalus*), which has nested in the park for the last four years. A total of 29 additional species observed are recognized as state species of special concern, federal species of conservation concern, or priority species under regional conservation initiatives.

The avifauna at PETE was negatively influenced, at least partially, by the near absence of open water on all of the units and by grasslands that have a history of management for agricultural uses. Most of the units were also too small to consider for wildlife management purposes. Of immediate concern is the impact from habitat loss on all sides of the park tied to expansion of the adjacent Fort Lee Army Base. Additionally, the parks native flora is being compromised by the rapid spread of invasive exotics which could have negative impacts on the avifauna as well.

Acknowledgements

This project would not have been possible without initial involvement by Bryan Watts in the early discussions with the NPS on establishing I&M survey protocols. Anne Womack secured the contractual arrangement for William and Mary, and Mark Roberts has administered the contract throughout. I would like to thank Beth Johnson and Sara Stevenson for early coordination and support in this effort, and Jim Comiskey for working closely with me to see the effort through. I also appreciate the efforts from Kristina Callahan with finalizing the project database and assisting with map production and other GIS efforts. Locally, I want to thank Tim Blumenschine for information and assistance with the set-up phase, as well as assistance with the draft report and last-minute consultations on unit details and management issues. I owe a great deal of gratitude to Mike Wilson for his analytical support and to Jessica and Julie Bradshaw for their assistance in compiling historical survey data. Thanks to Larry Lynch (birder6@juno.com) for the use of the ovenbird photograph. And finally, I greatly appreciate Fenton Day and Matthew Smith's tireless effort at covering field surveys at PETE in conjunction with all their other park surveys that were simultaneously underway all over the state.

Introduction

Background

The National Park Service has established the Inventory and Monitoring Program (I&M) to gather existing and new information about natural resources in the parks and to make that information easily available at different levels to park resource managers, the scientific community, and the public. For park managers to effectively maintain biological diversity and ecological health within their parks they must have a basic knowledge of what natural resources exist in parks, as well as an understanding of the factors that may threaten them. One of the first goals of the I&M Program has been to establish baseline biological inventories for vascular plant and vertebrate species in order to provide reliable species lists, a fundamental tool for management.

This report presents the results of a baseline bird inventory conducted at Petersburg National Battlefield (PETE), located in central Virginia. The primary project objective was to document at least 90% of birds expected to occur at the Park by confirming the existence of species expected from published data and documenting year-round species diversity in the park. Local records, surveys, and published literature were used to develop a list of species expected to occur in the park (Kain 1987; Trollinger and Reay 2001). The list is composed of 126 species, of which 93 were species expected to occur during breeding season, 18 wintering species, and 15 to occur only as transient migrants.

Study Area

Petersburg National Battlefield (PETE) is one of the larger parks within the Northeast Region Mid-Atlantic Network of parks. It encompasses some 1,093.5 ha (2,701 ac) in 10 separate units, scattered across two counties and the cities of Petersburg and Hopewell, Virginia (Figure 1). The bulk of the land area is contained within two main units; the Eastern Front (584 ha [1,443 ac]), located adjacent to Fort Lee Army Base on Rt. 36 between the cities of Hopewell and Petersburg, and Five Forks (453 ha [1,118 ac]), located approximately 21 km (13 mi), to the west-southwest, in Dinwiddie County. The remaining units are all less than 20 ha (49 ac), with the bulk of them less than 2 ha (5 ac), including two isolated monuments and a national cemetery, Poplar Grove. All but one of these units lie geographically between the two main units and are collectively known as the Western Front, and include Fort Gregg and Fishhook. The exception is Grant's Headquarters, a 10.5 ha (26 ac) unit at City Point in Hopewell overlooking the confluence of the James and Appomattox rivers. Grant's Headquarters and the Eastern Front are both located in the western Coastal Plain and drain into the Chesapeake Bay via the Appomattox and James rivers. Five Forks and the smaller units are all located in the eastern Piedmont region and are part of the Albemarle Sound watershed via the Nottoway and Chowan rivers. Wooded habitats comprised about 70% of the land area within PETE, with the remaining 30% in mostly open fields and developed areas. The forested components harbor mostly mature forest of mixed hardwood and pine species. Understory is still heavy in some areas from past logging operations and natural regeneration. Most of the open fields are managed under agricultural permits for hay production. The remaining fields are kept mowed, at varying frequencies, depending on the unit.

Habitat Types

Forest/Field Edge

The forest/field edge habitat references the interface between open and forested habitats. It refers primarily to a "hard" edge, where a grassland meets a forest, with little or no transitional habitat. This is not a standard habitat for classifying birds, but was useful for associating with transient birds that most often might be observed along edges in migration, for raptors, and for facultative grassland birds that opportunistically take advantage of grassland resources but remain associated most closely with the forest.

Grassland

Grassland implies any pasture, agriculture, or fallow field at less than shrub stage (having less than 5% woody vegetation), excluding lawns. Most of the open habitats at PETE were grassland habitats, the majority of them fescue-dominated hay fields.

Forested Wetland

Forested wetlands at PETE occur primarily along floodplain forests dominated by deciduous trees. Because of the relatively young age of most of the PETE forests, the floodplain canopy is dominated by red maple (*Acer rubrum*), tulip poplar (*Liriodendron tulipifera*), and/or sweetgum

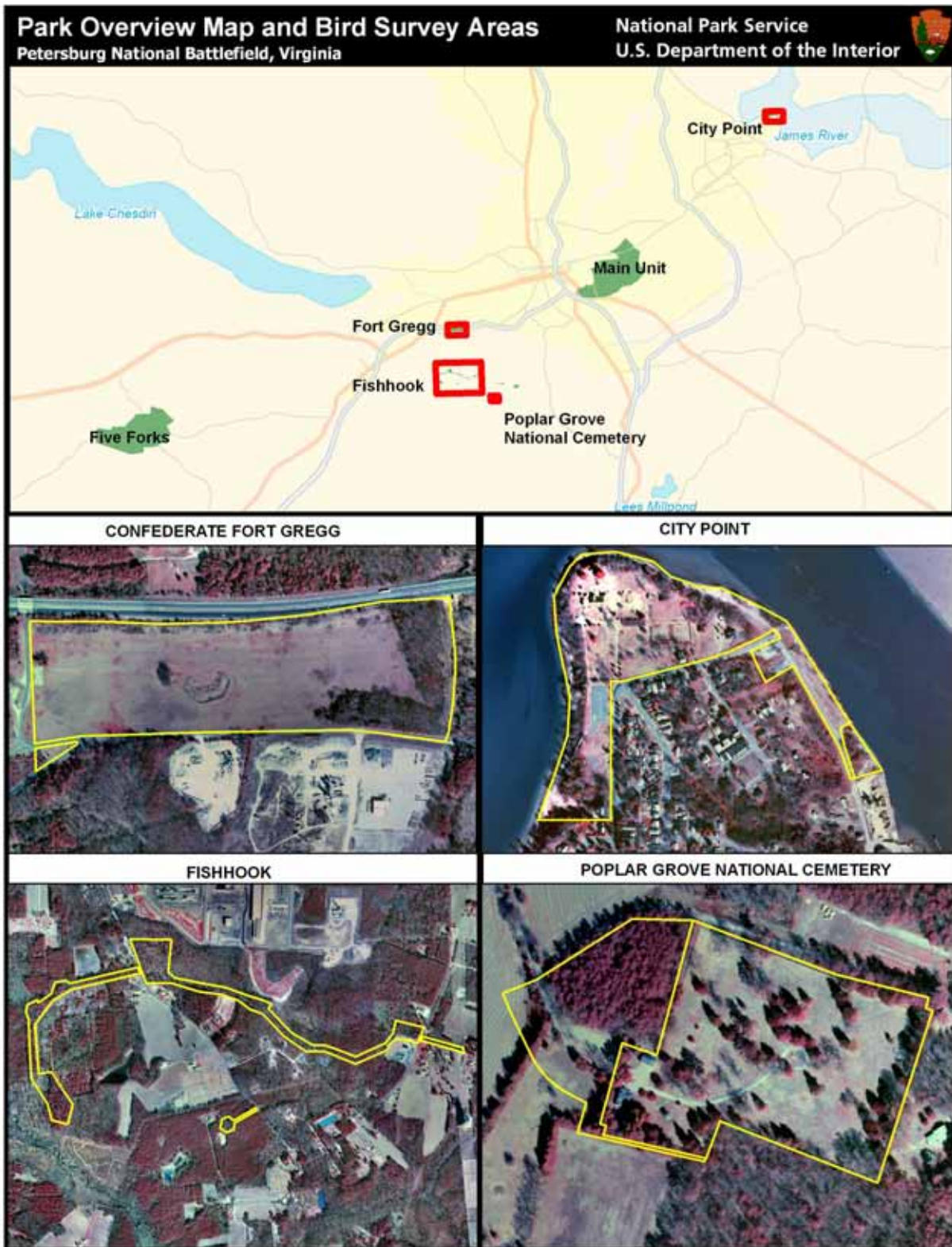


Figure 1. Map of Petersburg National Battlefield, VA, and survey areas at Fort Gregg, City Point, Fishhook, and Poplar Grove National Cemetery.

(*Liquidambar styraciflua*). Additional species, depending on microhabitat, include river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), sycamore (*Platanus occidentalis*), and slippery elm (*Ulmus rubra*). Loblolly pines (*Pinus taeda*) and several oak (*Quercus*) species may also be present. Shrubs include ironwood (*Carpinus caroliniana*), American holly (*Ilex opaca*), and common spicebush (*Lindera benzoin*) as dominants. Trumpet vine (*Campsis radicans*), grapes (*Vitis* sp.), and Japanese honeysuckle (*Lonicera japonica*) are often found along the edges.

Scrub/Shrub

Scrub/shrub habitats at PETE are typically comprised of either regenerating woody species or successional grasslands that have become dominated by woody species. They are often dominated by exotic species such as tree of heaven (*Ailanthus altissima*), white mulberry (*Morus alba*) and paper-mulberry (*Broussonetia papyrifera*). Native species include red cedar (*Juniperus virginiana*), winged elm (*Ulmus alata*), hackberries (*Celtis* sp.), and sumacs (*Rhus* sp.). Vines include poison ivy (*Toxicodendron radicans*), Japanese honeysuckle, grapes, and blackberries (*Rubus* sp.).

Mature Mixed Forest

Mature mixed forests dominated most of the mature forests at PETE, comprised of mixed stands of loblolly pine, American beech (*Fagus grandifolia*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), and tulip poplar. Other species include sweetgum, green ash, and several hickory species (*Carya* sp.). Subcanopies include canopy species as well as black gum (*Nyssa sylvatica*), red maple, and flowering dogwood (*Cornus florida*). Common shrub species are ironwood, American holly, and blueberry (*Vaccinium* sp.).

Mature Deciduous Forest

Oaks and hickories dominate the overstory with American beech, red maple, green ash, sweetgum, and tulip poplar as co-dominants, depending on site conditions and hydrology. The shrub layer is more open in these forested tracts because of the lack of light penetration to the ground under the dense canopies. Flowering dogwood, American holly, and ironwood double as shrub and sub-canopy species, with canopy species saplings rounding out the suite.

Mature Pine

The mature pine stands, found only in the Eastern Front Unit, were essentially pockets of seed tree loblolly pines (*Pinus taeda*) left over from where natural regeneration was used in the past to propagate future pine stands. They are relatively small stands but discrete where they occur.

Pine Plantation

The bulk of the pine component at PETE is comprised of regenerating pine stands found in the homogeneous age classes of pine plantations. They span the entire range of age classes, but most are in the 20–30 year stage. Five forks is dominated by pine plantations.

Pine Savanna

Unique to the Eastern Front, pine savanna occurs at a single site characterized by over-mature loblolly pines accompanied only by a grassland understory. The site is only 3 ha (8 ac) in size, but harbors a unique bird community.

Emergent Wetland/Forest Edge

Unique to Five Forks, emergent wetland/forest edge habitat refers to a point on the edge of a beaver-impounded wetland along Hatcher Run that was surrounded by young forest. The impoundment was predominantly open water (approximately 2 ha [5 ac]) with emergent pond lily and marsh mallow and surrounded by a soft edge of sumac, honeysuckle, other shrubs, and loblolly pine saplings adjacent to a young plantation pine forest. It also contained several dead snag trees, making good perch sites for species such as herons and kingbirds.

Methodology

Expected Species List Development

Before field surveys were initiated, an expected species list for the park was generated from several sources. An initial breeding species list was assembled from The Virginia Breeding Bird Atlas Project 1985–1989 (Trollinger and Reay 2001). Data were compiled from a survey area that extended five USGS 7 ½ minute topo maps wide by five topographic high that was centered on PETE. Additional data were collected using results from over 20 years of data from the four nearest Breeding Bird Survey routes that surround PETE in all directions. Likewise, over 10 years of Christmas Bird Count (CBC) data from the Hopewell CBC was evaluated for winter birds, because that count covers at least one unit of PETE. Finally, field guide range maps (Peterson 1980; Sibley 2000) were consulted, along with years of combined local knowledge of the area avifauna by professional colleagues. These lists were consolidated and edited to reflect only those species that would be subject to occur within the habitats known to exist at PETE. Likewise, a list of spring and fall migrants expected to utilize habitats at PETE was assembled from the same field guides and local knowledge, in addition to data on wintering locations and migration routes (Faaborg and Terborgh 1980; Degraaf and Rappole 1995; Dunn and Garrett 1997). A total of 135 species was expected to occur at PETE, of which 96 species were expected during the breeding season, 17 species in winter, and 22 species to occur as transient migrants (Appendix A). Seasonal separation was determined as follows: birds expected during the breeding season included all resident birds and any temperate or neotropical migrants known to breed at, or close to, PETE. Winter birds included only those birds unique to the winter season; typically temperate migrants that do not also breed at the latitude of PETE. Transient migrants included only those migrants utilizing PETE as a “refueling,” or stopover area, en route to points north or south, with no evidence of breeding or wintering presence at the park.

Site Selection and Unit Descriptions

The avian inventory began with a review of recent aerial imagery, from which park boundaries and habitat types were evaluated. Imagery used was 2000 color-infrared digital orthophoto imagery rendered using Mr Sid compression. The imagery was provided by the NPS along with the most current park unit boundary shapefiles. Upon examination of the imagery, all significant habitat types were noted for each park unit, along with size and distribution of each. Any trails, roads, or other access points were noted as well, for use in establishing the most efficient survey routes. Potential survey points were laid out on the imagery to give the most effective coverage of available habitats. These points were uploaded to handheld GPS units and taken in the field for ground truthing. Once in the field, observers selected a point on the ground that best approximated the photo location and collected a final GPS location with the handheld unit that would serve as the official survey point (Figure 2). (Appendix B).

Rather than a random distribution of points, this project used points that were subjectively selected to encompass both edge and interior components of each distinct habitat type, where applicable. This technique was used to better assess bird diversity within specific habitat types as an aid to long-term management. In addition, some of the habitat units were small, which, when evaluated in terms of a 250 m (820 ft) separation between survey points (Ralph 1993),



Figure 2. Map of survey points and transects at Eastern Front, Petersburg National Battlefield, VA.

made it important to be sure that key habitats were sampled. Therefore, the habitat type was a primary consideration in point selection.

The PETE Units

Because of the tremendous size disparity in the different land units at PETE, survey techniques were matched to unit size. The Eastern Front, at 584 ha (1,443 ac.), is the largest unit and is segregated into three adjacent parcels (Figure 2). Westernmost is the 55 ha (117 ac.) Crater Section, comprised primarily of a large mowed field area surrounded by mostly plantation pine, with smaller sections of mature deciduous forest. The parcel is separated from the middle section by a railroad. To the east, across the railroad, is the middle unit (504 ha [1,244 ac]), which lies in two municipal jurisdictions. The western 70% lies within the City of Petersburg, while the eastern 30% lies in Prince George County, Virginia. The middle section contains a couple of relatively large field complexes but is dominated by a mosaic of mature pine and mature deciduous habitat with pine plantations and forested wetlands intermixed. No single habitat type dominates this area, although some of the more unique habitats occur here. This section contains the only example of pine savanna and one of the few sites of scrub/shrub habitat. The park tour road winds through this entire section and there are miles of hiking and horse trails interlaced within the parcel. This area sustained the greatest damage from Hurricane Isabel of any of the park units. It is separated from the easternmost section by Route 36 which links the towns of Hopewell and Petersburg. The eastern section contains the Visitor Center and is 47 ha (117 ac) in size. It is characterized by a central field with the Visitor Center and parking area surrounded by mostly mature mixed and mature deciduous forest, with buffer areas of scrub/shrub. As a result of the relatively large size of the Eastern Front, point counts were used as the primary survey technique at this unit. A series of 24 points were laid out according to habitat types and were visited for two breeding season rounds, with a subset of those points visited multiple times at other times of the year. Transects were used to survey bird use of the fields.

The second largest unit was Five Forks and also made use of a series of point counts (Figure 3). At 453 ha (1,118 ac), this unit is predominantly comprised of plantation pine stands with intermittent farm fields. It is segregated by three state roads emanating like spokes on a wheel in five directions from a central intersection. At least one of the five sections contained almost entirely mature mixed forest, and another had the most extensive forested wetlands of any PETE unit, culminating in a large emergent wetland surrounded by young forest. Because so many of the other habitats were duplicated from the Eastern Front, only 11 points were established at Five Forks. These were used to examine poorly represented habitats at other units (pine plantations and mature mixed forest) and one unique habitat as well (emergent wetland/forest edge).

Third in size was the Confederate Fort Gregg (Figure 1). This 19 ha (47 ac) tract was almost entirely grassland with a small buffer of mature mixed forest at the eastern end. The unit is very narrow, long, and relatively homogeneous; as a result, no point counts were established here. Only transects were used to survey grassland birds in both winter and summer. Area searches were conducted in the woody margins during both seasons as well.

Grant's Headquarters at City Point in Hopewell was also surveyed using a basic area search technique (Figure 1). There were no point counts established here. This 10.5 ha (26 ac) area is a

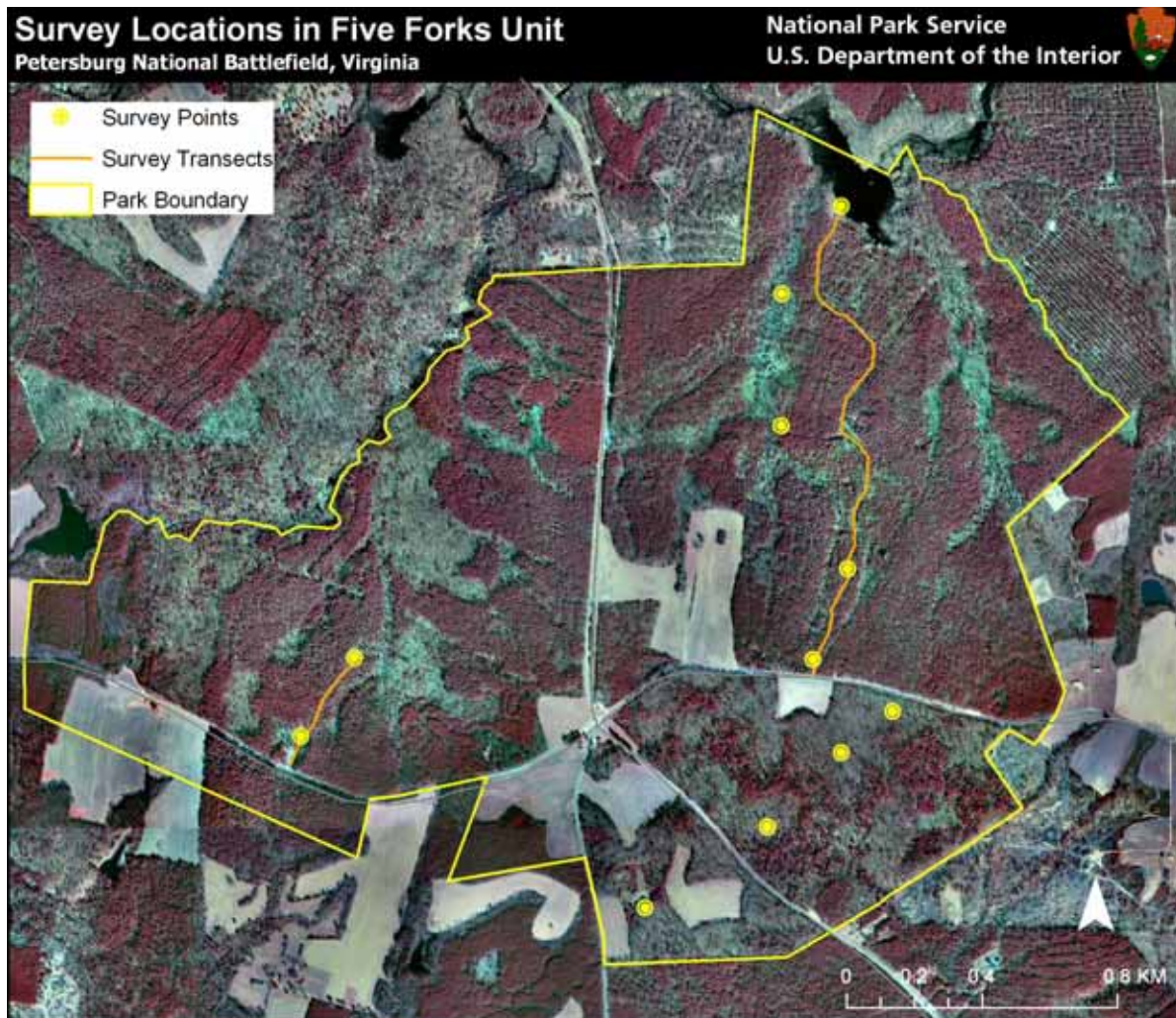


Figure 3. Map of survey points and transects at Five Forks, Petersburg National Battlefield, VA.

heavily visited, mostly open, grassland site with a large historic building perched atop a bluff overlooking the confluence of the Appomattox and James rivers. The bluff is lined by a thin veneer of deciduous trees along both sides, with mostly scrub/shrub habitat covering the bank beneath the summit. The site was traversed on foot, covering all areas for each of numerous year-round surveys. The beachfront below the point, the summit of the bluff up and down both sides, and a thorough search of the trees and open lands around the buildings were conducted during each survey. At the end of each survey, the observer usually just stood poised at the bluff overlooking the river for at least another half hour to an hour time to record bird activity on the river.

The only two additional areas that were surveyed were two components of the Western Front: Poplar Grove Cemetery and the Fishhook (Figure 1). Because of their small size, both were surveyed using an area search method. Poplar Grove Cemetery is only 5 ha (12.8 ac). The historic church and cemetery cover much of this area. A small mature pine forest and intermittent mature pines throughout the cemetery are the only natural habitats present. This area was only surveyed once during the winter and once in summer. The Fishhook is a linear forest tract that follows an old road bed through a mature pine forest. It is approximately 6 ha (14.4 ac) in size. It is bounded by mixed forest to the west and by a regenerating clear-cut to the east, both on private property. This parcel was surveyed simply by walking back and forth along the old road bed and recording only the birds detected overhead or to the immediate sides.

Adjacent to the Fishhook was the Long Flank (Figure 1), a 9 ha (22.3 ac) tract that runs along a state road. Because of inadequate shoulder width for parking, this section was omitted from surveying. It essentially just represented the forest buffer along either side of the road edge. All of the remaining components of the Western Front (Short Flank, Fort Wheaton) and the Eastern Front (Gowen Monument, Pennsylvania Monument, Gee House, and Fort Wadsworth) were omitted from surveying because they were either too small or contained no appreciable natural habitat.

Field Surveys

In order to effectively inventory bird communities at PETE, a number of sampling techniques were conducted during different times of the year. All techniques employed standardized methodologies, but often multiple techniques were used during a single season to maximize species detection probabilities.

Breeding Season Surveys

The primary inventory objective was to determine which bird species occurred at PETE during the breeding season. This was accomplished through a standardized point count methodology using 10 minute periods to record all birds seen or heard in all directions from a fixed survey point (Ralph 1993). Count data were segregated within this 10 minute period into consecutive segments of 3, 2, 2, and 3 minutes. Count data were also recorded relative to distance intervals, recognizing all birds detected within a radius of 50 m (164 ft) from the count center and those beyond 50 m (164 ft). This data recording methodology allows for better comparison with other survey data from other times and/or places and provides data for generating density estimates for species detected within a fixed radius. A total of 35 points distributed among all major habitat

types were sampled over the course of the survey period (Appendix B.) All breeding season surveys were initiated at sunrise and terminated not later than 4 hours after sunrise. Surveys assumed reasonably fair weather and light winds. No surveys were undertaken in heavy rain or winds exceeding an average of 15 mph. Each point was surveyed twice during a single breeding season, referenced in this project as 1 June–15 July. Species detected between point counts were compiled separately and used only to supplement the overall species list. Likewise, birds observed as “fly-overs” during the count period were not used in the density estimates, but were recorded as part of the overall species list.

Relative abundance was calculated for all species detected within the 50 m (164 ft) radius count circle. This value was calculated as the total number of individuals of a species detected within the 50 m (164 ft) radius of a point divided by the total number of individuals of all species detected within 50 m (164 ft) of a point for all point counts conducted during the breeding season. The value is shown as a percentage in the data tables. The data were analyzed using Statistica v7.0 (Statsoft Inc. 1984–2003) and presented in tabular form representing relative abundance for species detected by unit and for species detected by habitat type for each of the primary habitat categories.

For the smaller units at PETE, point counts were not used due to the lack of spatial separation between proposed points. These units were searched completely during breeding, migration, and winter seasons using a generic ‘area search’ methodology to investigate all habitats present and record all birds seen or heard.

Migration Surveys

A secondary objective of this project was to assess bird use of respective park units during migration and winter to better develop a year round profile of bird diversity at PETE. Although migration survey work requires intensive effort to develop meaningful data on bird density and distribution, this project concentrated more on diversity and general abundance of migrants during peak periods of migration. The number of available observers was not adequate to undertake a systematic methodology to capture the entirety of bird migration. As a result, data was not collected for detailed analysis, but rather to evaluate the park units and their habitats for areas of significant importance to migrants as foraging or staging areas during peak times of migration, to the extent possible from available effort. For this purpose, multiple survey methods were employed. One method made use of the existing point counts, where a subset of the original points was surveyed during different periods of migration. For additional survey effort, transects were walked between survey points recording all birds detected to either side of the transect. Migration surveys for passerines were conducted during the first 4 hours after sunrise. The migration periods were recognized as 15 March to 31 May and 15 August to 15 November, although the bulk of the migration survey effort was undertaken between 15 April and 15 May, which covers the peak of the spring passerine migration in eastern Virginia.

Winter Surveys

Winter surveys were conducted similar to those during migration. Given the tendencies of birds to form mixed-species foraging flocks during winter and adopt a more nomadic existence, there is tremendous heterogeneity in bird distribution across a given habitat (Morse 1970). As a result,

winter survey work made use of all techniques again: point counts, transects, and area searches. Winter data were not collected for analysis, only for building a winter species profile. An initial survey was conducted at each permanent survey point as the points were originally established in January 2003. Surveys were conducted throughout the day, with the emphasis on the first 5 hours after sunrise. Additional transect surveys were conducted within specific habitat types (forested wetlands, shrub/scrub, and mature hardwood) during the following winter in an effort to detect new wintering species. All winter surveys were conducted between 15 November and 15 March.

Grassland Surveys

In addition to the presence of point counts in some of the agricultural fields and open areas, transect surveys were also conducted in all open fields that exceeded 1 ha (2.5 ac) in size. Transects were used to supplement breeding season point counts in order to help locate grassland species that sing infrequently. Surveys involved walking the long axis of the field within 50 m (164 ft) of an edge, and then a second transect at least 100 m (328 ft) from the edge or through the center of the field, whichever was furthest from an edge. Transects were used as the primary survey method in grassland habitats for winter and fall migration surveys. They were used primarily to determine presence/absence of birds, rather than density.

Audio-Playback Surveys

Several species groups are not readily detected by conventional passerine survey techniques. Among those are nocturnal species and birds of prey. Among the nocturnal species, nightjars and owls are the two groups of relevance at PETE. As a result, night surveys were conducted using taped playbacks of conspecific calls for each species of interest. Chuck-will's-widows and whip-poor-wills were surveyed from roadsides adjacent to suitable habitats. The survey sequence employed a 2 minute period of listening followed by 30 seconds of playbacks, 2 minutes of listening, 30 seconds of playback, and a final 2 minutes of listening. This sequence was followed for both species at each stop. The same protocol was followed on a second date but with the species reversed. Surveys were conducted only on calm nights with clear skies and at least some moonlight.

Owls were surveyed from roadsides and/or forest interior locations, depending on habitat conditions. Four species were targeted: great horned owl, barred owl, barn owl, and eastern screech owl. The same sequence of playing and listening was done for owls as for nightjars. Distance between survey points for both owls and nightjars was a minimum of 1 km (1,093 yd).

Area Searches

Several of the PETE units were too small to incorporate point counts because of inadequate spatial separation between proposed points. These units (City Point, Fishhook, Fort Gregg, and Poplar Grove Cemetery) were instead 'area-searched' using a comprehensive survey technique to access and investigate all habitat types during each of the survey seasons. The very smallest units, including the solitary monument sites, received no survey effort and were not visited during this project.

Results

Inventory Results

A total of 129 species was detected during the 2-year inventory (Table 1). Of these, 78 species were confirmed or suspected of breeding within the park based on repeated observations within appropriate habitat during the breeding season. An additional 9 species known to breed within the region were also observed in the park during breeding season. Another 24 species were detected as transients only during the spring and/or fall migration. And a final 18 species were detected as wintering birds only. Of these 129 species, only 116 were from the original expected list of 126 species. This resulted in an overall detection of 92% of the species that were expected to occur at PETE. Broken down by season, the results confirmed 93% of the breeding season species; 93% of the transient migrants; and 83% of the wintering species (Appendix A). The thirteen additional detected species that had not been anticipated were all either unexpected spring migrants or winter waterfowl observed off of City Point.

Species Relative Abundance Data

Relative abundance data was calculated for all breeding season survey points by habitat type (Table 2). Data included was limited to that collected within the 50 m (164 ft) survey radius due to the relatively small size of habitat patches and subsequent attempt to reduce the influence from extraneous habitats.

Table 2 provides an overview of the avian species composition of the Eastern Front by habitat. Northern cardinal was the only species represented across all habitats, while red-eyed vireo was the most abundant overall, with blue-gray gnatcatcher and eastern tufted titmouse very prominent in most habitats as well. Forested wetlands showed the greatest species diversity with 27 species documented, followed by scrub/shrub habitats with 25 species, and mature pines with 24 species. Grassland habitats were not analyzed independently because there were almost no grassland obligate species detected. All grasslands were essentially of the same composition and, therefore, did not afford opportunities for comparison.

At Five Forks, the emergent wetland-forest edge habitat held the greatest species diversity, at 21 species, and the most unique species, 7 (Table 3). Forested wetlands were forth in species diversity, behind mature pine, and mature mixed habitats. Red-eyed vireo was once again the most abundant species and was one of three represented across all five habitats. The other two were Carolina wren and black-and-white warbler.

Collectively, habitats at PETE showed forested wetlands harboring the greatest number of species, with high percentages (54%) of neotropical migrants (Table 4). The emergent wetland-forest edge habitat contained a species suite comprised of 71% neotropical migrants. Mature hardwood stands, with only a moderate number of species, had the highest relative percentage of priority species (53%), followed by the mature mixed habitat (50%).

Table 1. Total species detected^a by seasonal status at Petersburg National Battlefield during inventories conducted in 2003–2004.

#	Species	Migration Status	Park Units ^b					
			EF	FF	CP	FG	FH	PG
1	double-crested cormorant	temperate migrant			b			
2	great blue heron	temperate migrant	b	b	b			
3	green heron	neotropical migrant		B				
4	Canada goose	temperate migrant	b	B	b			
5	wood duck	temperate migrant		B				
6	mallard	temperate migrant		B				
7	lesser scaup	temperate migrant			W			
8	bufflehead	temperate migrant			W			
9	ruddy duck	temperate migrant			W			
10	turkey vulture	neotropical migrant	b	b	b		b	b
11	black vulture	neotropical migrant	b	b				b
12	sharp-shinned hawk	temperate migrant	W		T			
13	red-shouldered hawk	temperate migrant	B	B			B	b
14	broad-winged hawk	neotropical migrant	T					
15	red-tailed hawk	temperate migrant	B			b		
16	bald eagle	resident	B		b			
17	osprey	neotropical migrant			B			
18	merlin	neotropical migrant			T			
19	northern bobwhite	resident		B				
20	wild turkey	resident	B	B				
21	killdeer	temperate migrant		b				
22	spotted sandpiper	neotropical migrant		T				
23	American woodcock	temperate migrant	T	T				
24	Bonaparte's gull	temperate migrant			T			
25	laughing gull	temperate migrant			b			
26	ring-billed gull	temperate migrant	W		W			
27	herring gull	temperate migrant			W			
28	great black-backed gull	temperate migrant			W			
29	caspian tern	neotropical migrant			T			
30	royal tern	neotropical migrant			T			
31	Forster's tern	neotropical migrant			T			
32	mourning dove	temperate migrant	B	B	B	B	B	B
33	yellow-billed cuckoo	neotropical migrant	B	B			B	B
34	great horned owl	resident					B	
35	barred owl	resident	B	B				
36	eastern screech owl	resident	B					
37	chimney swift	neotropical migrant	b		B	b	b	b
38	ruby-throated hummingbird	neotropical migrant	B	B		b		
39	belted kingfisher	temperate migrant		B				
40	red-bellied woodpecker	resident	B	B	B		B	
41	yellow-bellied sapsucker	temperate migrant	W	W				
42	downy woodpecker	resident	B	B			B	B
43	hairy woodpecker	resident	B	B				
44	northern flicker	temperate migrant	B	B				
45	pileated woodpecker	resident	B	B			B	
46	eastern wood-pewee	neotropical migrant	B	B			B	B
47	acadian flycatcher	neotropical migrant	B	B			B	B
48	yellow-bellied flycatcher	neotropical migrant	T					
49	willow flycatcher	neotropical migrant			T			
50	eastern phoebe	neotropical migrant	B	B				B

Table 1. Total species detected^a by seasonal status at Petersburg National Battlefield during inventories conducted in 2003–2004 (continued).

#	Species	Migration Status	Park Units ^b					
			EF	FF	CP	FG	FH	PG
51	great crested flycatcher	neotropical migrant	B	B			B	B
52	eastern kingbird	neotropical migrant	B	B	B		B	
53	red-eyed vireo	neotropical migrant	B	B	B		B	B
54	warbling vireo	neotropical migrant			T			
55	white-eyed vireo	neotropical migrant	B	B			B	
56	yellow-throated vireo	neotropical migrant	B	B				
57	blue-headed vireo	neotropical migrant	T	T				
58	blue jay	temperate migrant	B	B	B	B	B	
59	American crow	resident	B	B	B		B	
60	fish crow	resident	b		b			
61	purple martin	neotropical migrant	b		B			
62	tree swallow	neotropical migrant			b			
63	barn swallow	neotropical migrant		b	B	b		
64	tufted titmouse	resident	B	B		B	B	B
65	Carolina chickadee	resident	B	B	B		B	B
66	white-breasted nuthatch	resident	B	B			B	
67	brown-headed nuthatch	resident	B					
68	brown creeper	temperate migrant	W	W				
69	Carolina wren	resident	B	B	B	B	B	
70	house wren	temperate migrant						B
71	winter wren	temperate migrant	W					
72	golden-crowned kinglet	temperate migrant	W	W				
73	ruby-crowned kinglet	temperate migrant	W	W	W			
74	blue-gray gnatcatcher	neotropical migrant	B	B	B		B	B
75	eastern bluebird	temperate migrant	B	B				B
76	American robin	temperate migrant	B	B	B		B	B
77	wood thrush	neotropical migrant	B			B	B	b
78	Swainson's thrush	neotropical migrant	T		T			
79	hermit thrush	temperate migrant	W	W				
80	gray catbird	temperate migrant		B		B	B	
81	northern mockingbird	resident	B		B	B	B	B
82	brown thrasher	temperate migrant	B	B	B			B
83	European starling	resident	B		B			
84	cedar waxwing	temperate migrant	B				B	B
85	northern parula	neotropical migrant	B	B			B	
86	yellow warbler	neotropical migrant	B		B			
87	chestnut-sided warbler	neotropical migrant	T					
88	magnolia warbler	neotropical migrant		T				
89	black-throated blue warbler	neotropical migrant					T	
90	blackburnian warbler	neotropical migrant			T			
91	yellow-rumped warbler	temperate migrant	T	T	T			
92	black-throated green warbler	neotropical migrant	T				T	
93	prairie warbler	neotropical migrant	B	B	B		B	B
94	palm warbler	temperate migrant		T				
95	pine warbler	temperate migrant	B	B			B	
96	bay-breasted warbler	neotropical migrant	T					
97	blackpoll warbler	neotropical migrant			T		T	
98	yellow-throated warbler	neotropical migrant	B	B				
99	prothonotary warbler	neotropical migrant		B				
100	black-and-white warbler	neotropical migrant	b	B				

Table 1. Total species detected^a by seasonal status at Petersburg National Battlefield during inventories conducted in 2003–2004 (continued).

#	Species	Migration Status	Park Units ^b					
			EF	FF	CP	FG	FH	PG
101	American redstart	neotropical migrant	T					
102	ovenbird	neotropical migrant	B	B			B	b
103	northern waterthrush	neotropical migrant	T					
104	Louisiana waterthrush	neotropical migrant	B	B				
105	common yellowthroat	temperate migrant	B	B		B	B	B
106	hooded warbler	neotropical migrant	B	B			B	
107	yellow-breasted chat	neotropical migrant		B				
108	summer tanager	neotropical migrant	B	B			B	
109	scarlet tanager	neotropical migrant	B	B				
110	northern cardinal	resident			B	B	B	B
111	blue grosbeak	neotropical migrant	B					
112	indigo bunting	neotropical migrant	B	B		B	B	
113	eastern towhee	temperate migrant	B	B			B	
114	field sparrow	temperate migrant						b
115	chipping sparrow	temperate migrant	B	B			B	B
116	white-throated sparrow	temperate migrant	W	W	W			
117	white-crowned sparrow	temperate migrant			W			
118	fox sparrow	temperate migrant	W					
119	song sparrow	temperate migrant	B	B	B	B	B	
120	swamp sparrow	temperate migrant		W				
121	dark-eyed junco	temperate migrant	W	W	W			
122	eastern meadowlark	temperate migrant	B		B	B		b
123	brown-headed cowbird	temperate migrant	B	B				
124	red-winged blackbird	temperate migrant		B	B	b		
125	common grackle	temperate migrant	B	B	B		B	B
126	orchard oriole	neotropical migrant	B	B	B			
127	house finch	resident	B	B	B	B	B	B
128	American goldfinch	temperate migrant	B	B	B	B	B	B
129	house sparrow	resident			B			

^aKey to detection:

B=Documented breeding, or observed repeatedly in appropriate habitat during breeding season.

b=No evidence that species breeds at unit, but observed at unit and known to breed locally.

T=Observed as a migratory transient only; not present during breeding or wintering season.

W=Occurs during winter only, or observed only during winter (for species that may actually be resident in other nearby areas.)

^bPark Unit identifications:

EF = Eastern Front

CP = City Point

FH = Fishhook

FF = Five Forks

FG = Fort Gregg

PG = Poplar Grove National Cemetery.

Table 2. Relative abundance for breeding season birds by habitat for Petersburg National Battlefield–Eastern Front.

Species	Habitat Types ^a								
	FW	MH	MM	MP	PP	PS	Grass	S/S	Edge
red-eyed vireo	20.354	10.00	16.667	12.346	3.448			3.077	
blue-gray gnatcatcher	9.735	6.667	3.030	6.173	10.345			7.692	4.545
Acadian flycatcher	8.850	3.333	3.030	1.235				1.538	
tufted titmouse	7.965	20.00	10.606	4.938	3.448	2.174		3.077	
Carolina chickadee	6.195	6.667	1.515	8.642					
blue jay	4.425	10.00						6.154	
wood thrush	4.425	3.333	1.515	1.235					
Louisiana waterthrush	4.425	3.333							
Carolina wren	3.540		3.030	4.938	3.448		3.226	7.692	
white-breasted nuthatch	3.540	6.667	4.545		3.448				
American goldfinch	2.655			1.235		8.696	3.226	1.538	
downy woodpecker	2.655		4.545	3.704					
great crested flycatcher	2.655		4.545	1.235	3.448	6.522		3.077	4.545
mourning dove	2.655			2.469	3.448				27.273
American robin	1.770		7.576	4.938	6.897	8.696	12.903		9.091
eastern wood-pewee	1.770	3.333				2.174		6.154	
northern parula	1.770							1.538	
hooded warbler	1.770		3.030	4.938					
black-and-white warbler	1.770		1.515	3.704				1.538	
brown-headed cowbird	0.885	3.333	6.061		3.448	6.522	6.452	4.615	4.545
northern cardinal	0.885	3.333	6.061	8.642	20.690	2.174	3.226	9.231	4.545
hairy woodpecker	0.885	6.667			3.448				
ovenbird	0.885	3.333	6.061	7.407	3.448				
scarlet tanager	0.885	3.333							
yellow-throated vireo	0.885								
white-eyed vireo	0.885							1.538	
yellow-billed cuckoo	0.885	3.333	3.030						
summer tanager		3.333	6.061	1.235	6.897				
American crow			3.030	1.235					
chipping sparrow			1.515			17.391	6.452	3.077	22.727
red-bellied woodpecker			1.515	1.235					
pine warbler			1.515	12.346	10.345	4.348			
wild turkey				2.469					
northern flicker				1.235	3.448				
ruby-throated				1.235				1.538	
hummingbird									
eastern kingbird				1.235		6.522		3.077	
eastern towhee					6.897		9.677	7.692	
brown thrasher					3.448		3.226	3.077	
house finch						8.696	3.226		
common grackle						8.696	6.452	3.077	
eastern bluebird						6.522	6.452	1.538	4.545
indigo bunting						4.348	9.677	7.692	9.091
brown-headed nuthatch						4.348			
pileated woodpecker						2.174			
European starling							12.903		
common yellowthroat							9.677	4.615	
blue grosbeak							3.226		

Table 2. Relative abundance for breeding season birds by habitat for Petersburg National Battlefield–Eastern Front (continued).

Species	Habitat Types ^a								
	FW	MH	MM	MP	PP	PS	Grass	S/S	Edge
orchard oriole								4.615	
yellow warbler								1.538	
northern mockingbird									9.091

^aHabitat types:

FW = Forested wetland

MM = Mature Mixed forest

PP = Pine Plantation

Grass = Grassland

Edge = Forest/field edge

MH = Mature Hardwood forest

MP = Mature Pine

PS = Pine Savanna

S/S = Scrub/Shrub

Table 3. Relative abundance for breeding season birds by habitat for Petersburg National Battlefield–Five Forks Unit.

Species	Habitat Types ^a				
	FW	MM	MP	S/S	EW-FE
red-eyed vireo	28.947	15.789	12.766	9.524	3.704
tufted titmouse	15.789	13.158	4.255		7.407
blue-gray gnatcatcher	7.895	2.632	4.255		3.704
mourning dove	7.895		4.255		
American robin	5.263	10.526	8.511		
blue jay	5.263				
Carolina chickadee	5.263	2.632	8.511		
hooded warbler	5.263	5.263	8.511		3.704
black-and-white warbler	5.263	2.632	6.383	4.762	3.704
Carolina wren	2.632	2.632	2.128	14.286	3.704
Acadian flycatcher	2.632	2.632	2.128	4.762	
ovenbird	2.632	5.263	8.511		
pine warbler	2.632	2.632	12.766		
white-eyed vireo	2.632				3.704
northern cardinal		7.895	4.255	4.762	
summer tanager		7.895	2.128		3.704
American crow		5.263	2.128		11.111
brown-headed cowbird		2.632		9.524	
chipping sparrow		2.632			
white-breasted nuthatch		2.632			
downy woodpecker		2.632	2.128		
great crested flycatcher		2.632			
wild turkey			4.255		
American goldfinch			2.128		7.407
indigo bunting				9.524	3.704
common grackle				9.524	
common yellowthroat				9.524	3.704
eastern towhee				4.762	7.407
northern parula				4.762	
ruby-throated hummingbird				4.762	
orchard oriole				4.762	
eastern wood-pewee				4.762	3.704
prothonotary warbler					7.407
yellow-billed cuckoo					3.704
yellow-throated vireo					3.704
eastern kingbird					3.704
eastern phoebe					3.704
red-winged blackbird					3.704
yellow-breasted chat					3.704

^aHabitat Types:

FW = Forested Wetland

MP = Mature Pine

EW-FE = Emergent Wetland-Forest Edge

MM = Mature Mixed forest

S/S = Scrub/Shrub

Table 4. Summary statistics for habitat type relative abundance data for avian inventories conducted at Petersburg National Battlefield, VA, from 2003-2004.

Habitat Type	# Species	Neotropical	Temperate	Resident	Priority Species ^a
Forested Wetland	28	15	5	8	7
Emer.Wtlnd-Forest Edge	21	15	3	3	5
Mature Hardwood	17	10	1	6	11
Mature Mixed	22	10	3	9	6
Mature Pine	24	11	5	8	5
Pine Plantation	17	5	6	6	5
Pine Savanna	16	4	6	6	7
Scrub/Shrub	25	14	7	4	5
Grassland	15	2	8	5	4
Field/Forest Edge	10	3	4	3	4

^a Priority Species - species listed as state or federal T&E species; species of conservation concern under USFWS guidelines; or priority species under Partners in Flight regional rankings.

Nocturnal Surveys

Nocturnal surveys were conducted only for barn owls and nightjars. The remaining owl species were detected during routine point counts, although great horned owls were detected incidentally during nightjar surveys as well. No whip-poor-wills or chuck-will's-widows were detected, nor were any barn owls.

Discussion

Species Inventory

Results of the species inventory conducted at PETE represent 92% of the species that were expected to occur in the park. By season, results for the migration period were on par with results from the breeding season. Ninety-three percent of the expected species were detected for each of the two seasonal periods. This is unusual due to the difficulty in performing adequate survey sampling during a dynamic migration period versus the relative stability of a breeding season. The reason for these results are primarily due to the proximity of PETE to the home location of the survey team allowing greater sampling effort, and the fact that the most dynamic migration site, Grant's Headquarters at City Point, was also the most accessible. Grant's Headquarters overlooks the confluence of the Appomattox and James River at City Point. It is easily accessible to the public and offers 1.5 km (4,921 ft) of waterfront view covering some 270 degrees. Of the total of 129 species detected, only 116 had been expected. Eleven additional migrants or wintering species that had not been anticipated were observed, and the bulk of them from City Point (Table 5).

This raises an issue that is unique to these parks that contain units adjacent to large bodies of water. Many species that move along the waterways are often tied to that habitat and would not be seen in interior or upland habitats, like waterfowl, terns, and gulls. But they are clearly visible to park visitors at that area and add to the overall visitor experience. For that reason, waterfowl and other maritime species were included in the species list for PETE, although they were not considered in any of the data analysis for relative abundance.

Species of Special Concern

There were no federally listed species detected in this survey. Bald eagles have nested at PETE since 2003, however this species is in the process of being de-listed from the federal list of Threatened and Endangered Species as of summer 2007 (USFWS 2007). It had previously been listed as "threatened" and still retains that status at the state level in Virginia (VDGIF 2006). The eagle nest at PETE has been productive each year since 2003 and the park has followed federal guidelines to ensure protection from visitor disturbance in that area.

Seven additional species detected at PETE are recognized as a species of Special Concern in Virginia (Table 6 and Appendix C). This designation applies only to the breeding population of these species and, therefore, does not apply to the birds detected at PETE. The one exception may be Forster's terns which nest along the barrier islands of Virginia, in addition to many areas to the north and west of Virginia. The breeding Forster's terns on the coast often disperse up into the tidal rivers in the post-breeding season before migration. So, at least some of the Forster's terns observed at PETE may be part of the Virginia breeding population (Kain 1987). The remaining Forster's terns as well as Caspian terns are seen at PETE primarily as transients on the way to and from breeding grounds from the Great Lakes north and west (Sibley 2000). The magnolia warbler is another Special Concern species only observed in the Coastal Plain as a transient. It nests in high elevation conifer forests in the mountains of Virginia but is a rare spring migrant elsewhere in the state; more commonly observed as a fall migrant along the coast

(Kain 1987). The remaining four Special Concern species are all temperate migrants that winter in Virginia, migrating down from more northerly states: brown creeper, golden-crowned kinglet, winter wren, and hermit thrush. They all also breed as uncommon to rare high elevation species in discreet areas of Virginia's mountains but these populations are independent of the more northerly breeding birds that winter throughout the state (Trollinger and Reay 2001).

Eighteen species are also ranked among Partners in Flight's (PIF) top tier of species within either the mid-Atlantic Piedmont (Kearney 2003) or the mid-Atlantic Coastal Plain (Watts 2000), depending in which unit they were detected (Table 7 and Appendix C). Species scoring 19 or higher (out of 30) in the PIF prioritization scheme indicate species of high regional or continental concern. Four of these species were already referenced in the USFWS Species of Management Concern list: brown-headed nuthatch, wood thrush, prairie warbler, and prothonotary warbler. The remaining 14 are shown in Table 7 by their distribution and abundance at PETE, and PIF score.

Habitat Associations

As is commonly seen in the Coastal Plain, the forested wetlands showed the highest species diversity and the highest number of neotropical migrant species. This is tied to the presence of water, increased insect availability, and overall heterogeneity of the habitat affording opportunities for more species to occupy and exploit the available resources (Wharton et al 1981; Pashley and Barrow 1993). Scrub/shrub habitats showed the next highest species diversity, which is normally an unusual situation; however, at PETE, most scrub/shrub habitats were edge habitats or small habitat blocks that were heavily influenced by species from adjacent habitats.

In this context, scrub habitats harbored species from multiple habitat types. Mature pine and mature hardwood habitats also showed results out of context, with pine having yielded 24 species relative to the 17 mature hardwood species. This is related to the context of these habitats at PETE. The mature pine habitats were very small and typically embedded in other habitats, thereby, reflecting species not always associated with the mature pine habitat type. The mature hardwood stands were slightly larger than the pine units and mostly of good quality where they existed. Although the species suite was small, this habitat type harbors 10 of the 25 species of management interest for the park and one of the highest ratios of neotropical migrants.

The emergent wetland-forest edge habitat harbored the fourth highest species diversity. This habitat, located at Five Forks, was the only open water habitat located at PETE and was surrounded by forest with a shrubby border. Its species profile was characterized by waterfowl, shrub species, and forest edge species. Likewise, the grassland habitat, another critical habitat in the region, had a relatively high species diversity profile for that habitat type, yet none of the species were grassland-obligate species. All of the open, pasture-type battlefields are comprised of dense stands of fescue, a sod-forming grass that excludes access to the bare soil beneath and typically results in a monoculture stand of virtually no value to birds (KDFWR 2004). In winter, rain and snow tend to flatten it in waves, leaving little room for cover beneath. This precludes use of these fields by the two prominent grassland-obligate species: grasshopper sparrows (breeding) and savannah sparrows (wintering), and minimizes foraging opportunities for a number of other grassland users such as meadowlarks, finches, and blackbirds (Askins 1993). The fact that the grasslands were relatively small and embedded in forest habitats, rather than

Table 5. Species detected that were not expected to occur at Petersburg National Battlefield.

Species	Taxonomic Name	Status	Detected
broad-winged hawk	<i>Buteo platypterus</i>	transient	Eastern Front
merlin	<i>Falco columbarius</i>	transient	City Point
Bonaparte's gull	<i>Larus philadelphia</i>	transient	City Point
caspian tern	<i>Sterna caspia</i>	transient	City Point
royal tern	<i>Sterna maxima</i>	transient	City Point
willow flycatcher	<i>Empidonax traillii</i>	transient	City Point
warbling vireo	<i>Vireo gilvus</i>	transient	City Point
chestnut-sided warbler	<i>Dendroica pensylvanica</i>	transient	Eastern Front
blackburnian warbler	<i>Dendroica fusca</i>	transient	Five Forks
bay-breasted warbler	<i>Dendroica castanea</i>	transient	Eastern Front
white-crowned sparrow	<i>Zonotrichia leucophrys</i>	winters	City Point

Table 6. Species of management concern and their status at Petersburg National Battlefield during inventories in 2003–2004.

Species	Status	Abundance	Distribution ¹	Management Status ²
bald eagle	breeds	rare	EF	Thr. – State
Caspian tern	transient	uncommon	CP	SC – State
Foster's tern	transient	common	CP	SC – State
brown-headed nuthatch	breeds	rare	EF	BCC – BCR 27
brown creeper	winters	uncommon	EF, FF	SC – State
winter wren	winters	uncommon	EF	SC – State
golden-crowned kinglet	winters	common	EF,FF	SC – State
wood thrush	breeds	common	EF, FG,FH,PG	BCC – BCR 27, 29, & USFWS Region 5
hermit thrush	winters	common	EF, FF	SC – State
northern parula	breeds	common	EF, FF, FH	BCC – BCR 27
magnolia warbler	transient	rare	FF	SC – State
Black-throated green warbler	transient	uncommon	EF, FH	BCC – BCR 27
prairie warbler	Breeds	uncommon	EF,FF, CP, FH, PG	BCC – BCR 27, 29, & USFWS Region 5
bay-breasted warbler	transient	rare	EF	BCC – USFWS R5
prothonotary warbler	breeds	rare	FF	BCC – BCR 29

¹Distribution; units identified as follows:

EF = Eastern Front

FG = Fort Gregg

PG = Poplar Grove National Cemetery

FF = Five Forks

FH = Fishhook

²Management Status:

Thr – Threatened

SC – Special Concern

BCC – USFWS Birds of Conservation Concern in the Southeast

BCR 27 = Southeastern Coastal Plain

BCR 29 = Mid-Atlantic Piedmont

USFWS Region 5 = VA, WV, MD, PA, NJ, NY, CT, MA, RI, NH, VT, ME.

Table 7. Partners in Flight priority species detected at Petersburg National Battlefield during inventories in 2003–2004.

Species	PIF Score ^a	Status	Distribution at PETE ^b	Abundance at PETE
green heron	20	breeds	FF	rare
northern bobwhite	20	breeds	FF	uncommon
American woodcock	23	winters	EF and FF	rare
eastern screech owl	20	breeds	EF	uncommon
chimney swift	20	breeds	All	common
Acadian flycatcher	23	breeds	EF, FF, FH, and PG	common
eastern wood-pewee	22	breeds	EF, FF, FH, and PG	common
willow flycatcher	18	transient	CP	rare
white-eyed vireo	22	breeds	EF, FF, and FH	common
yellow-throated vireo	23	breeds	EF and FF	uncommon
brown-headed nuthatch	23	breeds	EF	rare
wood thrush	25	breeds	EF, FG, FH, and PG	common
prairie warbler	25	breeds	All, except FG	uncommon
prothonotary warbler	22	breeds	FF	rare
Louisiana waterthrush	21	breeds	EF and FF	uncommon
scarlet tanager	22	breeds	EF and FF	common
eastern towhee	19	breeds	EF, FF, and FH	common
field sparrow	20	breeds	PG	uncommon

^aPIF priority species taken from Kearny (2003) and Watts (2000) depending in which units species were detected.

^bDistribution; Units identified as follows:

EF=Eastern Front

FG=Fort Gregg

PG=Poplar Grove Cemetery

FF=Five Forks

FH=Fishhook

CP=City Point

contiguously linked, also reduced their capacity to support grassland-obligate species, since many of these species tend to be area-sensitive (Herckert 1994; Watts et al 1997).

The unique habitats within PETE exemplify why habitat-specific survey points, rather than randomly selected points, were critical to the success of the inventory. It is unlikely that randomly selected points would have fallen on the 3-ha (7.4-ac) pine savanna at the Eastern Front or the emergent wetland of Hatcher Run at Five Forks, but, collectively, these two habitats added another six species to the total. Brown-headed nuthatches were only observed in association with the pine savanna habitat; this species depends on the open characteristics and mature trees associated with this habitat (Wilson and Watts 1999). The pine savanna habitat also contained the bald eagle nest. The emergent wetland-forest edge habitat yielded eastern phoebe, prothonotary warblers, yellow-breasted chats, and red-winged blackbirds. With half of these six species listed as state protected (bald eagle) or USFWS Species of Conservation Concern (brown-headed nuthatch and prothonotary warbler), it is fortunate that PETE has these habitats and is in a position to extend protection to them.

Seasonal Variation

Breeding Season

There were no species detected that had not been expected at PETE during the breeding season. However, PETE failed to yield a few routine species that had been anticipated: Cooper's hawk, American kestrel, grasshopper sparrow, Kentucky warbler, northern rough-winged swallow, and red-headed woodpecker. Although more common as a nesting species in the mountains, Cooper's hawks have been documented nesting in all regions of the state (Trollinger and Reay 2001), including within just a few kilometers from PETE (Bradshaw, pers. obs.). The species is also a common migrant through the state, as well as a regular wintering species (Kain 1987). It is unusual for this species not to have been observed at one of the PETE units, and it is more likely that it was simply missed. This species probably routinely visits PETE and may well be a nesting species in the future, if not already.

In 2004, three pairs of American kestrels occupied breeding sites at Fort Lee Army Base, directly adjacent to PETE (Bradshaw pers. obs.). Two of those pairs occupied artificial nest boxes. The amount of open grassland at PETE exceeds the amount of suitable foraging area at Fort Lee. It is possible that there are no adequate nest sites in proximity to the foraging areas at PETE, or that the poor grassland quality does not support a viable prey population for the kestrels. Another factor is the availability of observation perches. American kestrels are widely known to use utility lines as perch sites from where they hunt roadside edges and fields (Smallwood and Bird 2002). The main park tour road which transects most of the grassland sites has no overhead lines or poles. Petersburg National Battlefield may not afford suitable sites for nesting or wintering kestrels, but it is still likely that the species will be observed visiting the park, given its year-round presence at neighboring properties.

The grasshopper sparrow is another species that was surprisingly absent. This species prefers moderately open grasslands, usually with patches of bare ground (Vickery 1996). Grasslands with these characteristics at neighboring Fort Lee Army Base contained high densities of grasshopper sparrows (Watts et al 1997). It was absent from PETE, however, and habitat quality

was most likely the cause. Even transects across Fort Gregg, areas composed almost entirely of grassland, yielded no grasshopper sparrows. The high fescue content of all PETE grasslands deprives this species of the bare ground and interstitial openings that it prefers. In addition, the species is at least moderately area-sensitive (Herkert 1994; Vickery et al 1994). This would work against grassland species trying to occupy a marginally sized habitat embedded in a forest-dominated landscape, as the grasslands are at most PETE units. Although the grasshopper sparrow sites at Fort Lee are not larger than those at PETE, they are surrounded by open areas, thereby preserving the open characteristics that facilitate occupation by area-sensitive species (Watts 1996).

In contrast, the Kentucky warbler probably should not have been listed as an expected species. There is almost no bottomland hardwood habitat at PETE, a habitat that is preferred by this species. Where forested wetlands occur in the park, they are normally in narrow corridors along a stream bank, and these are usually not sufficiently large to harbor Kentucky warblers (Gibbs and Faaborg 1990). The species is considered area-sensitive and requires a well developed ground cover and thick understory for nesting (Lynch and Whigham 1984; McDonald 1998). These habitat requirements do not conform to sites at the Eastern Front, and are only marginally available at Five Forks. The Five Forks unit may harbor this species intermittently, but it does not appear to be a regular breeding species there.

Northern rough-winged swallow is a common migrant and breeder throughout the state and is known to breed at several locations along the upper James River (Kain 1987; College of William and Mary, B. Watts, Biologist, pers. comm., 2001). It is surprising that this species was not detected at the City Point unit. The northern rough-winged swallow often migrates far inland from the coast, however, and may not be as prevalent along the coast as are many other swallows (DeJong 1996). It should not be considered a rare species during migration at City Point though, and still should be detected, albeit less frequently, at the other units as well. It was likely missed simply due to inadequate survey effort.

Although there is a small population on the adjacent property of Fort Lee (Bradshaw, pers.obs.), red-headed woodpeckers were not detected at PETE. This species tends to have an affinity for more open habitats and areas free from disturbance (Smith et al 2000). On Fort Lee they occupy a large bottomland hardwood and swamp habitat that is very open and with numerous dead trees. No habitats like this existed at PETE during the survey period. Hurricane Isabel, however, in 2003, was responsible for significant loss of canopy trees at PETE. Park staff estimated at least 6,000 trees downed during the storm (NPS, T. Blumenschine, PETE Resource Manager, pers. comm., 2004). The canopy now has significant openings in many areas and there are more standing dead trees. Although absent during this survey, it is likely that red-headed woodpeckers may have moved into PETE in the intervening years, and may reside there as long as there are pockets of open habitat.

Migration

Surveys during migration were extremely productive at PETE, at least partially due to the dynamics of bird movement along the river at City Point. The significance of this migration survey was the number of species that were observed that had not been expected, most of which were encountered at this riverfront site. Although Forster's terns are usually seen this far up

river, it is uncommon to observe caspian or royal terns (Kain 1987), both of which were detected at City Point. Likewise, Bonaparte's gull is a common migrant along the coast and lower reaches of the major rivers, but is seldom seen as far inland as Hopewell (Kain 1987).

Kain also references merlins as relatively common migrants along the immediate coast, but there are few records of this species in the interior, and it too was detected at City Point. Two other species detected at Grant's Headquarters were warbling vireo and willow flycatcher. Both occur as breeders in the mountains and upper Piedmont and uncommon to rare in migration elsewhere in the state (Trollinger and Reay 2001).

Other unexpected species were three warblers detected in spring migration that are more commonly associated with the Ridge and Valley migration corridor based on their migration origin in the tropics (Faaborg and Terborgh 1980; Degraaf and Rappole 1995). Chestnut-sided warbler and bay-breasted warbler were detected at the Eastern Front during a major migration event in which numerous mixed species of warbler flocks were observed moving through the canopies in early May. A blackburnian warbler was detected in the pine canopies at Five Forks that same week. Broad-winged hawk was the final observed species that had not been anticipated. This species is an uncommon migrant and rare summer resident, especially in the Coastal Plain where there are almost no breeding records (Kain 1987; Trollinger and Reay 2001). They are very secretive and tend to occur in large contiguous mixed forest habitats, typically away from human disturbance (Goodrich et al 1996). One individual was detected at the Eastern Front in September 2003. This species has been observed during breeding season multiple times in recent years in the Coastal Plain (Bradshaw, pers. obs.) and may ultimately nest at PETE.

Cape May warbler was the only expected neotropical migrant that was not detected at PETE. This species winters in the West Indies and would normally be observed in the Coastal Plain in migration, although not commonly (Kain 1987; Degraaf and Rappole 1995; Dunn and Garrett 1997). It likely occurs at one or more PETE units each spring, but would only be detected with intensive migration monitoring.

Winter

The most noticeably absent species from the survey were winter birds, and especially two grassland species common to this region: northern harrier and savannah sparrow. Northern harriers are a common transient and winter resident in Virginia, although their distribution is more common toward the coast (Kain 1987) where the species also nests locally (Watts and Rottenborn 2001). They are seen foraging most often over extensive grasslands and marshes in search of small mammals and birds (MacWhirter and Bildstein 1996). Although the grasslands on the Eastern Front are likely too small to attract this species, the agricultural areas at Five Forks or the grassland at Fort Gregg are both likely areas for harriers to be seen foraging. The species is no doubt uncommon at PETE, but is probably a regular winter visitor at one or more units.

The absence of savannah sparrows is most likely tied to the quality of grassland habitats at PETE. This species requires a mosaic of bare ground with grassy to weedy patches, or open grasslands with lots of interstitial bare ground available (Wheelwright and Rising 1993; Watts

1996). The grasslands at all PETE units are predominantly fescue-dominated, sod forming grasses that generate dense mats of vegetation with virtually no bare ground exposed. Savannah sparrows are present on properties on all sides of PETE that contain open grasslands, and this species could be incorporated into the avifauna of PETE with active grassland management.

The only other conspicuously absent species, which should have been detected at City Point, was ring-necked duck. This species is one of the most abundant winter waterfowl species in this area, with one of the highest counts for the state recorded near Hopewell (Kain 1987; CBC Data). Other waterfowl species that are quite common winter residents in this area include American wigeon, gadwall, and hooded merganser. These species, however, are all most often associated with ponds, marshes, and other shallow water habitats, rather than open river environments (Belrose 1980), and so were not considered expected species at PETE and were not observed.

A final species that was observed, but had not been expected was white-crowned sparrow. Detected at Grant's Headquarters, this species is an uncommon and local winter resident (Kain 1987). Although some of the highest winter counts (57) have occurred on the Hopewell CBC, all of these birds have historically been recorded on the large plantation farms just across the James River from City Point (CBC Data). These properties are rich in hedgerows and shrubby borders which this species prefers (Chilton et al 1995). Although the habitat is appropriate, it was unusual to detect this sparrow along the brushy margins of the City Point unit.

Summary and Management Considerations

In summary, PETE harbors a relatively diverse avifauna, although many of its species are represented by only a few individuals, many of which are associated with relatively small, or unique, habitats. The park's diversity is also hindered by its context within the landscape. The Eastern Front is the largest unit and has the most mature stands of hardwood and pine, in relatively large contiguous blocks. Yet the unit is embedded in a mosaic of residential, commercial, and industrial development; therefore, there is little exchange with species populations from outside properties. Area-sensitive species are poorly represented and the quality of the grasslands is incompatible with most grassland bird species. Conversely, the Five Forks unit is relatively remote, contained in a forest-dominated landscape interspersed with agricultural fields; yet the forests are substantially younger at Five Forks and are predominantly pine-dominated. Most of the significant wetlands are embedded within these young pine stands, so the ability of the unit to express the full compliment of forested wetland species is hampered by the age class and heavy pine composition of the wetlands. Likewise, the agricultural fields are of the size to support grassland species, but they are all still incorporated in an active agricultural program at this time.

These habitat issues notwithstanding, PETE still provides islands of important habitat in an otherwise unprotected or degraded landscape. There are issues, however, that continue to threaten the core of the PETE units that warrant additional discussion.

Encroachment Issues

The Eastern Front unit shares its eastern boundary with Fort Lee Army Base. Although much of the military installation is heavily developed, two of the boundary areas shared with PETE contain extensive forest land. However, under the Congressionally authorized Base Re-alignment and Closure (BRAC) law, Fort Lee has been designated a 'gaining' installation, and will over the next 5 years be making way for dramatic increases in personnel and infrastructure as it takes on missions from other installations (USACE 2007). This is not without consequences for all of its neighbors, not the least of which is Petersburg National Battlefield. Over 161 ha (400 ac) of forest land will be lost on Fort Lee to make way for training and residential housing. Portions of this loss include the bulk of the forest land that shares a boundary with PETE. One of the areas formerly maintained a link between the park and the forested tributaries that lead to the Appomattox River. Another area compromises the existing link between the park and the contiguous forest that connects to the extensive Blackwater Swamp. Although the impacts to biodiversity may be small, they can be significant for a subset of species, primarily those area-dependent species that were already marginalized in the existing habitats at PETE, such as the black-and-white warbler.

The impacts from the BRAC action will not be limited to changes at Fort Lee, however. This event will no doubt spawn intense development within several miles of the area in every direction, from restoration and enhancement of adjacent Petersburg and Hopewell city services to increased residential and commercial development in the surrounding counties (USACE 2007). There is little doubt that the Eastern Front will ultimately be little more than an island habitat surrounded by development. This will precipitate the influx of even more generalist

species into the avifauna of PETE, placing additional competition for nest and roost sites on the existing species. Park staff will need to consider this in the long term management of the park to assess at what point wildlife management issues warrant consideration in the interests of maintaining a historical park. Even if wildlife management is moved to the forefront, there is very little that can be done other than the normal wise management of forests and fields and practicing Best Management Practices around streams and wetlands. Overall, PETE provides a healthy, mature forest and field ecosystem and should continue to maintain a rich avifauna, although it is possible that most area-sensitive forest species may be lost from the system.

This issue is not relevant to Five Forks at this time, but may impact the smaller units that themselves become surrounded by development. The ecological impacts at those sites, however, will be minimal, since most of the other sites are really too small to have a manageable bird community. Grant's Headquarters at City Point should remain unaffected, as it is already in a highly developed area, and as long as the coastal scrub border habitat is maintained around that site, it should continue to provide an excellent stop-over habitat for migrants at the confluence of the two rivers.

Grassland Management

Management of grassland habitats is probably the one area where the largest difference could be made in species diversity and habitat suitability. Conversion of fescue-dominated fields to warm-season, native grasses could yield significant benefits for the avifauna, as well as other taxa. Unfortunately, this is a relatively expensive proposition and, understandably, not a priority when funding is limited, and wildlife management is not a significant part of the park's mission. However, grassland management is not simply about converting fescue to native grasses, but also about evaluating the size and context of grasslands to determine if conversion is even the most useful strategy. Extensive work on grasslands within the mid-Atlantic region has shown that there is a size class below which grasslands are better left to succeed into shrublands for maximum species benefit (Watts et al. 1997). This area tends to be around 6 ha (15 ac). Since most grassland-obligate species tend to be area-sensitive, they derive no benefit from grasslands that fall below that minimum threshold of tolerance. Those fields, therefore, are best left to succeed to the shrub stage where they can harbor a suite of species that is in need of management attention easily as much as are grassland species (Watts 1996; Kearney 2003). Some of the immediate advantages of converting to shrubland are lower maintenance costs due to less frequent maintenance, but there is a cost to park aesthetics, which also must be considered. Appomattox Court House National Historic Park is already involved in implementing some grassland conversion strategies on some of its fields, and with significant success. In addition, Colonial National Historical Park commissioned a study a few years ago to investigate the costs and benefits of grassland conversion and its implications for biodiversity (Watts 2000). This report is available for general distribution and should be considered for guidance if grassland management is to be undertaken.

Invasive Species Control

As with most of the national parks now, there is a renewed interest in controlling and/or eradicating invasive and exotic species. Petersburg National Battlefield has made great strides, especially in controlling some of the more traditional and conspicuous exotic species. Of

concern now is one of the latest additions to Virginia's list of invasive and exotic species as maintained by the Virginia Department of Conservation and Recreation's Division of Natural Heritage—*Microstegium vimineum*, commonly referred to as Nepalese browntop, or Japanese stiltgrass. *Microstegium* is a prolific seed disperser, capable of exploiting disturbed areas more quickly than most native plants. The seeds of this plant are extremely small and are thought to be spread via a multitude of natural and anthropogenic means, from the coats and feet of mammals and birds to the shoes and clothes of pedestrians, automobile tires, wind, and rain. As a result, events such as Hurricane Isabel provide an ideal venue for the spread of *Microstegium* via stump holes and day-lighted areas from downed trees. It occurs and proliferates under more varied environmental conditions than any other invasive species, including all parts of the state, all soils, and almost all hydrologic and sun exposure conditions. The seeds remain viable in the soil for 5 to 7 years making it virtually impossible to eradicate once established (Tu 2000).

Just within the last five years this plant has become noticeable within the park. During this survey it was mostly confined to the road edges and trails, but now has been estimated to cover 16 ha (40 ac) or more of the PETE landscape (NPS, T. Blumenschine, PETE Resource Manager, pers. comm., 2004). No doubt, the spread has been facilitated by the disturbance from Hurricane Isabel in 2003. Of particular concern with *Microstegium* is its effects on biodiversity. It has been shown to displace communities of native plant species but very little information exists on its impacts to wildlife (Barden 1987). Anecdotal evidence suggests that its growth form and tendency to overtake native species may create problems for ground-nesting and foraging birds. The natural resources staff at PETE have undertaken an aggressive effort to attempt to control the spread of, and ultimately eradicate, the species in a few test areas. This is a pioneering effort within the park system and could yield significant benefits if a successful strategy can be developed.

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Appendix A. List of species expected and detected at Petersburg National Battlefield, VA, during inventories in 2003–2004.

#	Species	Taxonomic name	Status	Expected	Detected
1	double-crested cormorant	<i>Phalacrocorax auritus</i>	breeding	expected	detected
2	great blue heron	<i>Ardea herodias</i>	breeding	expected	detected
3	green heron	<i>Butorides virescens</i>	breeding	expected	detected
4	black vulture	<i>Coragyps atratus</i>	breeding	expected	detected
5	turkey vulture	<i>Cathartes aura</i>	breeding	expected	detected
6	Canada goose	<i>Branta canadensis</i>	winter	expected	detected
7	wood duck	<i>Aix sponsa</i>	breeding	expected	detected
8	mallard	<i>Anas platyrhynchos</i>	breeding	expected	detected
9	ring-necked duck	<i>Aythya collaris</i>	winter	expected	not detected
10	lesser scaup	<i>Aythya affinis</i>	winter	expected	detected
11	bufflehead	<i>Bucephala albeola</i>	winter	expected	detected
12	ruddy duck	<i>Oxyura jamaicensis</i>	winter	expected	detected
13	osprey	<i>Pandion haliaetus</i>	breeding	expected	detected
14	bald eagle	<i>Haliaeetus leucocephalus</i>	breeding	expected	detected
15	northern harrier	<i>Circus cyaneus</i>	winter	expected	not detected
16	sharp-shinned hawk	<i>Accipiter striatus</i>	transient	expected	detected
17	Cooper's hawk	<i>Accipiter cooperii</i>	breeding	expected	not detected
18	red-shouldered hawk	<i>Buteo lineatus</i>	breeding	expected	detected
19	broad-winged hawk	<i>Buteo platypterus</i>	transient	not expected	detected
20	red-tailed hawk	<i>Buteo jamaicensis</i>	breeding	expected	detected
21	American kestrel	<i>Falco sparverius</i>	breeding	expected	not detected
22	merlin	<i>Falco columbarius</i>	transient	not expected	detected
23	wild turkey	<i>Meleagris gallopavo</i>	breeding	expected	detected
24	northern bobwhite	<i>Colinus virginianus</i>	breeding	expected	detected
25	killdeer	<i>Charadrius vociferus</i>	breeding	expected	detected
26	spotted sandpiper	<i>Actitis macularia</i>	breeding	expected	detected
27	American woodcock	<i>Scolopax minor</i>	transient	expected	detected
28	laughing gull	<i>Larus atricilla</i>	breeding	expected	detected
29	Bonaparte's gull	<i>Larus philadelphia</i>	transient	not expected	detected
30	ring-billed gull	<i>Larus delawarensis</i>	winter	expected	detected
31	herring gull	<i>Larus argentatus</i>	winter	expected	detected
32	great black-backed gull	<i>Larus marinus</i>	winter	expected	detected
33	caspian tern	<i>Sterna caspia</i>	transient	not expected	detected
34	royal tern	<i>Sterna maxima</i>	transient	not expected	detected
35	Forster's tern	<i>Sterna forsteri</i>	transient	expected	detected
36	mourning dove	<i>Zenaida macroura</i>	breeding	expected	detected
37	yellow-billed cuckoo	<i>Coccyzus americanus</i>	breeding	expected	detected
38	eastern screech owl	<i>Otus asio</i>	breeding	expected	detected
39	great horned owl	<i>Bubo virginianus</i>	breeding	expected	detected
40	barred owl	<i>Strix varia</i>	breeding	expected	detected
41	chimney swift	<i>Chaetura pelagica</i>	breeding	expected	detected
42	ruby-throated hummingbird	<i>Archilochus colubris</i>	breeding	expected	detected
43	belted kingfisher	<i>Ceryle alcyon</i>	breeding	expected	detected
44	red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	breeding	expected	not detected
45	red-bellied woodpecker	<i>Melanerpes carolinus</i>	breeding	expected	detected
46	yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	winter	expected	detected
47	downy woodpecker	<i>Picoides pubescens</i>	breeding	expected	detected
48	hairy woodpecker	<i>Picoides villosus</i>	breeding	expected	detected
49	northern flicker	<i>Colaptes auratus</i>	breeding	expected	detected
50	pileated woodpecker	<i>Dryocopus pileatus</i>	breeding	expected	detected
51	eastern wood-pewee	<i>Contopus virens</i>	breeding	expected	detected
52	yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	transient	expected	detected
53	Acadian flycatcher	<i>Empidonax virescens</i>	breeding	expected	detected
54	willow flycatcher	<i>Empidonax traillii</i>	transient	not expected	detected
55	eastern phoebe	<i>Sayornis phoebe</i>	breeding	expected	detected

Appendix A. List of species expected and detected at Petersburg National Battlefield, VA, during inventories in 2003–2004 (continued).

#	Species	Taxonomic name	Status	Expected	Detected
56	great crested flycatcher	<i>Myiarchus crinitus</i>	breeding	expected	detected
57	eastern kingbird	<i>Tyrannus tyrannus</i>	breeding	expected	detected
58	white-eyed vireo	<i>Vireo griseus</i>	breeding	expected	detected
59	yellow-throated vireo	<i>Vireo flavifrons</i>	breeding	expected	detected
60	blue-headed vireo	<i>Vireo solitarius</i>	transient	expected	detected
61	warbling vireo	<i>Vireo gilvus</i>	transient	not expected	detected
62	red-eyed vireo	<i>Vireo olivaceus</i>	breeding	expected	detected
63	blue jay	<i>Cyanocitta cristata</i>	breeding	expected	detected
64	American crow	<i>Corvus brachyrhynchos</i>	breeding	expected	detected
65	fish crow	<i>Corvus ossifragus</i>	breeding	expected	detected
66	purple martin	<i>Progne subis</i>	breeding	expected	detected
67	tree swallow	<i>Tachycineta bicolor</i>	transient	expected	detected
68	northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	breeding	expected	not detected
69	barn swallow	<i>Hirundo rustica</i>	breeding	expected	detected
70	Carolina chickadee	<i>Poecile carolinensis</i>	breeding	expected	detected
71	tufted titmouse	<i>Baeolophus bicolor</i>	breeding	expected	detected
72	white-breasted nuthatch	<i>Sitta carolinensis</i>	breeding	expected	detected
73	brown-headed nuthatch	<i>Sitta pusilla</i>	breeding	expected	detected
74	brown creeper	<i>Certhia americana</i>	winter	expected	detected
75	Carolina wren	<i>Thryothorus ludovicianus</i>	breeding	expected	detected
76	house wren	<i>Troglodytes aedon</i>	breeding	expected	detected
77	winter wren	<i>Troglodytes troglodytes</i>	winter	expected	detected
78	golden-crowned kinglet	<i>Regulus satrapa</i>	winter	expected	detected
79	ruby-crowned kinglet	<i>Regulus calendula</i>	winter	expected	detected
80	blue-gray gnatcatcher	<i>Polioptila caerulea</i>	breeding	expected	detected
81	eastern bluebird	<i>Sialia sialis</i>	breeding	expected	detected
82	Swainson's thrush	<i>Catharus ustulatus</i>	transient	expected	detected
83	hermit thrush	<i>Catharus guttatus</i>	winter	expected	detected
84	wood thrush	<i>Hylocichla mustelina</i>	breeding	expected	detected
85	American robin	<i>Turdus migratorius</i>	breeding	expected	detected
86	gray catbird	<i>Dumetella carolinensis</i>	breeding	expected	detected
87	northern mockingbird	<i>Mimus polyglottos</i>	breeding	expected	detected
88	brown thrasher	<i>Toxostoma rufum</i>	breeding	expected	detected
89	European starling	<i>Sturnus vulgaris</i>	breeding	expected	detected
90	cedar waxwing	<i>Bombycilla cedrorum</i>	breeding	expected	detected
91	northern parula	<i>Parula americana</i>	breeding	expected	detected
92	yellow warbler	<i>Dendroica petechia</i>	breeding	expected	detected
93	chestnut-sided warbler	<i>Dendroica pensylvanica</i>	transient	not expected	detected
94	magnolia warbler	<i>Dendroica magnolia</i>	transient	expected	detected
95	Cape May warbler	<i>Dendroica tigrina</i>	transient	expected	not detected
96	black-throated blue warbler	<i>Dendroica caerulescens</i>	transient	expected	detected
97	yellow-rumped warbler	<i>Dendroica coronata</i>	transient	expected	detected
98	black-throated green warbler	<i>Dendroica virens</i>	transient	expected	detected
99	blackburnian warbler	<i>Dendroica fusca</i>	transient	not expected	detected
100	yellow-throated warbler	<i>Dendroica dominica</i>	breeding	expected	detected
101	pine warbler	<i>Dendroica pinus</i>	breeding	expected	detected
102	prairie warbler	<i>Dendroica discolor</i>	breeding	expected	detected
103	palm warbler	<i>Dendroica palmarum</i>	transient	expected	detected
104	bay-breasted warbler	<i>Dendroica castanea</i>	transient	not expected	detected
105	blackpoll warbler	<i>Dendroica striata</i>	transient	expected	detected
106	black-and-white warbler	<i>Mniotilta varia</i>	breeding	expected	detected
107	American redstart	<i>Setophaga ruticilla</i>	breeding	expected	detected
108	prothonotary warbler	<i>Protonotaria citrea</i>	breeding	expected	detected
109	ovenbird	<i>Seiurus aurocapillus</i>	breeding	expected	detected
110	northern waterthrush	<i>Seiurus noveboracensis</i>	transient	expected	detected

Appendix A. List of species expected and detected at Petersburg National Battlefield, VA, during inventories in 2003–2004 (continued).

#	Species	Taxonomic name	Status	Expected	Detected
111	Louisiana waterthrush	<i>Seiurus motacilla</i>	breeding	expected	detected
112	Kentucky warbler	<i>Oporornis formosus</i>	breeding	expected	not detected
113	common yellowthroat	<i>Geothlypis trichas</i>	breeding	expected	detected
114	hooded warbler	<i>Wilsonia citrina</i>	breeding	expected	detected
115	yellow-breasted chat	<i>Icteria virens</i>	breeding	expected	detected
116	summer tanager	<i>Piranga rubra</i>	breeding	expected	detected
117	scarlet tanager	<i>Piranga olivacea</i>	breeding	expected	detected
118	eastern towhee	<i>Pipilo erythrophthalmus</i>	breeding	expected	detected
119	chipping sparrow	<i>Spizella passerina</i>	breeding	expected	detected
120	field sparrow	<i>Spizella pusilla</i>	breeding	expected	detected
121	savannah sparrow	<i>Passerculus sandwichensis</i>	winter	expected	not detected
122	grasshopper sparrow	<i>Ammodramus savannarum</i>	breeding	expected	not detected
123	fox sparrow	<i>Passerella iliaca</i>	winter	expected	detected
124	song sparrow	<i>Melospiza melodia</i>	breeding	expected	detected
125	swamp sparrow	<i>Melospiza georgiana</i>	winter	expected	detected
126	white-throated sparrow	<i>Zonotrichia albicollis</i>	winter	expected	detected
127	white-crowned sparrow	<i>Zonotrichia leucophrys</i>	winter	not expected	detected
128	dark-eyed junco	<i>Junco hyemalis</i>	winter	expected	detected
129	northern cardinal	<i>Cardinalis cardinalis</i>	breeding	expected	detected
130	blue grosbeak	<i>Guiraca caerulea</i>	breeding	expected	detected
131	indigo bunting	<i>Passerina cyanea</i>	breeding	expected	detected
132	red-winged blackbird	<i>Agelaius phoeniceus</i>	breeding	expected	detected
133	eastern meadowlark	<i>Sturnella magna</i>	breeding	expected	detected
134	common grackle	<i>Quiscalus quiscula</i>	breeding	expected	detected
135	brown-headed cowbird	<i>Molothrus ater</i>	breeding	expected	detected
136	orchard oriole	<i>Icterus spurius</i>	breeding	expected	detected
137	house finch	<i>Carpodacus mexicanus</i>	breeding	expected	detected
138	American goldfinch	<i>Carduelis tristis</i>	breeding	expected	detected
139	house sparrow	<i>Passer domesticus</i>	breeding	expected	detected

Appendix B. UTM coordinates (NAD83) and description of habitat context of avian survey point locations at Petersburg National Battlefield, VA, 2003–2004.

PT #	Unit	X Coordinate	Y Coordinate	Habitat
1	Eastern Front	4124591	291059	grassland
2	Eastern Front	4124584	290869	early successional
3	Eastern Front	4123873	290785	mature deciduous forest
4	Eastern Front	4123679	290563	forested wetland
5	Eastern Front	4123531	290787	mature mixed forest
6	Eastern Front	4123117	290204	forested wetland
7	Eastern Front	4123212	289927	mature pine forest
8	Eastern Front	4123041	289741	grassland
9	Eastern Front	4123057	289414	pine savanna
10	Eastern Front	4122062	289656	scrub/shrub
11	Eastern Front	4121765	289470	grassland
12	Eastern Front	4121702	288973	pine savanna
13	Eastern Front	4121932	289877	mature mixed forest
14	Eastern Front	4121550	289763	pine plantation
15	Eastern Front	4122179	290021	mature deciduous forest
16	Eastern Front	4122506	290499	forested wetland
17	Eastern Front	4123054	291080	pine plantation
18	Eastern Front	4123084	291371	pine plantation
19	Eastern Front	4123285	291651	pine plantation
20	Eastern Front	4123031	291747	scrub/shrub
21	Eastern Front	4122646	291190	forested wetland
22	Eastern Front	4122780	291597	pine plantation
23	Eastern Front	4122571	289706	mature mixed forest
24	Eastern Front	4121944	288853	pine plantation
25	Five Forks	4113747	267651	pine plantation
26	Five Forks	4114015	267752	pine plantation
27	Five Forks	4114435	267557	forested wetland
28	Five Forks	4114825	267559	forested wetland
29	Five Forks	4115084	267734	emergent wetland
30	Five Forks	4113472	267735	forested wetland
31	Five Forks	4113595	267886	mature mixed forest
32	Five Forks	4113014	267154	mature mixed forest
33	Five Forks	4113253	267516	mature mixed forest
34	Five Forks	4113521	266137	mature mixed forest
35	Five Forks	4113751	266295	pine plantation

Appendix C. Species list and conservation status of birds detected at Petersburg National Battlefield during inventories in 2003–2004.

#	Species	Migration Status	Fed.	State	PIF Score
1	double-crested cormorant	temperate migrant			
2	great blue heron	temperate migrant			
3	green heron	neotropical migrant			20
4	Canada goose	temperate migrant			
5	wood duck	temperate migrant			
6	mallard	temperate migrant			
7	lesser scaup	temperate migrant			
8	bufflehead	temperate migrant			
9	ruddy duck	temperate migrant			
10	turkey vulture	neotropical migrant			
11	black vulture	neotropical migrant			
12	sharp-shinned hawk	temperate migrant			
13	red-shouldered hawk	temperate migrant			
14	broad-winged hawk	neotropical migrant			
15	red-tailed hawk	temperate migrant			
16	bald eagle	resident		LT	
17	osprey	neotropical migrant			
18	merlin	neotropical migrant			
19	northern bobwhite	resident			20
20	wild turkey	resident			
21	killdeer	temperate migrant			
22	spotted sandpiper	neotropical migrant			
23	American woodcock	temperate migrant			23
24	Bonaparte's gull	temperate migrant			
25	laughing gull	temperate migrant			
26	ring-billed gull	temperate migrant			
27	herring gull	temperate migrant			
28	great black-backed gull	temperate migrant			
29	Caspian tern	neotropical migrant		SC	
30	royal tern	neotropical migrant			
31	Forster's tern	neotropical migrant		SC	
32	mourning dove	temperate migrant			
33	yellow-billed cuckoo	neotropical migrant			
34	great horned owl	resident			
35	barred owl	resident			
36	eastern screech owl	resident			20
37	chimney swift	neotropical migrant			20
38	ruby-throated hummingbird	neotropical migrant			
39	belted kingfisher	temperate migrant			
40	red-bellied woodpecker	resident			
41	yellow-bellied sapsucker	temperate migrant			
42	downy woodpecker	resident			
43	hairy woodpecker	resident			
44	northern flicker	temperate migrant			
45	pileated woodpecker	resident			
46	eastern wood-pewee	neotropical migrant			22
47	Acadian flycatcher	neotropical migrant			23
48	yellow-bellied flycatcher	neotropical migrant			
49	willow flycatcher	neotropical migrant			18
50	eastern phoebe	neotropical migrant			

Appendix C. Species list and conservation status of birds detected at Petersburg National Battlefield during inventories in 2003–2004 (continued).

#	Species	Migration Status	Fed.	State	PIF Score
51	great crested flycatcher	neotropical migrant			
52	eastern kingbird	neotropical migrant			
53	red-eyed vireo	neotropical migrant			
54	warbling vireo	neotropical migrant			
55	white-eyed vireo	neotropical migrant			22
56	yellow-throated vireo	neotropical migrant			23
57	blue-headed vireo	neotropical migrant			
58	blue jay	temperate migrant			
59	American crow	resident			
60	fish crow	resident			
61	purple martin	neotropical migrant			
62	tree swallow	neotropical migrant			
63	barn swallow	neotropical migrant			
64	tufted titmouse	resident			
65	Carolina chickadee	resident			
66	white-breasted nuthatch	resident			
67	brown-headed nuthatch	resident	BCC		23
68	brown creeper	temperate migrant		SC	
69	Carolina wren	resident			
70	house wren	temperate migrant			
71	winter wren	temperate migrant		SC	
72	golden-crowned kinglet	temperate migrant		SC	
73	ruby-crowned kinglet	temperate migrant			
74	blue-gray gnatcatcher	neotropical migrant			
75	eastern bluebird	temperate migrant			
76	American robin	temperate migrant			
77	wood thrush	neotropical migrant	BCC		25
78	Swainson's thrush	neotropical migrant			
79	hermit thrush	temperate migrant		SC	
80	gray catbird	temperate migrant			
81	northern mockingbird	resident			
82	brown thrasher	temperate migrant			
83	European starling	resident			
84	cedar waxwing	temperate migrant			
85	northern parula	neotropical migrant	BCC		
86	yellow warbler	neotropical migrant			
87	chestnut-sided warbler	neotropical migrant			
88	magnolia warbler	neotropical migrant		SC	
89	black-throated blue warbler	neotropical migrant			
90	blackburnian warbler	neotropical migrant			
91	yellow-rumped warbler	temperate migrant			
92	black-throated green warbler	neotropical migrant	BCC		
93	prairie warbler	neotropical migrant	BCC		25
94	palm warbler	temperate migrant			
95	pine warbler	temperate migrant			
96	bay-breasted warbler	neotropical migrant	BCC		
97	blackpoll warbler	neotropical migrant			
98	yellow-throated warbler	neotropical migrant			
99	prothonotary warbler	neotropical migrant	BCC		22
100	black-and-white warbler	neotropical migrant			

Appendix C. Species list and conservation status of birds detected at Petersburg National Battlefield during inventories in 2003–2004 (continued).

#	Species	Migration Status	Fed.	State	PIF Score
101	American redstart	neotropical migrant			
102	ovenbird	neotropical migrant			
103	northern waterthrush	neotropical migrant			
104	Louisiana waterthrush	neotropical migrant			21
105	common yellowthroat	temperate migrant			
106	hooded warbler	neotropical migrant			
107	yellow-breasted chat	neotropical migrant			
108	summer tanager	neotropical migrant			
109	scarlet tanager	neotropical migrant			22
110	northern cardinal	resident			
111	blue grosbeak	neotropical migrant			
112	indigo bunting	neotropical migrant			
113	eastern towhee	temperate migrant			19
114	field sparrow	temperate migrant			20
115	chipping sparrow	temperate migrant			
116	white-throated sparrow	temperate migrant			
117	white-crowned sparrow	temperate migrant			
118	fox sparrow	temperate migrant			
119	song sparrow	temperate migrant			
120	swamp sparrow	temperate migrant			
121	dark-eyed junco	temperate migrant			
122	eastern meadowlark	temperate migrant			
123	brown-headed cowbird	temperate migrant			
124	red-winged blackbird	temperate migrant			
125	common grackle	temperate migrant			
126	orchard oriole	neotropical migrant			
127	house finch	resident			
128	American goldfinch	temperate migrant			
129	house sparrow	resident			

Abbreviations:

Fed.= Federal list of threatened and endangered species

State=State list of threatened and endangered species

SC = Special Concern

LT=Listed Threatened

BCC = Birds of Conservation Concern

PIF Score = Partners in Flight conservation score; species with scores higher than 20 are considered to be of high conservation concern within the continent or the region.

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-099 March 2008

National Park Service
U.S. Department of the Interior



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