

I. Introduction

Birds are a significant part of our nation's natural heritage as well as an important component of the fauna of our nation's natural areas. Bird species play a vital role in the complex functioning of our natural world. The presence or absence of some specific bird species or species assemblages within particular natural communities can be an indicator of the overall ecological health of these communities. Therefore, an accurate baseline inventory of bird species is an important tool for use by natural resource managers when making land management and wildlife conservation decisions. Baseline bird inventory data is also important for use in educating the public about our natural areas. This study provides the results of an initial baseline inventory of the birds found at one unit of the national park system: Ninety Six National Historic Site (NISI).

Ninety Six National Historic Site is located approximately 3 miles south of the town of Ninety Six, South Carolina (Figure 1). The unit is approximately 400 hectares or 988 acres in size (Figure 2). The site was protected by the National Park Service due to its national historic significance as a village, fort and important battle site of the American Revolution. Though protected for its cultural significance, the park unit protects many acres of natural resource significance.

The park unit is located within the Southern Piedmont physiographic region of South Carolina as designated by the national Partners in Flight program (Figure 3). The park

protects a diverse variety of habitats including: riparian / bottomland hardwood forest, mesic-mixed hardwood forest, oak-hickory forest, mixed pine hardwood forest, pine plantation, agricultural fields /maintained grassy areas and a small (11 ha.) lake and its associated wetland. A very good diversity of birds inhabit this park unit due in part to the fact that the overall unit is not fragmented and that the diversity of habitat types present are still in a relatively natural state.

II. Methods

An inventory of the birds at this park unit was conducted during two breeding seasons and two winter seasons beginning in June 2004 and ending in February 2006. The primary goal of the inventory was to provide data on the presence, status and relative abundance of bird species during the winter season and the breeding season and to provide data that relates the distribution of breeding bird species to the various habitat types within the unit. An attempt was made to document 90% of the bird species present during each season. Data was collected on all incidental species encountered during each park visit and all data was utilized to prepare an updated checklist of birds for the park unit. Inventory methods utilized conform to priority items #1 and #2 as specified by the National Park Service in the “Scope of Work” for “Bird Inventories of National Parks in the Cumberland Piedmont and Appalachian Highlands Networks”. Table 1 provides the dates of all work conducted as part of this inventory.

Breeding Season Point Counts

Breeding season point counts were conducted at fifteen 50 m radius circular plots placed at least 250 meters apart (Figure 4 and Figure 5). These plots were pre-established as 1 ha. plant community sampling plots for a detailed vegetation survey conducted by the University of Georgia. The plots represent an approximate grid density of 1 sample point per 27 ha. The plots were established in each major habitat type within the park unit. Plot locations were located with a Garmin eTrex GPS receiver during initial site visits each year. The center of each plot is identified by a numbered metal tag placed on a tree and the tagged trees were flagged once each year, when initially located, so they could be used for quick visual reference on data collection mornings. All flagging used was later removed. GPS coordinates and primary vegetation cover for all plots are shown in Figure 6.

Plots were sampled at least twice during each of two breeding seasons: June 2004 and June 2005. Counts were conducted at least two weeks apart to provide for better sampling. Counts were conducted only under acceptable weather conditions. Count days began at sunrise and all required counts were completed before 10:15 am EST. Each count was conducted for a ten minute interval recording all birds heard or seen during three time periods: 0-3 minutes, 3-5 minutes, and 5-10 minutes. Each individual bird was recorded on a “bulls-eye” data sheet (Figure 7) and each individual’s distance was estimated from the point center and recorded. To provide better distance estimates from the center point, initial 25m, 50m, and 100m reference points were determined in the field using a Nikon

Laser800 rangefinder (8x28) on points where the vegetation allowed. The sampling route was altered for the second count period each year to allow for better sampling. It was impossible for one person to conduct point counts at each of the 16 plots within the allotted time frame because the plots are located far apart and there is no vehicle access to many of the points. Therefore, a two person team was used to collect point count data and the points were divided between them. Having two observers also helped to reduce observer bias.

Winter Bird Inventory

Non-structured, unconstrained surveys were conducted for bird species during the winter seasons. At least one survey was conducted in December 2004, January 2005, February 2005, December 2005, January 2006, and February 2006. Observers explored each habitat type in the park and documented all bird species present. Optional transect methods recommended to survey for grassland bird species were not utilized due to the nature of the field habitats present at NISI. Robin Carter (author of *Finding Birds in South Carolina*) provided additional data from bird counts he conducted at NISI during this time frame, for inclusion in this report.

III. Results

Breeding Season Summary

Several descriptive statistics were calculated from the point count data collected and the results are presented below. A detailed statistical analysis of the data was not performed as this was beyond the scope of this report. However, a large enough sample size was collected for a more in depth statistical analysis to be conducted. The descriptive statistics presented below are based on an unlimited radius, but specific distance from center point data was collected and this data could be used to compare with data from future studies in order to help provide insight into changes in both species composition and relative abundance over time. It should be remembered that point count data is sampling data and as such these data are not meant to be equated with census data. Both species and individuals can be missed when the sample is taken.

Observed Versus Expected Species Diversity

A total of 37 point counts were conducted during the breeding season at NISI in 2004. A total of seven (19%) additional counts were conducted beyond the 30 required counts to help provide additional breeding species data. A total of 30 point counts were conducted during the breeding season in 2005 resulting in a total of 67 point counts conducted during the two year sampling period. All additional “incidental” birds encountered away from

point circles while traveling to and from the points were also recorded and these data were included in the observation data summary and added to the park checklist as needed. A total of 64 species and 944 individuals were documented during these breeding season point counts (Table 2).

According to the *South Carolina Breeding Bird Atlas* (John Cely, SCWMRD, 2003), 92 bird species are possible, probable or confirmed as breeders in Greenwood County. Of these 92 species, approximately 87 species may be expected to be documented as breeding species in this park unit. This is due to a variety of factors including an absence of specific breeding habitat, limitations in habitat type, size, or quality, or due to the species' being an irregular or inconsistent breeder in this area. Refer to Table 2a for a complete list of all expected breeding bird species within this park unit. In addition to the 64 species documented on point counts, seven species were recorded as incidental species detections for a total of 72 species detected during the breeding season. The total of species observed represents 83% of the 87 expected breeding species at the park unit.

Detections by Plot

Plot data is summarized in Table 3. The total number of species detected at individual plots in 2004 ranged from 10 species detected at plot 13 to 27 species detected at plot 9. The total number of species detected at individual plots in 2005 ranged from 10 species detected at plot 15 to 24 species detected at plot 9. A comparison of plot sampling between

the two sampling years shows a decline of one (8%) in the mean number of species from 2004 to 2005. This difference could be the result of weather factors that were present in 2005 when rain stopped data collection and the remainder of the points had to be surveyed on a new day.

The mean number of species detected per plot (rounded to a whole number) was 15 in 2004 and 13 in 2005. This indicates a decline of 2 (14%) in the mean number of individuals detected per plot between the two sampling years. Again, this difference may simply be due to the impact of precipitation on sampling in 2005.

Detection by Species

Data showing the distribution of individual species by plot is presented in Table 4. The five most widely distributed species, each detected on 100% of the plots, were: Carolina Wren, Northern Cardinal, Red-bellied Woodpecker, Red-eyed Vireo, and Tufted Titmouse. American Crow, Northern Parula, and Yellow-billed Cuckoo were each detected at 94% of all plots. Acadian Flycatcher and Blue-gray Gnatcatcher were detected at 87% of the plots. Breeding and foraging habitats for each of these 10 species is common throughout the park unit.

Sixteen species were detected at only one plot each on point counts: American Robin, Barred Owl, Black Vulture, Brown Thrasher, Chimney Swift, Common Yellowthroat,

Eastern Bluebird, Eastern Phoebe, Green Heron, Grasshopper Sparrow, Northern Mockingbird, Ovenbird, Swainson's Warbler, Wild Turkey, Wood Duck, and Yellow-breasted Chat. Black Vulture and Chimney Swift were flyovers and are not necessarily associated with the plot sampled. Barred Owl and Wild Turkey are difficult to sample using point counts. Habitat for Common Yellowthroat, Grasshopper Sparrow, Green Heron, Wood Duck and Yellow-breasted Chat is limited to Star Fort Pond and the fields surrounding this pond. American Robin, Brown Thrasher, Eastern Bluebird, Eastern Phoebe, Northern Mockingbird and Ovenbird should each be expected to have a wider distribution within the park unit than this sampling data suggests, because there is plenty of breeding habitat available for these species here. Swainson's Warbler was an excellent find for this park unit. Breeding habitat is present for this rare Piedmont nesting species, but only one bird was found here during one sampling year and it is possible that this bird could have been a late migrant. Future attention should be made to further document the breeding status of this species in and around plot #7.

Relative Association with Habitat Types

In Table 5, plots were assessed and grouped by their dominant plant community type and each bird species detected on a breeding season point count plot was ranked as to its relative association with each dominant plant community type within the park unit.

Distribution of species is consistent with the distribution that would be expected in the Piedmont of the Carolinas. Statistical analysis of the distance data collected would help provide more precision to these species / habitat associations. While most associations are

obvious, it is important to look at the data with an understanding of the habitats adjacent to each point and that birds detected on plots at 100m or more away from the center point may be primarily associated with the habitat of a different primary plant community type. It is also important to note that some of the plots sampled within this park unit are in successional transition.

Additional Results

Breeding species possibly expected but not detected include: Cooper's Hawk, Broad Winged Hawk, Killdeer, Rock Pigeon, Great Horned Owl, Chuck-will's-widow, Whip-poor-will, Loggerhead Shrike, Blue-headed Vireo, Northern Rough-winged Swallow, House Wren, European Starling, Prairie Warbler, Black-and-white Warbler, Red-winged Blackbird, House Finch, and House Sparrow.

Breeding habitat is available for both Cooper's Hawk and Broad-winged Hawk but neither may breed here. Cooper's Hawks are rare as breeders in South Carolina and are often hard to detect during the breeding season. The nesting distribution of the Broad-winged Hawk is described as "spotty" in the South Carolina Piedmont (Cely, 2003).

Great Horned Owl, Chuck-will's-widow, and Whip-poor-will are nocturnal species that are poorly detected by point counts. Great Horned Owl was documented in the winter so it should be present as a breeder. The two nightjars are both possible breeders here. A

nocturnal calling survey should be conducted to confirm these species presence. Killdeer was also only documented in the winter months. It requires short grass, rocky areas, or bare ground habitat which is limited in the park, but this habitat is present in the surrounding area.

Each of the following species has appropriate habitat available within the park unit but the extent of the habitat is limited and the species distribution in this region is “spotty” so therefore, the species may or may not breed here: Loggerhead Shrike, Blue-headed Vireo, Northern Rough-winged Swallow, House Wren, Black-and-white Warbler and Red-winged Blackbird. Both Prairie Warbler and House Finch should be expected as a breeding species here and they were probably just missed during the sampling.

European Starling, House Sparrow and Rock Pigeon are all non-native species that breed throughout South Carolina. House Sparrows have been in decline and may breed in town but not within the park. Rock Pigeons require ledges and crevices for communal nesting and little – if any - of that is available here. European Starlings should be expected to nest within the park boundaries or very nearby.

Breeding Season Abundance

The relative abundance of each species present during breeding season was determined after referencing the maximum relative abundance of the species as tallied in the Observation Summary section. Relative abundance codes were established and were included on the final Checklist of Birds compiled for the park unit.

Winter Season Summary

Surveys to detect winter birds were conducted on December 4, 2004, January 17, 2005, February 6, 2005, December 4, 2005, January 8, 2006, and February 12, 2006. Additional surveys were conducted by Robin Carter on October 30, 2004, November 15, 2004, and January 15, 2005 and he has generously offered his data for inclusion in this report. All winter data is included in the Observation Summary section. The diversity of winter bird species documented is consistent with the diversity that is to be expected in these habitat types within the Carolina Piedmont during the winter season.

Approximately 59 species of birds can be anticipated here during the winter. A total of 49 species were documented during the winter surveys. Therefore, 84% of the expected winter species were documented.

Very few species of birds were documented in the deep forest areas during the winter. Most species were found along the forest edges and in the grass and shrub habitats present

throughout the park unit and a good variety of birds was always found in and around Star Fort Pond.

Star Fort Pond harbored many waterbirds and waterfowl species including: Pied-billed Grebe, Great Blue Heron, Canada Goose, Wood Duck, Mallard, Blue-winged Teal, Redhead, Ring-necked Duck, both Greater and Lesser Scaup, Bufflehead, Hooded Merganser, Ruddy Duck, American Coot, and Belted Kingfisher. A Northern Harrier was documented hunting the fields around the pond during January 2005.

Red-shouldered Hawks, Red-tailed Hawks, and Black and Turkey Vultures were found soaring over the forest and hunting or scavenging the fields every day. American Crows and Blue Jays were numerous throughout the unit during the winter as well. Wild Turkey were regular in winter, but Northern Bobwhite was not found.

Mixed flocks of common species such as: Carolina Chickadee, Tufted Titmouse, Golden-crowned and Ruby Crowned Kinglets, and Yellow-rumped Warblers were common with an occasional Brown Creeper joining them or a solitary Hermit Thrush in the ground cover nearby. Northern Cardinal, American Goldfinch, American Robin, Eastern Bluebird, Cedar Waxwing, and Carolina Wren were abundant as well. Eastern Phoebe was regular in low numbers. Surprisingly, Mourning Doves were not well represented in the winter data. Blue-headed Vireos were regular in the 2005-2006 winter season. Brown-headed Nuthatches were common, while only a single White-breasted Nuthatch was found. Red-

breasted Nuthatches, an irruptive species were regularly documented during the winter of 2004-2005, but they were not found at all during the winter of 2005-2006.

Seven species of woodpeckers were regularly found during the winter: Red-headed Woodpecker, Red-bellied Woodpecker, Yellow-bellied Sapsucker, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, and Pileated Woodpecker. Red-headed Woodpeckers were most often found in the pine plantations east of Star Fort.

Mixed sparrow flocks made up predominately of White-throated Sparrow, Song Sparrow, Chipping Sparrow, Field Sparrow, Dark-eyed Junco, and Eastern Towhee were common throughout brushy areas within the park unit. Individual Fox Sparrows were confirmed once each in 2004 and 2005. Swamp Sparrows were not as numerous as the other sparrows, but they are certainly present each winter in limited numbers. Savannah Sparrows were numerous in the fields around Star Fort Pond and Vesper Sparrows are a possibility in these fields in the winter as well. Management activities should strive to increase the quality of native grass habitat present within these fields. Mixed flocks of blackbirds including Red-winged Blackbird, Common Grackle, European Starling, and Brown-headed Cowbird frequently visit these fields in winter as well. Rusty Blackbirds were documented twice. This species is in severe decline throughout the country and the forested wetland habitat utilized by this species here in the winter is becoming increasingly rare and it should be protected.

IV. Discussion and Recommendations

A total of 137 species of birds have now been documented within the boundaries of Ninety Six National Historic Site. This represents an increase of 19 species (~16%) from the original park list compiled by Rusty Wilson and members of the Carolina Bird Club.

Species of Conservation Concern

Thirty-one species of birds of conservation concern have been documented at NISI (Table 6). The majority of these conservation sensitive species should persist within the boundaries of this park unit with some attention by management staff to their specific management concerns.

Wood Thrush, Yellow-billed Cuckoo, Eastern Wood-Pewee, Acadian Flycatcher, Kentucky Warbler, Hooded Warbler, Louisiana Waterthrush, Swainson's Warbler, Yellow-throated Vireo, and Rusty Blackbird would each benefit from leaving the mature forested areas and riparian corridors intact, unfragmented and free from invasive-exotic plant species.

Pine Warbler, Brown Thrasher, Eastern Kingbird, Field Sparrow, Grasshopper Sparrow, Blue Grosbeak, and Indigo Bunting all rely primarily on early successional habitat for breeding. This habitat type is restricted to the fields around Star Fort pond. It is recommended that no cutting of the fields should be allowed during the breeding season,

approximately April 15 through the end of July, to insure successful breeding recruitment. Otherwise, the current field maintenance regime should be maintained.

Cavity-nesting species of conservation concern present at NISI include: Chimney Swift, Red-headed Woodpecker, Northern Flicker, Carolina Chickadee, Brown-headed Nuthatch, and Prothonotary Warbler. These species would benefit from the placement of artificial nest boxes in appropriate habitat throughout the park unit.

The presence of egg eating predators including raccoons and skunks and the presence of fire ant colonies that attack hatchlings, both can negatively impact the breeding recruitment of the ground nesting bird species present at NISI. Ground nesting species present here include Northern Bobwhite, Whip-poor-will, Chuck-will's-widow, and Eastern Meadowlark. Management of fire ant colonies should be implemented. Management of nest predators like raccoons and skunks, may be warranted if it is determined that there is an over abundance of these species present.

Little Blue Heron was documented during the summer of 2004 and not during the summer of 2005. Individuals of this and other colonial waterbird species disperse inland after breeding ("post-breeding dispersal") and they do not necessarily require specific management attention. Worm-eating Warbler was only documented during migration. The stopover habitat on which it relies should be present without specific management changes.

Note: Common Grackle and Blue Jay are listed as being of conservation concern not because they need management attention, but because of the negative impacts they have on the species needing conservation assistance.

Problems Encountered

No major problems were encountered during this inventory. The weather impacted data collection on one breeding season day. Point counts were started at sunrise on June 19, 2005 after a night of rain, but they were discontinued after rain began to fall again during the morning. The rest of the point counts were later successfully completed on June 24, 2005. The only data gap evident for this breeding season and winter season inventory is the lack of data on nocturnal bird species.

The inventory was limited in scope due to the limitations of funding provided. More sampling days would provide a better assessment of the species present.

Recommendations for Further Study

In order for the inventory to be complete, fieldwork needs to be conducted during both spring and fall to add species that regularly use the park units as stopover habitat during migration. It is recommended that funding be procured for this field work so that a complete year round sample of the avifauna utilizing habitats within the park can be obtained.