



Landbird Community Monitoring at Congaree National Park

2014 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2016/1057



ON THE COVER

House wren (*Troglodytes aedon*)

Photo courtesy of Rachel Holzman

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

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Executive Summary

Birds are an important component of park ecosystems. Due to their high body temperature, rapid metabolism, and high ecological position in most food webs, birds are also good indicators of the effects of local and regional ecosystem changes. Patterns in the community composition, distribution, and occurrence of breeding birds provide a metric for assessing ecological integrity and sustainability in southeastern U. S. ecosystems. Further, trends in these attributes in relation to activities occurring at Ocmulgee National Monument (e.g., management actions, natural disturbance, invasive-species treatment) will improve our understanding of the effects of various management actions and other stressors on the condition of monument resources.

This report summarizes data collected during implementation of the SECN landbird community monitoring protocol (Byrne et al. 2014) at Congaree National Park in 2014.

- Automated recording devices collected bird detection/non-detection data (i.e., presence/absence) from 20 spatially balanced random locations at the park.
- Approximately 1,200 minutes of recordings were collected from March–June, to represent a closed population, and were evaluated for the presence of vocalizing birds
- Fifty-five bird species were detected, including one non-native species, the European starling.
- Monitoring efforts provided the first documented occurrences of one new species at the park and an addition to the official species list: northern flicker (*Colaptes auratus*).
- Results suggest that species richness of birds is moderate to high at the park.
- Acadian flycatcher, Carolina wren, northern cardinal, northern parula, pileated woodpecker, red-bellied woodpecker, red-eyed vireo, and tufted titmouse were the most frequently occurring and widely distributed species at the park, occurring at all of the sampling locations.
- The full dataset and metadata are available from the NPS data store at the Integrated Resource Management Applications portal (<https://irma.nps.gov/App/Portal/Home>).

Introduction

Overview

Birds play several critical roles in park ecosystems. They occupy and interact with several trophic levels of the food web, including their role as both predator and prey. Among their many functions, birds regulate rodent populations (Ims and Andreassen 2000), regulate insect populations (Mols and Visser 2002), and scavenge dead animals (Pain et al. 2003). Some avian species aid in pollination of wild and cultivated crop plants (Stiles 1978) and provide mechanisms for seed dispersal (Howe and Smallwood 1982). Bird guano contains nutrients necessary for many vegetation communities (Wootton 1991). Management activities aimed at preserving habitat for bird populations (e.g., neotropical migrants) frequently have the added benefit of preserving entire ecosystems and their attendant ecosystem services (Karr 1991, Maurer and Heywood 1993).

A wide range of stressors affect bird communities, and birds often respond quickly to environmental stressors, perturbations, or changes. Therefore, characteristics of the bird community at a park are good indicators of the extent of the impact of those stressors on park lands. Many bird species have been extensively studied; their biology and life histories are well defined and their habitat-use patterns have been identified. Consequently, the composition, richness and diversity, and distribution of bird communities provide substantial insight into the ecological condition of park resources. Information about the landbird community also provides derivative information about other characteristics of the park and surrounding area (e.g., vegetation community types, extent of fragmentation).

Because many birds are primarily diurnal, visible and vocal, and attractive, they are a major point of interest for many park visitors and for the general public. Birds have a strong public appeal and are the recreational focus for many park visitors. Birdwatching has a substantial and positive impact on the U.S. economy, contributing well over \$100 billion annually (Carver 2013), and it is one of the most popular recreational activities pursued by Americans (Cordell et al. 2002).

More than 400 species of birds, representing 61 families, use Southeast Coast Network (SECN) parks annually for breeding, wintering, or as a migratory stopover area. The high bird diversity in the Southeast Coast Network exists because of the concentration of SECN parks within the Atlantic Flyway. Many SECN parks occur in a highly fragmented landscape, and because the network encompasses inland and coastal areas, it provides a wide range of bird habitat types

This report summarizes data collected with the SECN landbird community monitoring protocol (Byrne et al. 2014). Protocol objectives that are addressed in this report include:

- a) Determine the species richness and diversity of the landbird community at each park,
- b) Determine how frequently the selected landbirds are detected, and
- c) Determine the distribution of landbirds within park lands.

Study Area

Congaree National Park (CONG) is located in central South Carolina approximately 30 kilometers (18.6 miles) southeast of the capital city of Columbia (Figure 1). The 10,845-hectare (ha) [26,800-acre (ac)] park is bordered to the south by the Congaree River and the Wateree River to the east. The park is the largest contiguous old-growth bottomland hardwood forest remaining in the United States. As such, it consists of a unique and uncommon assemblage of aquatic and terrestrial plant and wildlife community types. Congaree National Park is predominantly a floodplain forest with nearly 90 native tree species, including many recognized as national and state champions for their size (see <https://www.americanforests.org/magazine/article/congaree-where-the-trees-are-still-tall/>). A wide variety of forest communities occur at the park, with dominant tree species ranging from upland pines (*Pinus spp.*) to wetland cypress (*Taxodium spp.*) and tupelo (*Nyssa spp.*) often occurring with ubiquitous species such as sugarberry (*Celtis laevigata*), sweetgum (*Liquidambar styraciflua*), and laurel oak (*Quercus laurifolia*).

Episodic and seasonal inundations in surface water are a critical component to the integrity of the CONG floodplain forest. The frequency, magnitude, and duration of flooding events is the primary driver for many of the vegetation communities, but also serves as a mechanism for the delivery of sediment and nutrients to the floodplain. Although periodic inundations continue to occur, the regulated flows through the park since the introduction of the Saluda Dam in 1930 do not follow seasonal hydrologic fluctuations or facilitate a natural (i.e., historic) hydroperiod. The effects of this alteration on the floodplain ecosystem remain unknown.

Congaree National Park has 198 known bird species (Appendix A Table A-1; NPSpecies 2015).

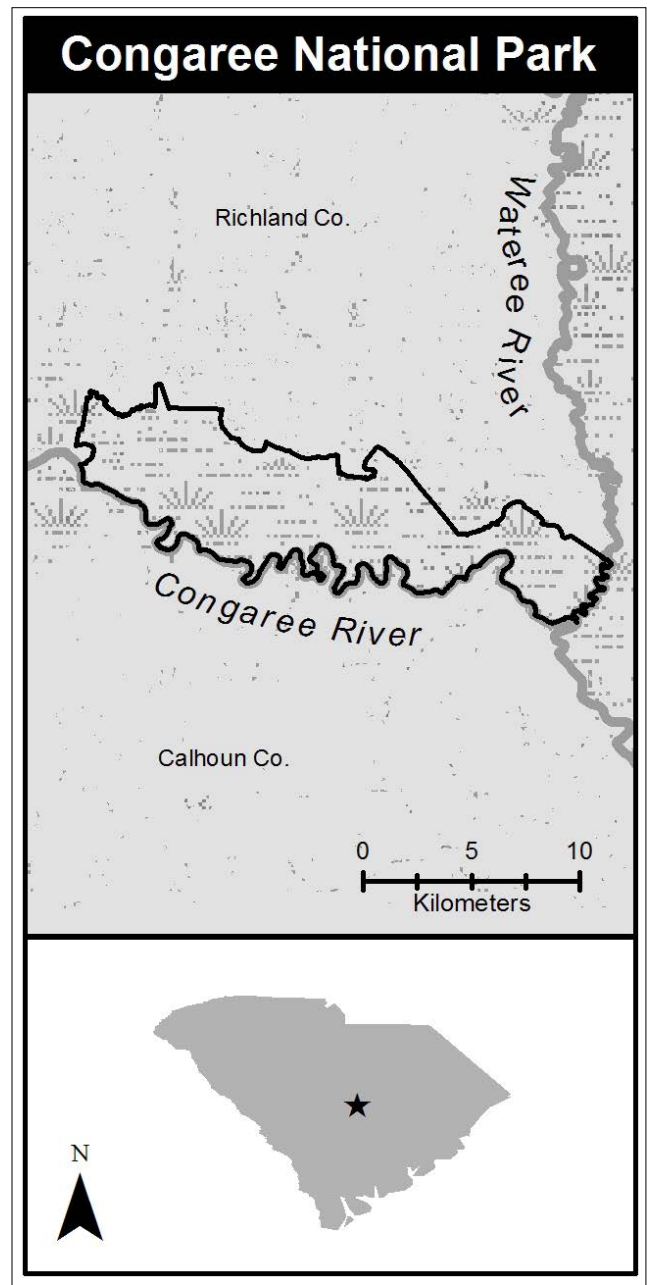


Figure 1. Location of Congaree National Park.

Methods

Sampling Design

The sampling design and sampling-location selection is detailed in Appendix B of the SECN landbird community monitoring protocol (Byrne et al. 2014) and in the sampling-location selection standard operating procedure #1.1.01 (Byrne 2012). In summary, the administrative boundary was used as the sampling frame to allow for park-wide inference. The sampling frame was divided into a systematic 0.5-hectare grid superimposed over the entire sampling frame (i.e., park boundary); the center point of each grid cell served as the potential sampling location. A spatially balanced sample was drawn from this grid using the Reversed Randomized Quadrant-Recursive Raster (RRQRR) algorithm (Theobald et al. 2007). Alternate points were used when specified selection criteria (e.g., safety issues, accessibility) were not met. A sample size of 30 was initially chosen based on consideration of park size, hypothesized variability, and logistical issues. However, the failure of two devices and time lost due to logistical problems resulted in reducing the final sample size of 20 (Figure 2).

Taxonomic Standards

Taxonomy and nomenclature follow that set forth in the Integrated Taxonomic Information System (ITIS; <http://www.itis.gov/>). The National Park Service uses the online application NPSpecies (<https://irma.nps.gov/npspecies>) to document “our knowledge about the occurrence and status of species on National Park Service lands,” including maintenance of species lists for NPS properties. The taxonomy and nomenclature in NPSpecies is periodically updated with the most current ITIS catalog.

All bird vocalizations are identified to the finest possible resolution in the taxonomic hierarchy. Only vocalizations identified to the species level are used in the analyses presented herein.

Data Collection

Automatic recording devices (ARDs) were deployed at all sampling locations March–June 2014. ARDs are deployed at the center point of each 0.5-hectare grid cell (i.e., the sampling location) and are programmed to record from 08:00 – 08:12 (i.e., 12 minutes) every other day for a period of 77 days (Byrne et al. 2014). This schedule results in the collection of 39 discrete sampling events across the spring migratory period and breeding season for each sampling location. Currently, however, our analysis efforts focus on

the time period that most accurately approximates a closed population of breeding birds. Therefore, species occurrences are derived from analyzing five recordings collected from May–June at each sampling location.

Manual Evaluation of Recordings

Ambient / background noise influences detectability in auditory avian surveys (Alldredge et al. 2007, Simons et al. 2007, Pacifici et al. 2008, Simons et al. 2009). To minimize the impact of background noise on detectability, three strategies are applied to all recordings: (1) omit recordings with a background noise level above approximately 45 decibels (dB), if possible; (2) quantify background noise categorically; and (3) use existing software tools to remove or minimize the influence of frequency ranges that are exclusive to the background noise and outside the frequency range of target vocalizations (Byrne et al. 2014). In general, sounds with a sound pressure level greater than 45 dB preclude hearing birds located over 100 meters (328 feet [ft]) from the observer. To provide a frame of reference, the approximate loudness of a watch or clock ticking is 20 dB, a quiet whisper is 30 dB, a steady and heavy rain is 50 dB, and normal conversation is 60 dB.

High levels of background noise can make it difficult to discern vocalizations, and this limits the researcher’s ability to adequately detect and classify bird vocalizations. Therefore, the background noise level for each recording was classified *a priori*, and an index score ranging from one (low) to three (high) was assigned. Each three-minute segment (i.e., 0–3, 3–6, 6–9, and 9–12) of the recordings was *a priori* categorized according to background noise level (i.e., 1=low, 2=moderate, and 3=high), and an average noise score was calculated for the entire 12-minute recording. The background noise level of the recording was defined as follows: (a) “low” characterizes a recording in which the vocalizations are clear and distinct, the vocalizations are the primary source of sound, and background noise is a low-volume muffle; (b) “moderate” characterizes a recording with uniform loudness of less than 45 dB, in which vocalizations are identifiable and some are clear and distinct while others blend into the background noise, which may contain a low- to medium-speed wind or light rain, distant traffic, or rustling vegetation; or (c) “high” characterizes a recording in which background noise is the dominant sound, above 45 dB, and some vocalizations are difficult to separate from the background noise.

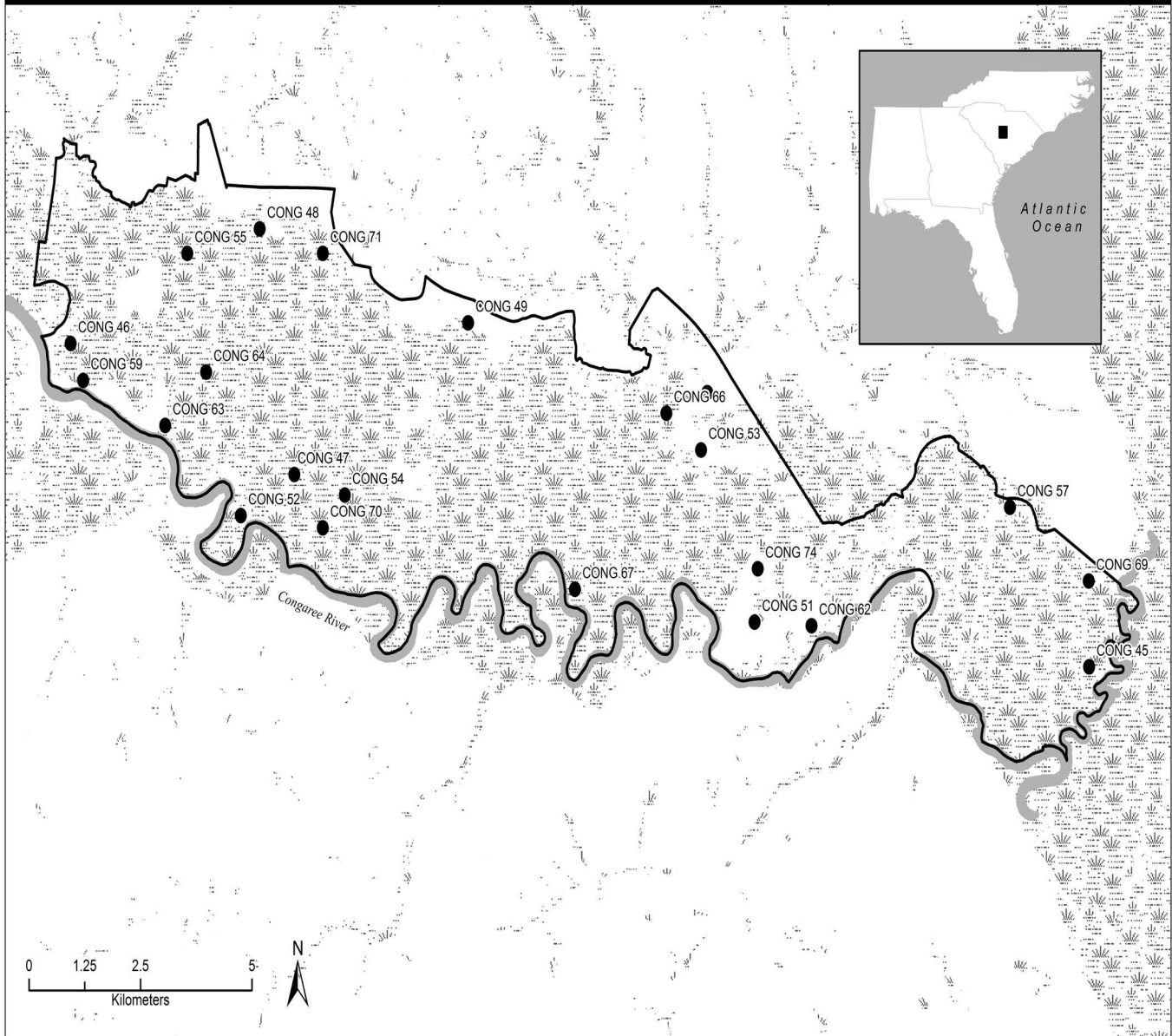


Figure 2. Landbird community monitoring sampling locations at Congaree National Park, 2014.

Examples of background noise in recordings in the “high” category include proximate automobile traffic, high winds in vegetation, insects (e.g., cicadas), frog choruses, trains, heavy rain, or thunderstorms. If both the alternate and primary recordings have similar background noise issues, then the next consecutive sampling event (i.e., next day) is reviewed. This process continues until five monitoring events within the May-to-mid-June window with the lowest noise levels are selected for evaluation for each sampling location. If all recordings from a sampling location have a substantial amount of background noise, the required number of recordings to meet our analysis objectives will continue to be analyzed such that sample size and replicates are not lost, and background noise is categorized as previously mentioned to be later used as an explanatory variable when modeling detectability. The methodology, implemented as part of Byrne et al. (2014), was designed specifically to create an alternate recording for each day of monitoring. This facilitates the screening process and minimizes the influence of anomalous sound events that could impede or preclude species detection.

All recordings were evaluated by one trained observer with several years of birding experience, astute at vocalization identification, whose skills were reviewed and tested. The observer performed the evaluation by listening to the recordings while simultaneously examining spectrograms in Song Scope software (Wildlife Acoustics, Inc.). The observer spent approximately one hour analyzing each 12-minute recording, including the time spent clarifying uncertain identifications with a digital library of vocalizations, online resources, or confirmation with other expert birders. All identifiable birds in each recording were documented. Some vocalizations were unidentifiable due to background noise or distance from the sampling location.

Data Analysis

Data in this report represent one year and are summarized in three general but closely linked categories: composition, richness, and distribution. Appendix B depicts all species detected by sampling location, and Appendix C depicts individual-species distribution maps. These results were derived from the manual evaluation of 1200 minutes from 100 recordings.

Composition

Measures of community composition are often good indicators of abiotic variability, disturbance, or other stressors. Summaries related to composition include the total number of species detected (i.e., species richness) and naïve occupancy. Species richness is simply the number of native species detected, and is presented for the ARD method. Naïve occupancy is the percentage of the sampling locations where a species was detected at least once, without adjusting for probability of detection (i.e., detectability). Naïve occupancy is also referred to as frequency of occurrence. Naïve occupancy provides insight into the distribution of a species across a park and whether the species can be considered common or uncommon. Species with high values occur at more locations than those with low values.

Richness

Species richness is a major component of species diversity. Magurran (2004) defines diversity as “the variety and abundance of species in a defined unit of study.” Diversity is a community property that is related to trophic structure, productivity, stability (McIntosh 1967, McNaughton 1977), immigration/emigration (Colwell and Lees 2000), and ecological condition (i.e., ecological integrity, as defined by Karr and Chu 1995). Species diversity consists of two components: the number of species (i.e., species richness) and the relative abundance of those species (i.e., species evenness/dominance) within a defined community (Margalef 1958, Lloyd and Ghelardi 1964, Pielou 1966). The methodology implemented by the Southeast Coast Network does not collect abundance data; therefore, the analysis focuses on species richness estimation of the landbird community. Further, the term “community” refers to the assemblage of species populations that occur together in space and time (Begon et al. 1986), and we consider the all taxa-species populations that occur at a park as the community.

Species richness and diversity is presented in the form of indices. Because richness and diversity indices respond differently to various mechanisms that influence community change, several indices must be used to adequately characterize richness and diversity in SECN parks (Haedrick 1975, Boyle et al. 1984). Based on characteristics of the SECN dataset and careful appraisal of the advantages and

disadvantages of several richness indices, the selected richness indices are presented in Table 1, including notes on value interpretation. Because observed species richness (i.e., S_{obs}) is an underestimate (i.e., influenced by detectability, observer error) of true species richness, richness indices more closely approximate true species richness for a defined area. In this analysis, richness estimates are based only on landbird observations identified to the species level, and detections/ occurrences of non-native species were not included in the calculations.

Distribution

Understanding changes in the distribution of landbirds is integral to informed management of species and their requisite habitats. Changes in species distributions over time provide useful information at both the local and landscape scale regarding how species respond to large-scale influences such as changing land use, climate, hydrology, or habitat availability and condition. Shifting species distributions alter species interactions and the food-web structure, thereby producing cascading effects on ecosystem processes (Montoya and Raffaelli 2010). Distribution maps for all bird species detected are presented in Appendix C.

Table 1. Incidence-based species richness indices used in this analysis, corresponding symbol, community attribute that the index reflects, range of index values, and notes on each index.

Index	Symbol	Community Attribute	Index Citation	Notes
Native Species Richness	S_{obs}	Richness	n/a	Value indicates the number of native species in the sample. Intuitive. Good discriminant ability if sampling effort is comparable; sensitive to sample size, the occurrence of rare species, or those with low detectability; does not account for relative abundances.
Chao 2	Chao2	Richness	Chao (1984) Chao (1987)	Values indicate an estimate of total species richness (including species not present in the sample); incidence-based estimate; works well with dataset containing several infrequent observations.
Incidence-based Coverage	ICE	Richness	Lee and Chao (1994) Chazdon et al. (1998)	Values indicate an estimate of total species richness (including species not present in the sample); incidence-based estimate.
Jackknife 1	Jack1	Richness	Burnham and Overton (1978) Burnham and Overton (1979) Heltshe and Forrester (1983)	Values indicate an estimate of total species richness (including species not present in the sample); incidence-based estimate; the higher the value the higher the species richness. This procedure requires no assumptions regarding the data distribution.
Jackknife 2	Jack2	Richness	Smith and van Bell (1984)	Values indicate an estimate of species richness; incidence-based estimate.
Bootstrap	Boot	Richness	Smith and van Bell (1984)	Values indicate an estimate of species richness; incidence-based estimate.

Results

Composition

Acadian flycatcher, Carolina wren, northern cardinal, northern parula, pileated woodpecker, red-bellied woodpecker, red-eyed vireo, and tufted titmouse were the most frequently occurring (i.e., highest naïve occupancy) species, occurring at 100% of the sampling locations (Table 2). The bird community composition appears robust,

with nine more species occurring at 90-95% of sampling locations. One non-native species, the European starling, was detected; however, this species was only detected at one sampling location. The occurrence of northern flicker was a new record for the park, and will be added to the species list (Table 3).

Table 2. Naïve occupancy estimates (i.e., proportion of sampling locations in which a species was detected) for birds at Congaree National Park, 2014.

Common Name	Scientific Name	Proportion of Sites Where Observed
Acadian flycatcher	<i>Empidonax virescens</i>	1.00
Carolina wren	<i>Thryothorus ludovicianus</i>	1.00
Northern cardinal	<i>Cardinalis cardinalis</i>	1.00
Northern parula	<i>Setophaga americana</i>	1.00
Pileated woodpecker	<i>Dryocopus pileatus</i>	1.00
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	1.00
Red-eyed vireo	<i>Vireo olivaceus</i>	1.00
Tufted titmouse	<i>Baeolophus bicolor</i>	1.00
American redstart	<i>Setophaga ruticilla</i>	0.95
Blue-gray gnatcatcher	<i>Poliophtila caerulea</i>	0.95
American crow	<i>Corvus brachyrhynchos</i>	0.90
Great crested flycatcher	<i>Myiarchus crinitus</i>	0.90
Prothonotary warbler	<i>Protonotaria citrea</i>	0.90
Summer tanager	<i>Piranga rubra</i>	0.90
White-eyed vireo	<i>Vireo griseus</i>	0.90
Yellow-throated vireo	<i>Vireo flavifrons</i>	0.90
Yellow-throated warbler	<i>Setophaga dominica</i>	0.90
Carolina chickadee	<i>Poecile carolinensis</i>	0.80
Brown-headed cowbird	<i>Molothrus ater</i>	0.75
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	0.75
Downy woodpecker	<i>Picoides pubescens</i>	0.70
Hooded warbler	<i>Setophaga citrina</i>	0.70
Red-shouldered hawk	<i>Buteo lineatus</i>	0.65
Louisiana waterthrush	<i>Parkesia motacilla</i>	0.60
Mourning dove	<i>Zenaida macroura</i>	0.60
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	0.60
Barred owl	<i>Strix varia</i>	0.55
White-breasted nuthatch	<i>Sitta carolinensis</i>	0.50
Chimney swift	<i>Chaetura pelagica</i>	0.40
Indigo bunting	<i>Passerina cyanea</i>	0.40
Fish crow	<i>Corvus ossifragus</i>	0.35

Table 2 (continued). Naïve occupancy estimates (i.e., proportion of sampling locations in which a species was detected) for birds at Congaree National Park, 2014.

Common Name	Scientific Name	Proportion of Sites Where Observed
Black-throated blue warbler	<i>Setophaga caerulescens</i>	0.30
Blue jay	<i>Cyanocitta cristata</i>	0.30
Common yellowthroat	<i>Geothlypis trichas</i>	0.30
Eastern wood-pewee	<i>Contopus virens</i>	0.30
Wild turkey	<i>Meleagris gallopavo</i>	0.25
Pine warbler	<i>Setophaga pinus</i>	0.20
Eastern towhee	<i>Pipilo erythrophthalmus</i>	0.15
Hairy woodpecker	<i>Picoides villosus</i>	0.15
American goldfinch	<i>Spinus tristis</i>	0.10
Belted kingfisher	<i>Megaceryle alcyon</i>	0.10
Canada goose	<i>Branta canadensis</i>	0.10
Northern flicker	<i>Colaptes auratus</i>	0.10
Ovenbird	<i>Seiurus aurocapillus</i>	0.10
Wood duck	<i>Aix sponsa</i>	0.10
Wood thrush	<i>Hylocichla mustelina</i>	0.10
American robin	<i>Turdus migratorius</i>	0.05
Cedar waxwing	<i>Bombycilla cedrorum</i>	0.05
European starling	<i>Sturnus vulgaris</i>	0.05
Gray catbird	<i>Dumetella carolinensis</i>	0.05
Great blue heron	<i>Ardea herodias</i>	0.05
Green heron	<i>Butorides virescens</i>	0.05
Osprey	<i>Pandion haliaetus</i>	0.05
Red-winged blackbird	<i>Agelaius phoeniceus</i>	0.05
Veery	<i>Catharus fuscescens</i>	0.05

Table 3. New bird species detected at Congaree National Park in 2014 and recommended NPSpecies classifications.

Common Name	Abundance	Residency	Nativity	Pest	Management Priority	Exploitation Concerns
Northern flicker	Unknown	Resident	Native	No	No	No

Richness

Native species richness for landbirds at Congaree National Park in 2014 was 55. Species richness indices were based on native species, and confidence intervals for each index were estimated with a bootstrap procedure. Richness indices were similar, ranging from 54.0 to 62.8 (Table 4). Even at the largest deviation, the S_{obs} estimate differed from the richness indices by no more than approximately 10%. Further, given the characteristics of these richness estimates, these indices are likely an accurate reflection of true species richness at the park.

Distribution

Distribution maps for all detected species are presented in Appendix C (Figures C-1–C-70) and indicate the sampling location(s) in which each species occurred. Acadian flycatcher, Carolina wren, northern cardinal, northern parula, pileated woodpecker, red-bellied woodpecker, red-eyed vireo, and tufted titmouse were the most widely distributed species at the park (Appendix C), occurring at all sampling locations. The distribution of less-common species appears to be random, with no species exhibiting clumped distributions.

Table 4. Species richness estimates for birds at Congaree National Park, 2014.

Index	Symbol	Value	Lower 95% CI	Upper 95% CI	Value Interpretation
Native Spp. Richness	S_{obs}	54.0	50.1	57.9	Number of native species detected; Species richness at the park is considered to be moderate to high
Chao 2	Chao2	58.3	54.9	74.5	Estimated true species richness; Considered to be moderate to high
Incidence-based Coverage	ICE	60.7	59.9	61.5	Estimated true species richness; Considered to be moderate to high
Jackknife 1	Jack1	61.6	60.3	62.9	Estimated true species richness; Considered to be moderate to high
Jackknife 2	Jack2	62.8	61.7	63.9	Estimated true species richness; Considered to be moderate to high
Bootstrap	Boot	57.8	57.4	58.2	Estimated true species richness; Considered to be moderate to high

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Appendix A—Species List

Table A-1. Birds known to occur at Congaree National Park based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Accipitriformes	Accipitridae	<i>Accipiter cooperii</i>	Cooper's hawk	X	
Accipitriformes	Accipitridae	<i>Accipiter striatus</i>	Sharp-shinned hawk	X	
Accipitriformes	Accipitridae	<i>Aquila chrysaetos</i>	Golden eagle	X	
Accipitriformes	Accipitridae	<i>Buteo jamaicensis</i>	Red-tailed hawk	X	
Accipitriformes	Accipitridae	<i>Buteo lineatus</i>	Red-shouldered hawk	X	X
Accipitriformes	Accipitridae	<i>Buteo platypterus</i>	Broad-winged hawk	X	
Accipitriformes	Accipitridae	<i>Buteo swainsoni</i>	Swainson's hawk	X	
Accipitriformes	Accipitridae	<i>Circus cyaneus</i>	Northern harrier	X	
Accipitriformes	Accipitridae	<i>Elanoides forficatus</i>	Swallow-tailed kite	X	
Accipitriformes	Accipitridae	<i>Haliaeetus leucocephalus</i>	Bald eagle	X	
Accipitriformes	Accipitridae	<i>Ictinia mississippiensis</i>	Mississippi kite	X	
Accipitriformes	Cathartidae	<i>Cathartes aura</i>	Turkey vulture	X	
Accipitriformes	Cathartidae	<i>Coragyps atratus</i>	Black vulture	X	
Accipitriformes	Pandionidae	<i>Pandion haliaetus</i>	Osprey	X	X
Anseriformes	Anatidae	<i>Aix sponsa</i>	Wood duck	X	X
Anseriformes	Anatidae	<i>Anas americana</i>	American wigeon	X	
Anseriformes	Anatidae	<i>Anas clypeata</i>	Northern shoveler	X	
Anseriformes	Anatidae	<i>Anas crecca</i>	Green-winged teal	X	
Anseriformes	Anatidae	<i>Anas discors</i>	Blue-winged teal	X	
Anseriformes	Anatidae	<i>Anas platyrhynchos</i>	Mallard	X	
Anseriformes	Anatidae	<i>Anas rubripes</i>	American black duck	X	
Anseriformes	Anatidae	<i>Aythya collaris</i>	Ring-necked duck	X	
Anseriformes	Anatidae	<i>Branta canadensis</i>	Canada goose	X	X
Anseriformes	Anatidae	<i>Lophodytes cucullatus</i>	Hooded merganser	X	
Apodiformes	Apodidae	<i>Chaetura pelagica</i>	Chimney swift	X	X
Apodiformes	Trochilidae	<i>Archilochus colubris</i>	Ruby-throated hummingbird	X	
Caprimulgiformes	Caprimulgidae	<i>Caprimulgus carolinensis</i>	Chuck-will's-widow	X	
Caprimulgiformes	Caprimulgidae	<i>Caprimulgus vociferus</i>	Whip-poor-will	X	
Caprimulgiformes	Caprimulgidae	<i>Chordeiles minor</i>	Common nighthawk	X	
Charadriiformes	Charadriidae	<i>Charadrius vociferus</i>	Killdeer	X	
Charadriiformes	Laridae	<i>Larus delawarensis</i>	Ring-billed gull	X	
Charadriiformes	Laridae	<i>Larus philadelphia</i>	Bonaparte's gull	X	
Charadriiformes	Laridae	<i>Sterna caspia</i>	Caspian tern	X	
Charadriiformes	Scolopacidae	<i>Actitis macularia</i>	Spotted sandpiper	X	
Charadriiformes	Scolopacidae	<i>Gallinago gallinago</i>	Common snipe	X	
Charadriiformes	Scolopacidae	<i>Scolopax minor</i>	American woodcock	X	
Charadriiformes	Scolopacidae	<i>Tringa flavipes</i>	Lesser yellowlegs	X	
Charadriiformes	Scolopacidae	<i>Tringa solitaria</i>	Solitary sandpiper	X	
Ciconiiformes	Ciconiidae	<i>Mycteria americana</i>	Wood stork	X	

Table A-1 (continued). Birds known to occur at Congaree National Park based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Columbiformes	Columbidae	<i>Columba livia</i>	Rock dove	X	
Columbiformes	Columbidae	<i>Streptopelia decaocto</i>	Eurasian collared-dove	X	
Columbiformes	Columbidae	<i>Zenaida macroura</i>	Mourning dove	X	X
Coraciiformes	Alcedinidae	<i>Megaceryle alcyon</i>	Belted kingfisher	X	X
Cuculiformes	Cuculidae	<i>Coccyzus americanus</i>	Yellow-billed cuckoo	X	X
Cuculiformes	Cuculidae	<i>Coccyzus erythrophthalmus</i>	Black-billed cuckoo	X	
Falconiformes	Falconidae	<i>Falco columbarius</i>	Merlin	X	
Falconiformes	Falconidae	<i>Falco peregrinus</i>	Peregrine falcon	X	
Falconiformes	Falconidae	<i>Falco sparverius</i>	American kestrel	X	
Galliformes	Odontophoridae	<i>Colinus virginianus</i>	Northern bobwhite	X	
Galliformes	Phasianidae	<i>Meleagris gallopavo</i>	Wild turkey	X	X
Gaviiformes	Gaviidae	<i>Gavia immer</i>	Common loon	X	
Passeriformes	Bombycillidae	<i>Bombycilla cedrorum</i>	Cedar waxwing	X	X
Passeriformes	Cardinalidae	<i>Cardinalis cardinalis</i>	Northern cardinal	X	X
Passeriformes	Cardinalidae	<i>Guiraca caerulea</i>	Blue grosbeak	X	
Passeriformes	Cardinalidae	<i>Passerina cyanea</i>	Indigo bunting	X	X
Passeriformes	Cardinalidae	<i>Pheucticus ludovicianus</i>	Rose-breasted grosbeak	X	
Passeriformes	Certhiidae	<i>Certhia americana</i>	Brown creeper	X	
Passeriformes	Corvidae	<i>Corvus brachyrhynchos</i>	American crow	X	X
Passeriformes	Corvidae	<i>Corvus ossifragus</i>	Fish crow	X	X
Passeriformes	Corvidae	<i>Cyanocitta cristata</i>	Blue jay	X	X
Passeriformes	Emberizidae	<i>Aimophila aestivalis</i>	Bachman's sparrow	X	
Passeriformes	Emberizidae	<i>Ammodramus henslowii</i>	Henslow's sparrow	X	
Passeriformes	Emberizidae	<i>Junco hyemalis</i>	Dark-eyed junco	X	
Passeriformes	Emberizidae	<i>Melospiza georgiana</i>	Swamp sparrow	X	
Passeriformes	Emberizidae	<i>Melospiza lincolni</i>	Lincoln's sparrow	X	
Passeriformes	Emberizidae	<i>Melospiza melodia</i>	Song sparrow	X	
Passeriformes	Emberizidae	<i>Passerculus sandwichensis</i>	Savannah sparrow	X	
Passeriformes	Emberizidae	<i>Passerella iliaca</i>	Fox sparrow	X	
Passeriformes	Emberizidae	<i>Pipilo erythrophthalmus</i>	Eastern towhee	X	X
Passeriformes	Emberizidae	<i>Pooecetes gramineus</i>	Vesper sparrow	X	
Passeriformes	Emberizidae	<i>Spizella passerina</i>	Chipping sparrow	X	
Passeriformes	Emberizidae	<i>Spizella pusilla</i>	Field sparrow	X	
Passeriformes	Emberizidae	<i>Zonotrichia albicollis</i>	White-throated sparrow	X	
Passeriformes	Fringillidae	<i>Carduelis pinus</i>	Pine siskin	X	
Passeriformes	Fringillidae	<i>Carduelis tristis</i>	American goldfinch	X	X
Passeriformes	Fringillidae	<i>Carpodacus mexicanus</i>	House finch	X	
Passeriformes	Fringillidae	<i>Carpodacus purpureus</i>	Purple finch	X	
Passeriformes	Fringillidae	<i>Coccothraustes vespertinus</i>	Evening grosbeak	X	
Passeriformes	Hirundinidae	<i>Hirundo pyrrhonota</i>	Cliff swallow	X	
Passeriformes	Hirundinidae	<i>Hirundo rustica</i>	Barn swallow	X	

Table A-1 (continued). Birds known to occur at Congaree National Park based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Passeriformes	Hirundinidae	<i>Progne subis</i>	Purple martin	X	
Passeriformes	Hirundinidae	<i>Riparia riparia</i>	Bank swallow	X	
Passeriformes	Hirundinidae	<i>Stelgidopteryx serripennis</i>	Rough-winged swallow	X	
Passeriformes	Hirundinidae	<i>Tachycineta bicolor</i>	Tree swallow	X	
Passeriformes	Icteridae	<i>Agelaius phoeniceus</i>	Red-winged blackbird	X	X
Passeriformes	Icteridae	<i>Dolichonyx oryzivorus</i>	Bobolink	X	
Passeriformes	Icteridae	<i>Euphagus carolinus</i>	Rusty blackbird	X	
Passeriformes	Icteridae	<i>Icterus galbula</i>	Baltimore oriole	X	
Passeriformes	Icteridae	<i>Icterus spurius</i>	Orchard oriole	X	
Passeriformes	Icteridae	<i>Molothrus ater</i>	Brown-headed cowbird	X	X
Passeriformes	Icteridae	<i>Quiscalus quiscula</i>	Common grackle	X	
Passeriformes	Icteridae	<i>Sturnella magna</i>	Eastern meadowlark	X	
Passeriformes	Laniidae	<i>Lanius ludovicianus</i>	Loggerhead shrike	X	
Passeriformes	Mimidae	<i>Dumetella carolinensis</i>	Gray catbird	X	X
Passeriformes	Mimidae	<i>Mimus polyglottos</i>	Northern mockingbird	X	
Passeriformes	Mimidae	<i>Toxostoma rufum</i>	Brown thrasher	X	
Passeriformes	Motacillidae	<i>Anthus rubescens</i>	American pipit	X	
Passeriformes	Paridae	<i>Baeolophus bicolor</i>	Tufted titmouse	X	X
Passeriformes	Paridae	<i>Poecile carolinensis</i>	Carolina chickadee	X	X
Passeriformes	Parulidae	<i>Dendroica caerulescens</i>	Black-throated blue warbler	X	X
Passeriformes	Parulidae	<i>Dendroica castanea</i>	Bay-breasted warbler	X	
Passeriformes	Parulidae	<i>Dendroica cerulea</i>	Cerulean warbler	X	
Passeriformes	Parulidae	<i>Dendroica coronata</i>	Yellow-rumped warbler	X	
Passeriformes	Parulidae	<i>Dendroica discolor</i>	Prairie warbler	X	
Passeriformes	Parulidae	<i>Dendroica dominica</i>	Yellow-throated warbler	X	X
Passeriformes	Parulidae	<i>Dendroica fusca</i>	Blackburnian warbler	X	
Passeriformes	Parulidae	<i>Dendroica magnolia</i>	Magnolia warbler	X	
Passeriformes	Parulidae	<i>Dendroica palmarum</i>	Palm warbler	X	
Passeriformes	Parulidae	<i>Dendroica pensylvanica</i>	Chestnut-sided warbler	X	
Passeriformes	Parulidae	<i>Dendroica petechia</i>	Myrtle warbler	X	
Passeriformes	Parulidae	<i>Dendroica pinus</i>	Pine warbler	X	X
Passeriformes	Parulidae	<i>Dendroica striata</i>	Blackpoll warbler	X	
Passeriformes	Parulidae	<i>Dendroica tigrina</i>	Cape May warbler	X	
Passeriformes	Parulidae	<i>Dendroica virens</i>	Black-throated green warbler	X	
Passeriformes	Parulidae	<i>Geothlypis trichas</i>	Common yellowthroat	X	X
Passeriformes	Parulidae	<i>Helmitheros vermivorus</i>	Worm-eating warbler	X	
Passeriformes	Parulidae	<i>Icteria virens</i>	Yellow-breasted chat	X	
Passeriformes	Parulidae	<i>Limnothlypis swainsonii</i>	Swainson's warbler	X	
Passeriformes	Parulidae	<i>Mniotilta varia</i>	Black-and-white warbler	X	
Passeriformes	Parulidae	<i>Oporornis formosus</i>	Kentucky warbler	X	
Passeriformes	Parulidae	<i>Oporornis philadelphia</i>	Mourning warbler	X	

Table A-1 (continued). Birds known to occur at Congaree National Park based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Passeriformes	Parulidae	<i>Parula americana</i>	Northern parula	X	X
Passeriformes	Parulidae	<i>Protonotaria citrea</i>	Prothonotary warbler	X	X
Passeriformes	Parulidae	<i>Seiurus aurocapillus</i>	Ovenbird	X	X
Passeriformes	Parulidae	<i>Seiurus motacilla</i>	Louisiana waterthrush	X	X
Passeriformes	Parulidae	<i>Seiurus noveboracensis</i>	Northern waterthrush	X	
Passeriformes	Parulidae	<i>Setophaga ruticilla</i>	American redstart	X	X
Passeriformes	Parulidae	<i>Vermivora bachmanii</i>	Bachman's warbler	X	
Passeriformes	Parulidae	<i>Vermivora celata</i>	Orange-crowned warbler	X	
Passeriformes	Parulidae	<i>Vermivora chrysoptera</i>	Golden-winged warbler	X	
Passeriformes	Parulidae	<i>Vermivora peregrina</i>	Tennessee warbler	X	
Passeriformes	Parulidae	<i>Vermivora pinus</i>	Blue-winged warbler	X	
Passeriformes	Parulidae	<i>Vermivora ruficapilla</i>	Nashville warbler	X	
Passeriformes	Parulidae	<i>Wilsonia canadensis</i>	Canada warbler	X	
Passeriformes	Parulidae	<i>Wilsonia citrina</i>	Hooded warbler	X	X
Passeriformes	Parulidae	<i>Wilsonia pusilla</i>	Wilson's warbler	X	
Passeriformes	Passeridae	<i>Passer domesticus</i>	House sparrow	X	
Passeriformes	Poliotilidae	<i>Poliotila caerulea</i>	Blue-gray gnatcatcher	X	X
Passeriformes	Regulidae	<i>Regulus calendula</i>	Ruby-crowned kinglet	X	
Passeriformes	Regulidae	<i>Regulus satrapa</i>	Golden-crowned kinglet	X	
Passeriformes	Sittidae	<i>Sitta canadensis</i>	Red-breasted nuthatch	X	
Passeriformes	Sittidae	<i>Sitta carolinensis</i>	White-breasted nuthatch	X	X
Passeriformes	Sittidae	<i>Sitta pusilla</i>	Brown-headed nuthatch	X	
Passeriformes	Sturnidae	<i>Sturnus vulgaris</i>	European starling	X	X
Passeriformes	Thraupidae	<i>Piranga olivacea</i>	Scarlet tanager	X	
Passeriformes	Thraupidae	<i>Piranga rubra</i>	Summer tanager	X	X
Passeriformes	Troglodytidae	<i>Thryothorus ludovicianus</i>	Carolina wren	X	X
Passeriformes	Troglodytidae	<i>Troglodytes aedon</i>	House wren	X	
Passeriformes	Troglodytidae	<i>Troglodytes troglodytes</i>	Winter wren	X	
Passeriformes	Turdidae	<i>Catharus bicknelli</i>	Bicknell's thrush	X	
Passeriformes	Turdidae	<i>Catharus fuscescens</i>	Veery	X	X
Passeriformes	Turdidae	<i>Catharus guttatus</i>	Hermit thrush	X	
Passeriformes	Turdidae	<i>Catharus minimus</i>	Gray-cheeked thrush	X	
Passeriformes	Turdidae	<i>Catharus ustulatus</i>	Swainson's thrush	X	
Passeriformes	Turdidae	<i>Hylocichla mustelina</i>	Wood thrush	X	X
Passeriformes	Turdidae	<i>Sialia sialis</i>	Eastern bluebird	X	
Passeriformes	Turdidae	<i>Turdus migratorius</i>	American robin	X	X
Passeriformes	Tyrannidae	<i>Contopus borealis</i>	Olive-sided flycatcher	X	
Passeriformes	Tyrannidae	<i>Contopus virens</i>	Eastern wood-pewee	X	X
Passeriformes	Tyrannidae	<i>Empidonax minimus</i>	Least flycatcher	X	
Passeriformes	Tyrannidae	<i>Empidonax virens</i>	Acadian flycatcher	X	X
Passeriformes	Tyrannidae	<i>Myiarchus crinitus</i>	Great crested flycatcher	X	X

Table A-1 (continued). Birds known to occur at Congaree National Park based upon records in NPSpecies (2014) and those detected during this sampling effort.

Order	Family	Scientific Name	Common Name	NPSpecies	2014
Passeriformes	Tyrannidae	<i>Sayornis phoebe</i>	Eastern phoebe	X	
Passeriformes	Tyrannidae	<i>Tyrannus tyrannus</i>	Eastern kingbird	X	
Passeriformes	Tyrannidae	<i>Tyrannus verticalis</i>	Western kingbird	X	
Passeriformes	Vireonidae	<i>Vireo flavifrons</i>	Yellow-throated vireo	X	X
Passeriformes	Vireonidae	<i>Vireo gilvus</i>	Warbling vireo	X	
Passeriformes	Vireonidae	<i>Vireo griseus</i>	White-eyed vireo	X	X
Passeriformes	Vireonidae	<i>Vireo olivaceus</i>	Red-eyed vireo	X	X
Passeriformes	Vireonidae	<i>Vireo philadelphicus</i>	Philadelphia vireo	X	
Passeriformes	Vireonidae	<i>Vireo solitarius</i>	Blue-headed vireo	X	
Pelecaniformes	Ardeidae	<i>Ardea alba</i>	Common egret	X	
Pelecaniformes	Ardeidae	<i>Ardea herodias</i>	Great blue heron	X	X
Pelecaniformes	Ardeidae	<i>Botaurus lentiginosus</i>	American bittern	X	
Pelecaniformes	Ardeidae	<i>Bubulcus ibis</i>	Cattle egret	X	
Pelecaniformes	Ardeidae	<i>Butorides virescens</i>	Green heron	X	X
Pelecaniformes	Ardeidae	<i>Egretta caerulea</i>	Little blue heron	X	
Pelecaniformes	Ardeidae	<i>Egretta thula</i>	Snowy egret	X	
Pelecaniformes	Ardeidae	<i>Egretta tricolor</i>	Tricolored heron	X	
Pelecaniformes	Ardeidae	<i>Nyctanassa violacea</i>	Yellow-crowned night-heron	X	
Pelecaniformes	Threskiornithidae	<i>Ajaia ajaja</i>	Roseate spoonbill	X	
Pelecaniformes	Threskiornithidae	<i>Eudocimus albus</i>	White ibis	X	
Piciformes	Picidae	<i>Campephilus principalis</i>	Ivory-billed woodpecker	X	
Piciformes	Picidae	<i>Colaptes auratus</i>	Common flicker	X	
Piciformes	Picidae	<i>Dryocopus pileatus</i>	Pileated woodpecker	X	X
Piciformes	Picidae	<i>Melanerpes carolinus</i>	Red-bellied woodpecker	X	X
Piciformes	Picidae	<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	X	X
Piciformes	Picidae	<i>Picoides borealis</i>	Red-cockaded woodpecker	X	
Piciformes	Picidae	<i>Picoides pubescens</i>	Downy woodpecker	X	X
Piciformes	Picidae	<i>Picoides villosus</i>	Hairy woodpecker	X	X
Piciformes	Picidae	<i>Sphyrapicus varius</i>	Yellow-bellied sapsucker	X	
Podicipediformes	Podicipedidae	<i>Podilymbus podiceps</i>	Pied-billed grebe	X	
Strigiformes	Strigidae	<i>Bubo virginianus</i>	Great horned owl	X	
Strigiformes	Strigidae	<i>Megascops asio</i>	Eastern screech owl	X	
Strigiformes	Strigidae	<i>Strix varia</i>	Barred owl	X	X
Strigiformes	Tytonidae	<i>Tyto alba</i>	Barn owl	X	
Suliformes	Anhingidae	<i>Anhinga anhinga</i>	Anhinga	X	
Suliformes	Phalacrocoracidae	<i>Phalacrocorax auritus</i>	Double-crested cormorant	X	

Appendix B—Species Detection Matrix

Table B-1. Species detected at each sampling location at Congaree National Park in 2014. Refer to Figure 2 for labeled sampling locations.

Species	43	45	46	47	48	49	51	54	55	57	59	62	63	64	66	67	69	70	71	74
Acadian flycatcher	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
American crow	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X
American goldfinch													X							X
American redstart	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
American robin																	X			
Barred owl			X				X	X	X		X			X	X	X	X	X		X
Belted kingfisher		X		X																
Black-throated blue warbler						X				X	X				X				X	X
Blue jay			X				X			X								X	X	X
Blue-gray gnatcatcher		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Brown-headed cowbird		X	X	X	X		X		X	X	X	X	X	X	X	X			X	X
Canada goose													X	X						
Carolina chickadee	X	X	X	X			X	X	X	X	X	X		X	X		X	X	X	X
Carolina wren	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cedar waxwing				X																
Chimney swift				X			X	X				X		X	X		X		X	
Common yellowthroat		X								X	X	X	X	X						
Downy woodpecker		X		X	X	X	X	X	X		X	X			X	X	X	X	X	
Eastern towhee					X										X				X	
Eastern wood-pewee					X	X	X	X										X	X	
European starling										X										
Fish crow		X	X							X		X	X	X	X					
Gray catbird														X						
Great blue heron														X						
Great crested flycatcher		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Green heron		X																		
Hairy woodpecker															X			X	X	
Hooded warbler	X		X		X	X	X		X	X	X	X	X	X				X	X	X
Indigo bunting			X		X					X	X	X	X				X			X

Table B-1 (continued). Species detected at each sampling location at Congaree National Park in 2014. Refer to Figure 2 for labeled sampling locations.

[illegible]

Appendix C—Species Distribution Maps

Ordered alphabetically by common name

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Acadian Flycatcher
Empidonax virescens

National Park Service
U.S. Department of the Interior

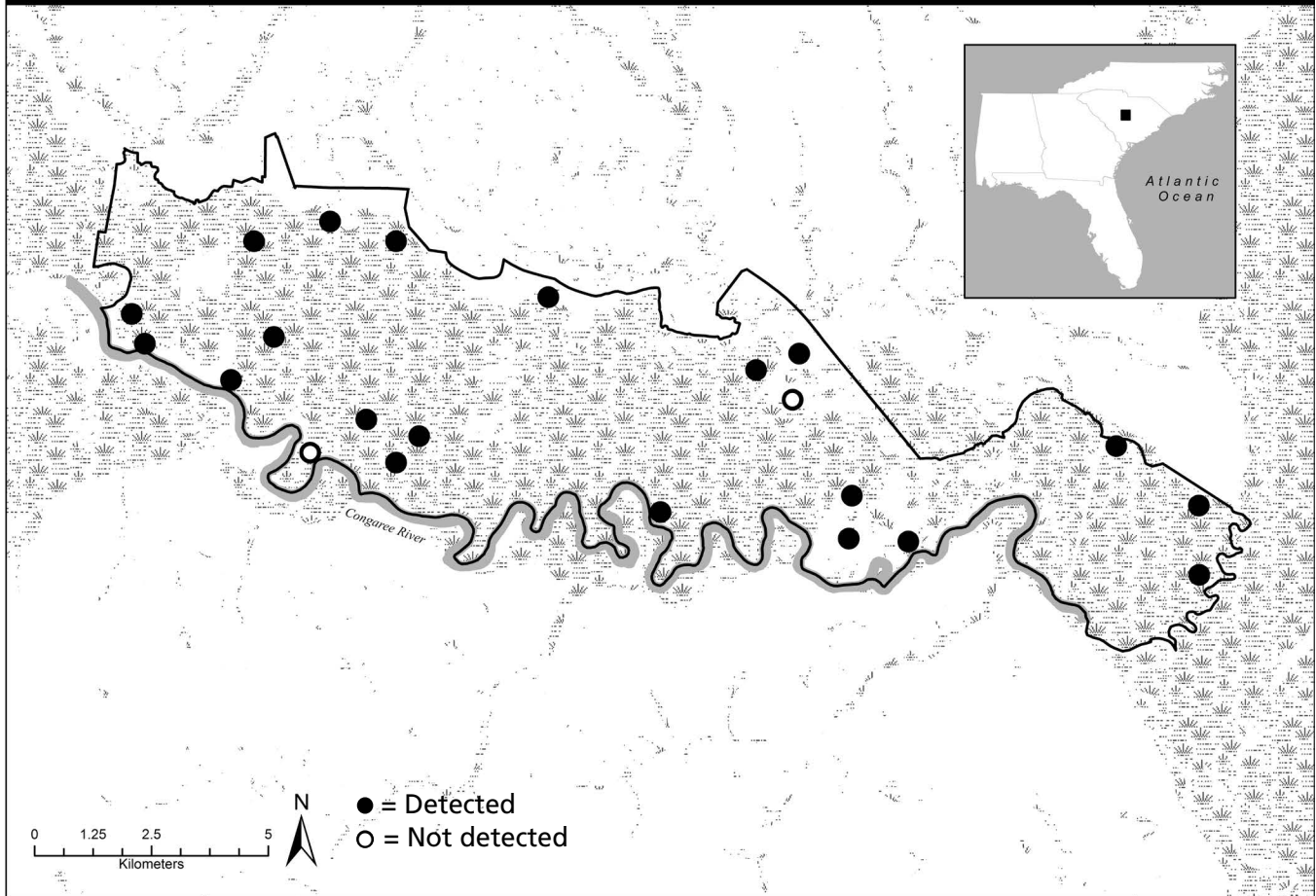


Figure C-1. Sampling locations where Acadian flycatcher (*Empidonax virescens*) was detected at Congaree National Park, 2014.

American Crow
Corvus brachyrhynchos

National Park Service
U.S. Department of the Interior

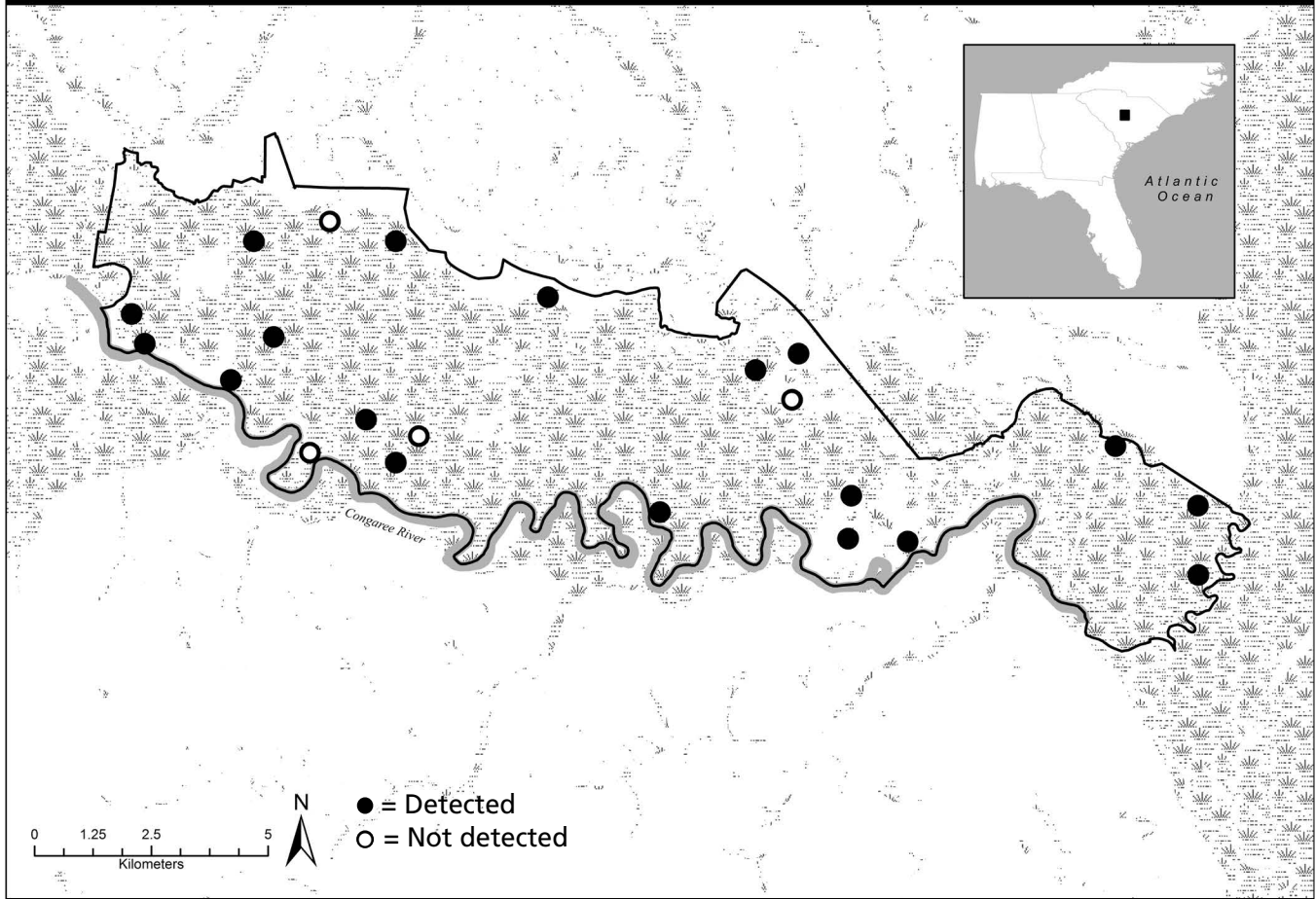


Figure C-2. Sampling locations where American crow (*Corvus brachyrhynchos*) was detected at Congaree National Park, 2014.

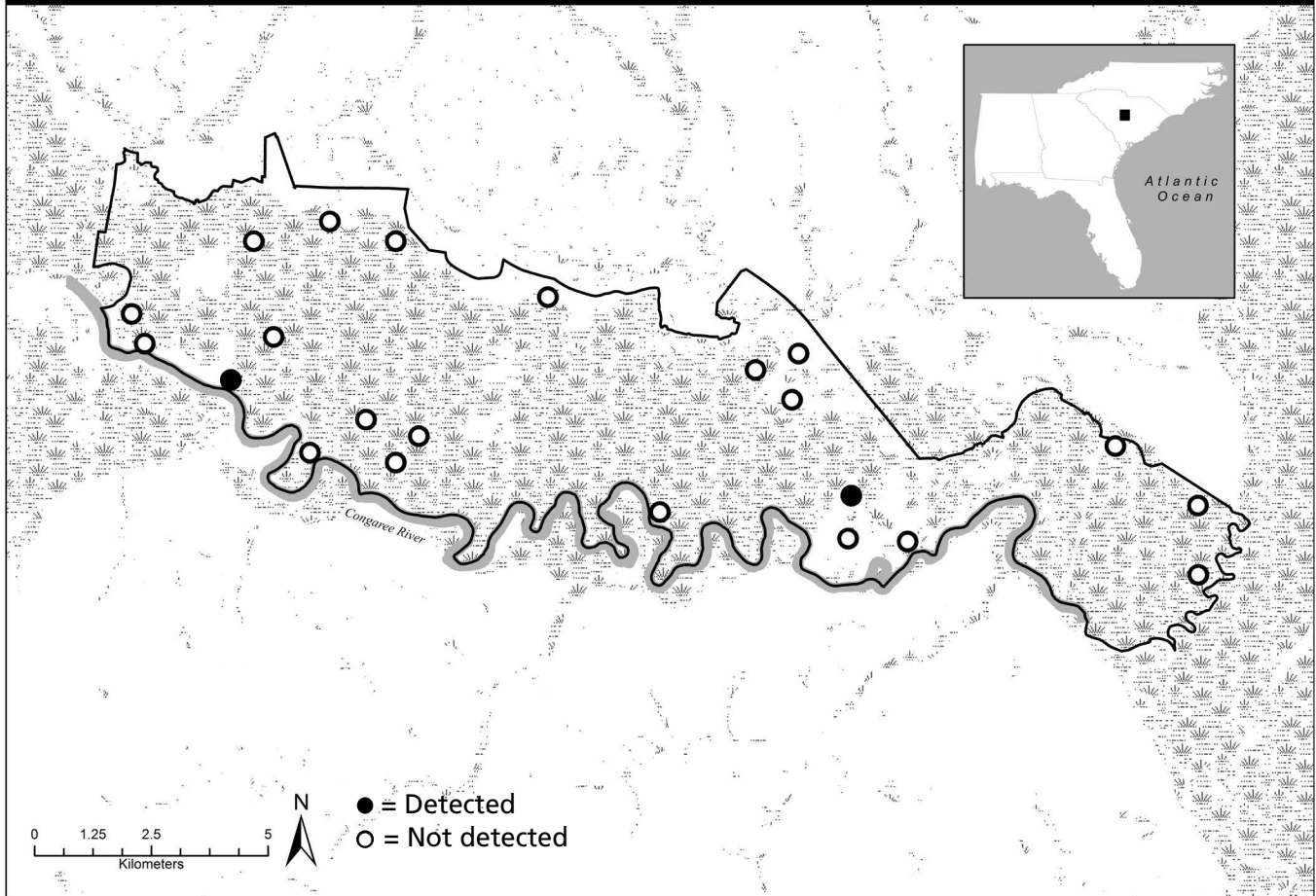


Figure C-3. Sampling locations where American goldfinch (*Spinus tristis*) was detected at Congaree National Park, 2014.

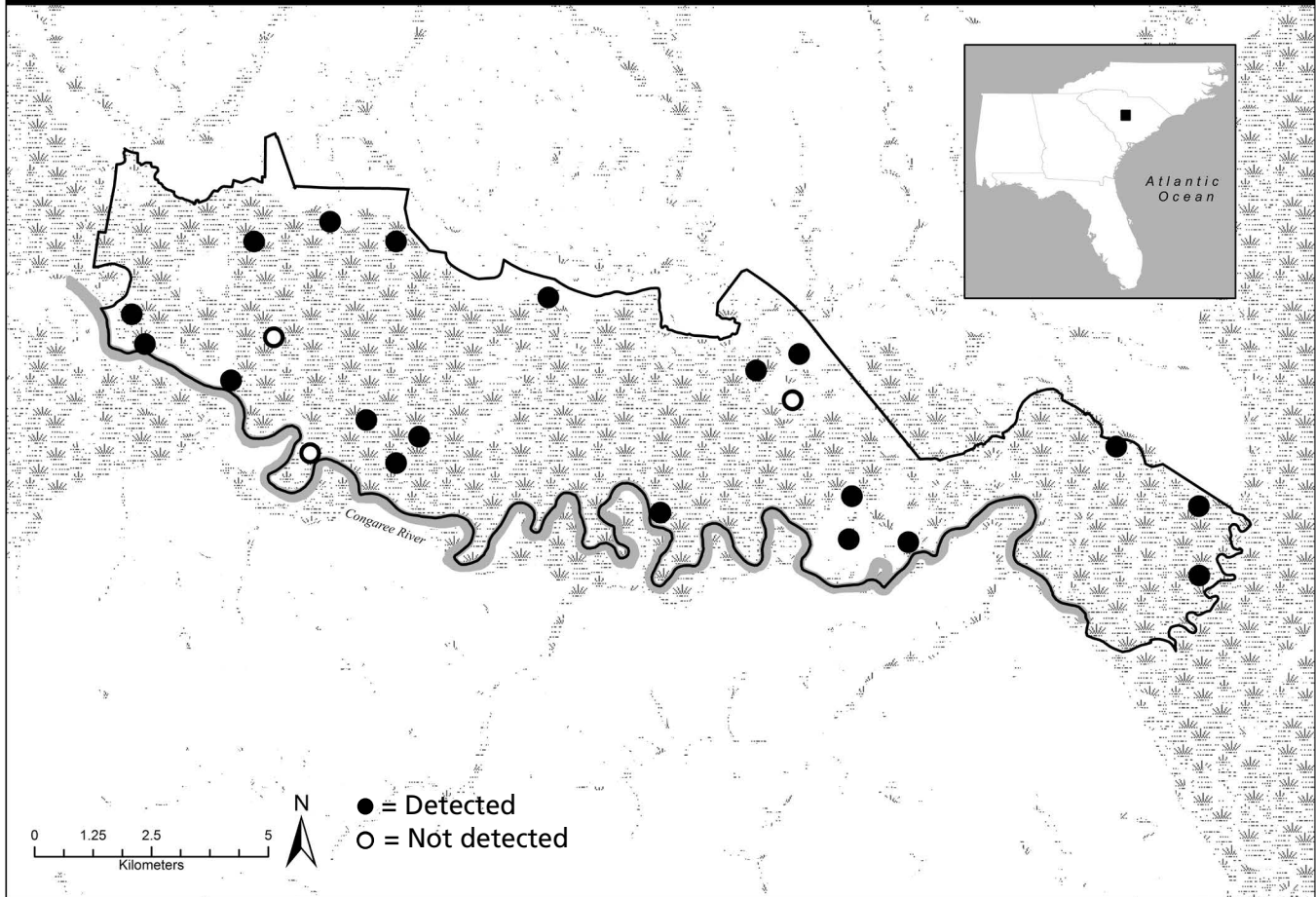


Figure C-4. Sampling locations where American redstart (*Setophaga ruticilla*) was detected at Congaree National Park, 2014.

American Robin
Turdus migratorius

National Park Service
U.S. Department of the Interior

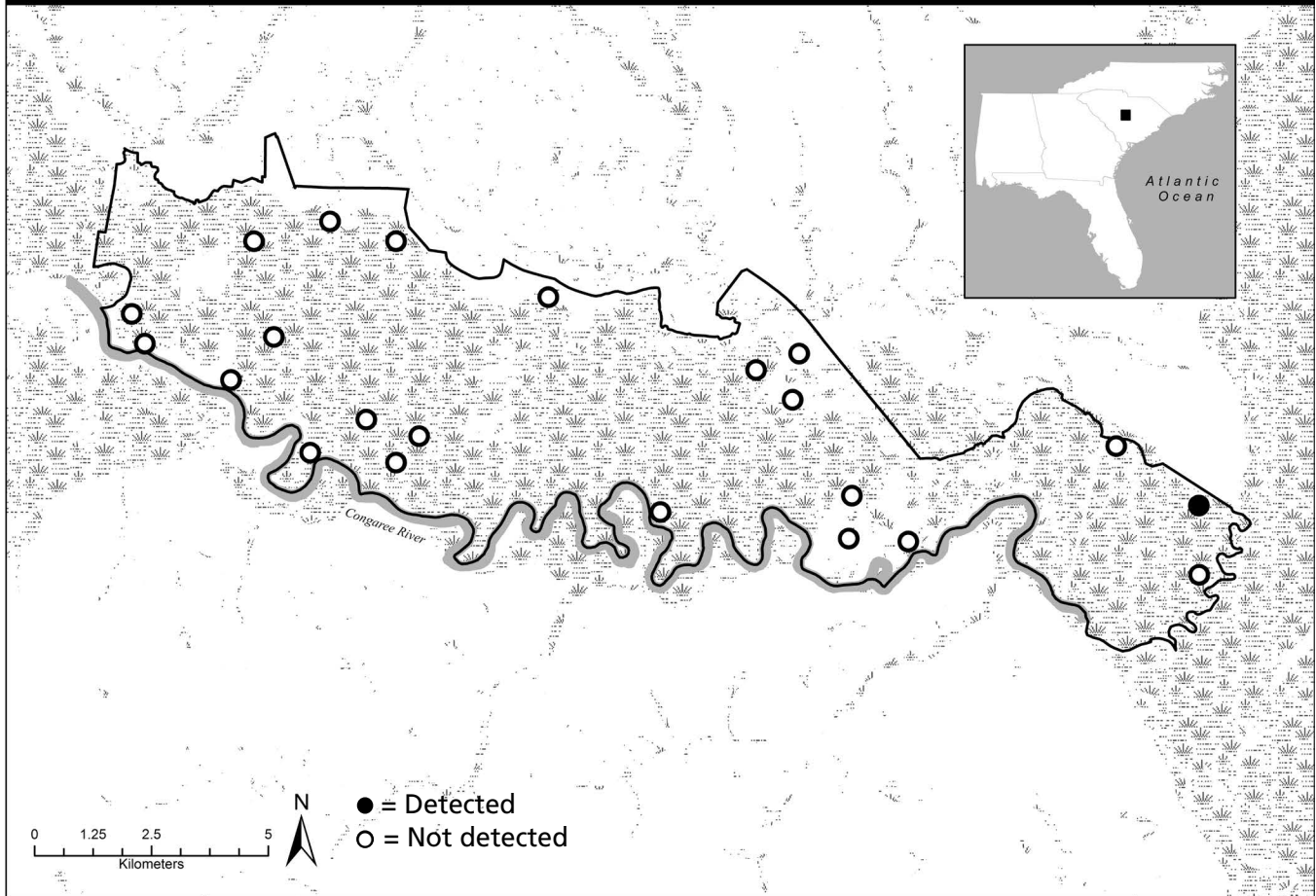


Figure C-5. Sampling locations where American robin (*Turdus migratorius*) was detected at Congaree National Park, 2014.

Barred Owl
Strix varia

National Park Service
U.S. Department of the Interior

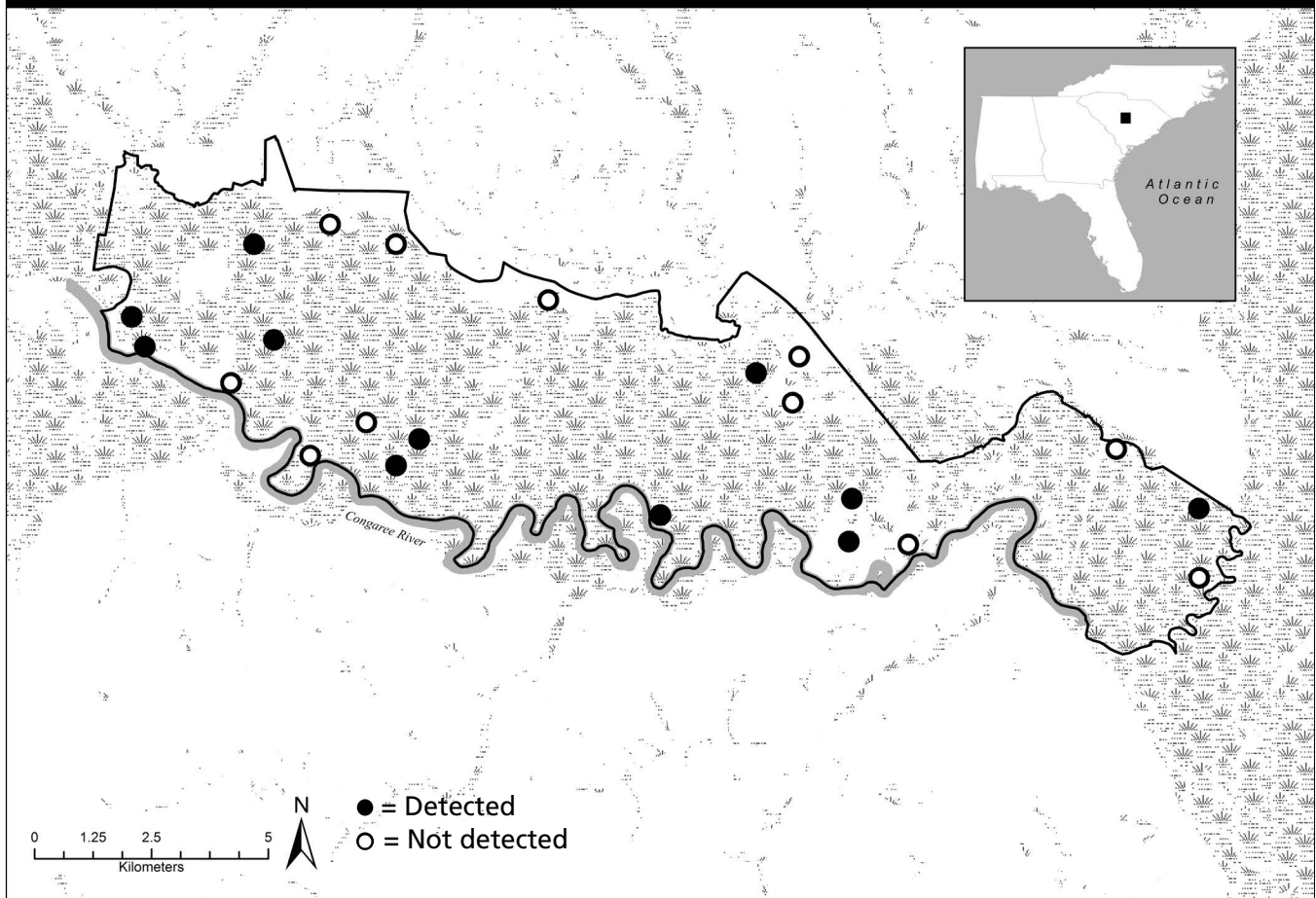


Figure C-6. Sampling locations where barred owl (*Strix varia*) was detected at Congaree National Park, 2014.

Belted Kingfisher
Megaceryle alcyon

National Park Service
U.S. Department of the Interior

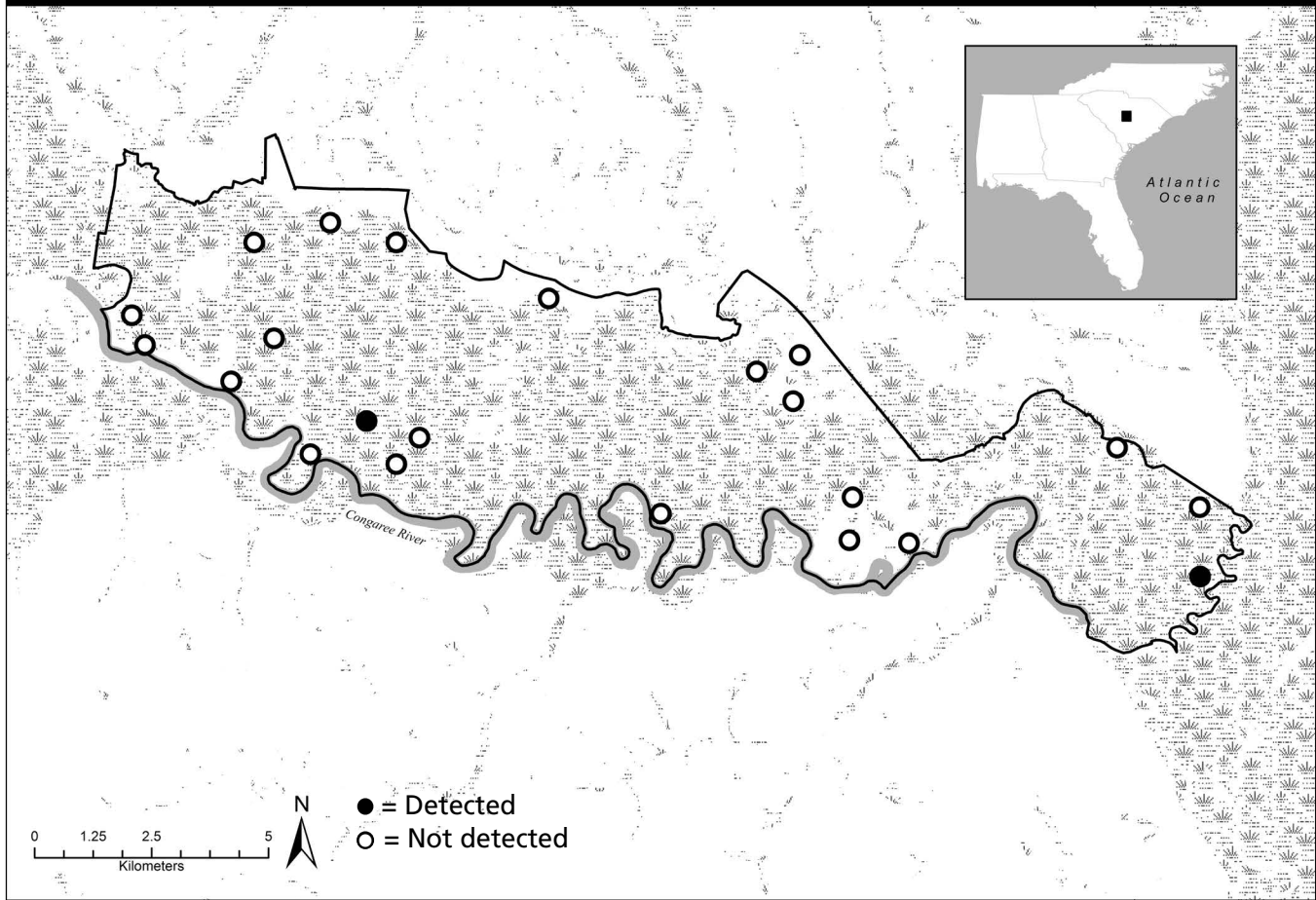


Figure C-7. Sampling locations where belted kingfisher (*Megaceryle alcyon*) was detected at Congaree National Park, 2014.

Black-throated Blue Warbler
Setophaga caerulescens

National Park Service
U.S. Department of the Interior

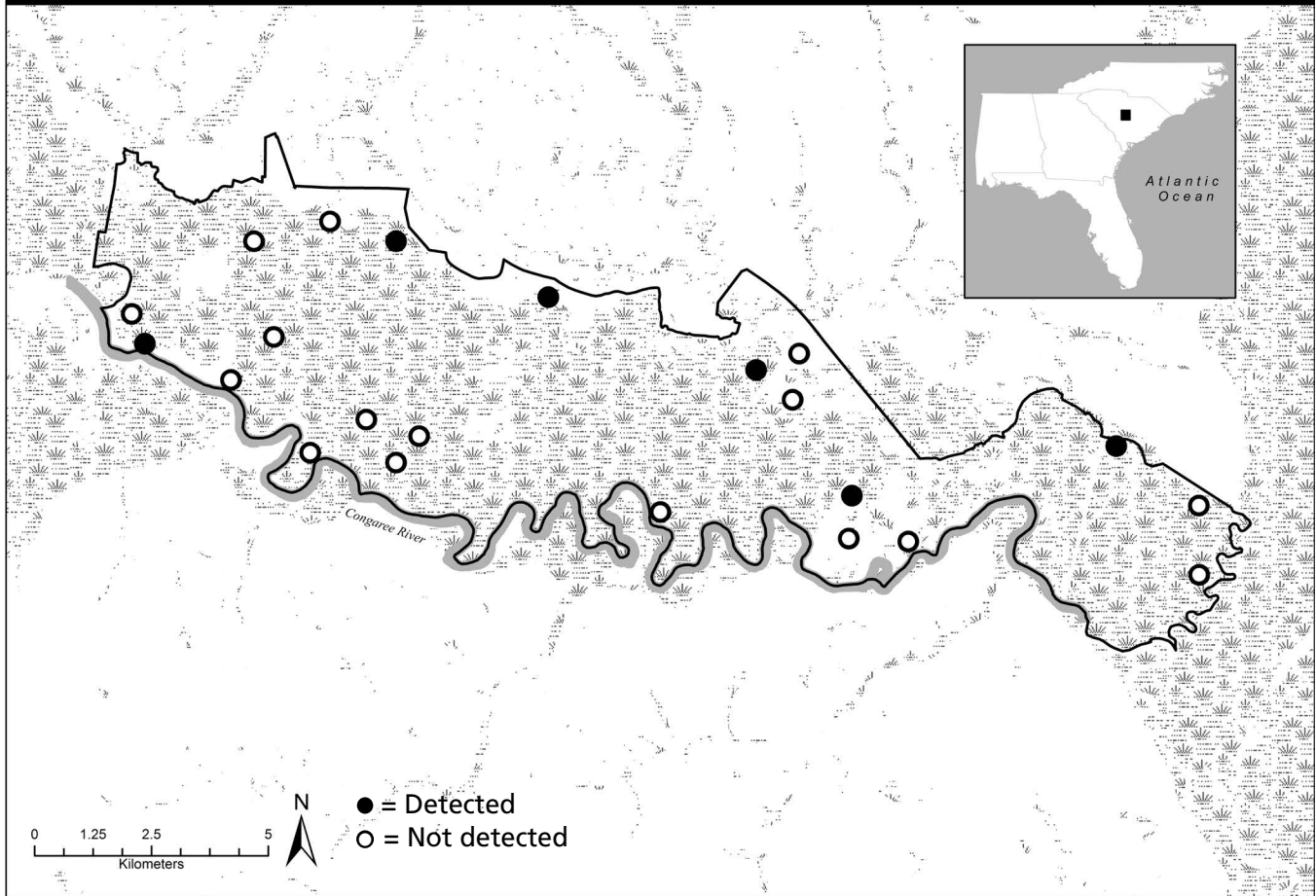


Figure C-8. Sampling locations where black-throated blue warbler (*Setophaga caerulescens*) was detected at Congaree National Park, 2014.

Blue Jay
Cyanocitta cristata

National Park Service
U.S. Department of the Interior

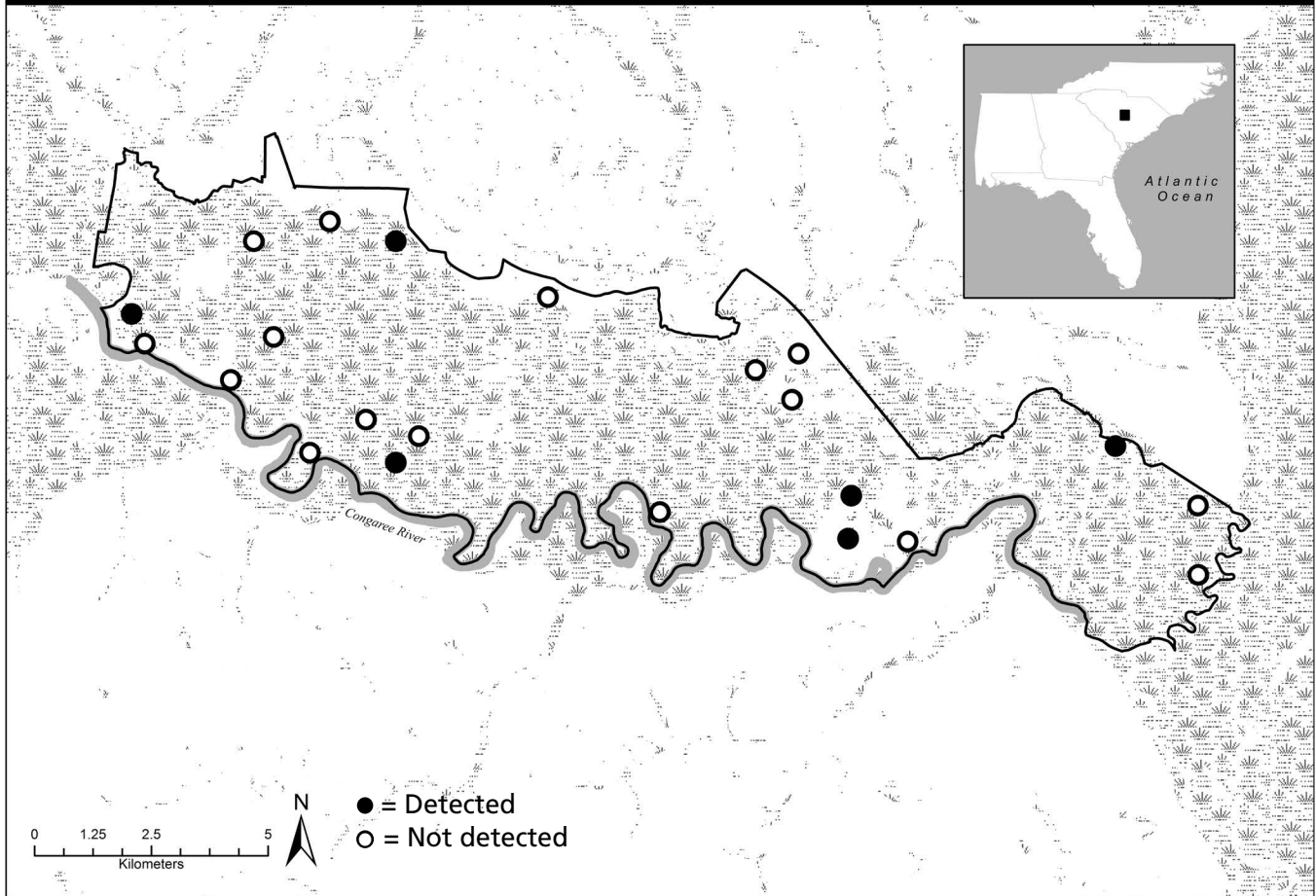


Figure C-9. Sampling locations where blue jay (*Cyanocitta cristata*) was detected at Congaree National Park, 2014.

Blue-gray Gnatcatcher
Poliopitila caerulea

National Park Service
U.S. Department of the Interior

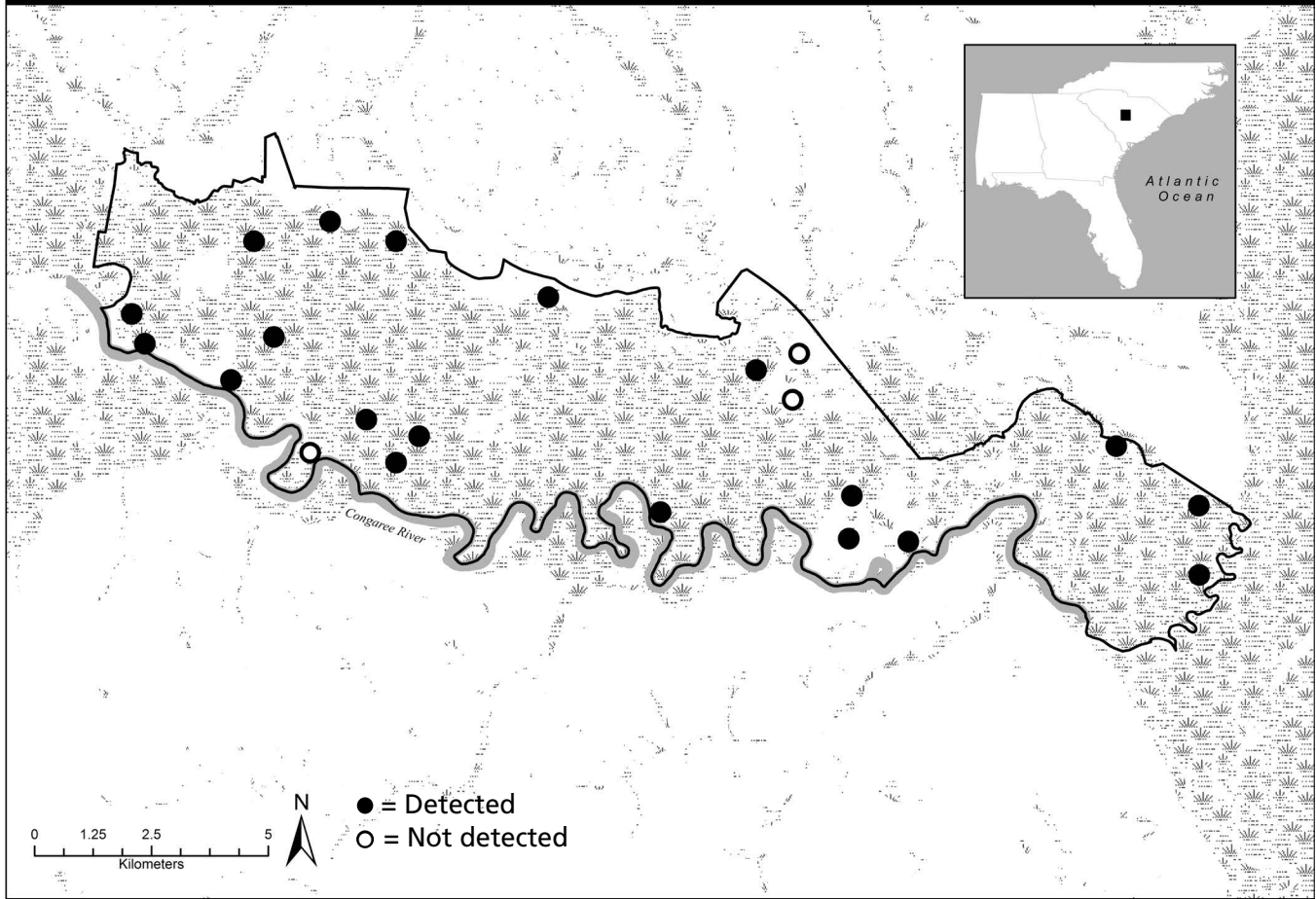


Figure C-10. Sampling locations where blue-gray gnatcatcher (*Poliopitila caerulea*) was detected at Congaree National Park, 2014.

Brown-headed Cowbird
Molothrus ater

National Park Service
U.S. Department of the Interior

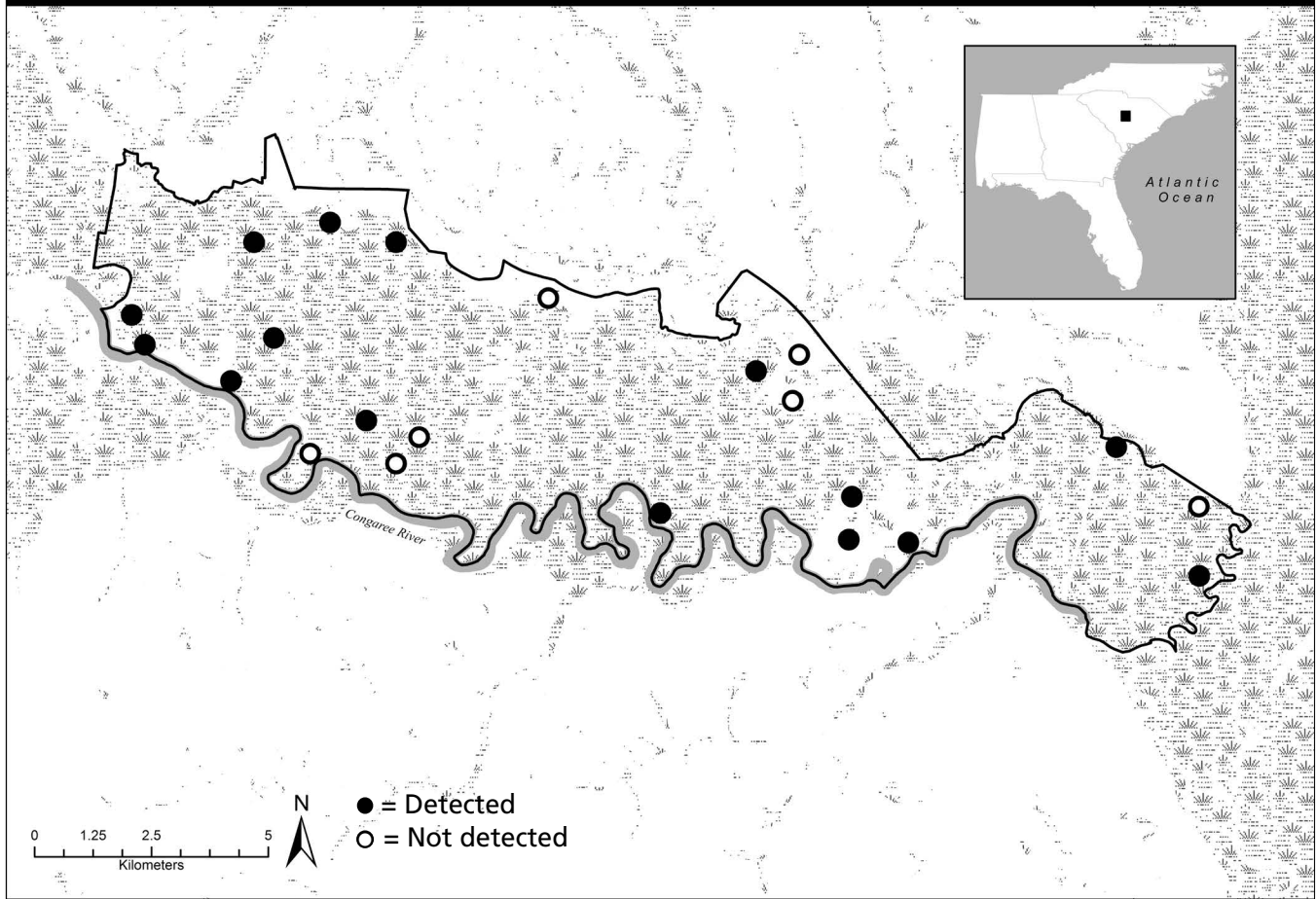


Figure C-11. Sampling locations where brown-headed cowbird (*Molothrus ater*) was detected at Congaree National Park, 2014.

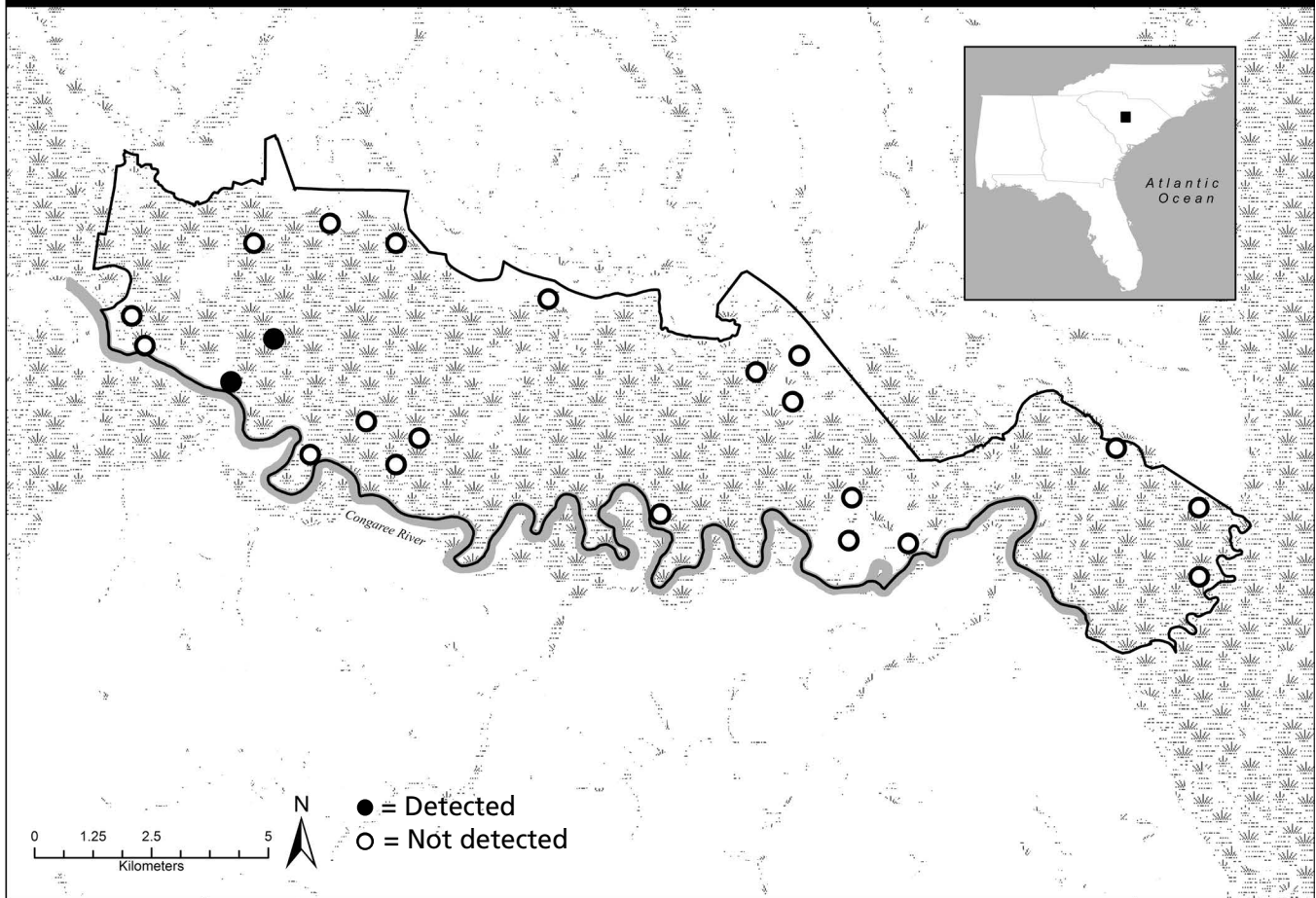


Figure C-12. Sampling locations where Canada goose (*Branta canadensis*) was detected at Congaree National Park, 2014.

Carolina Chickadee
Poecile carolinensis

National Park Service
U.S. Department of the Interior

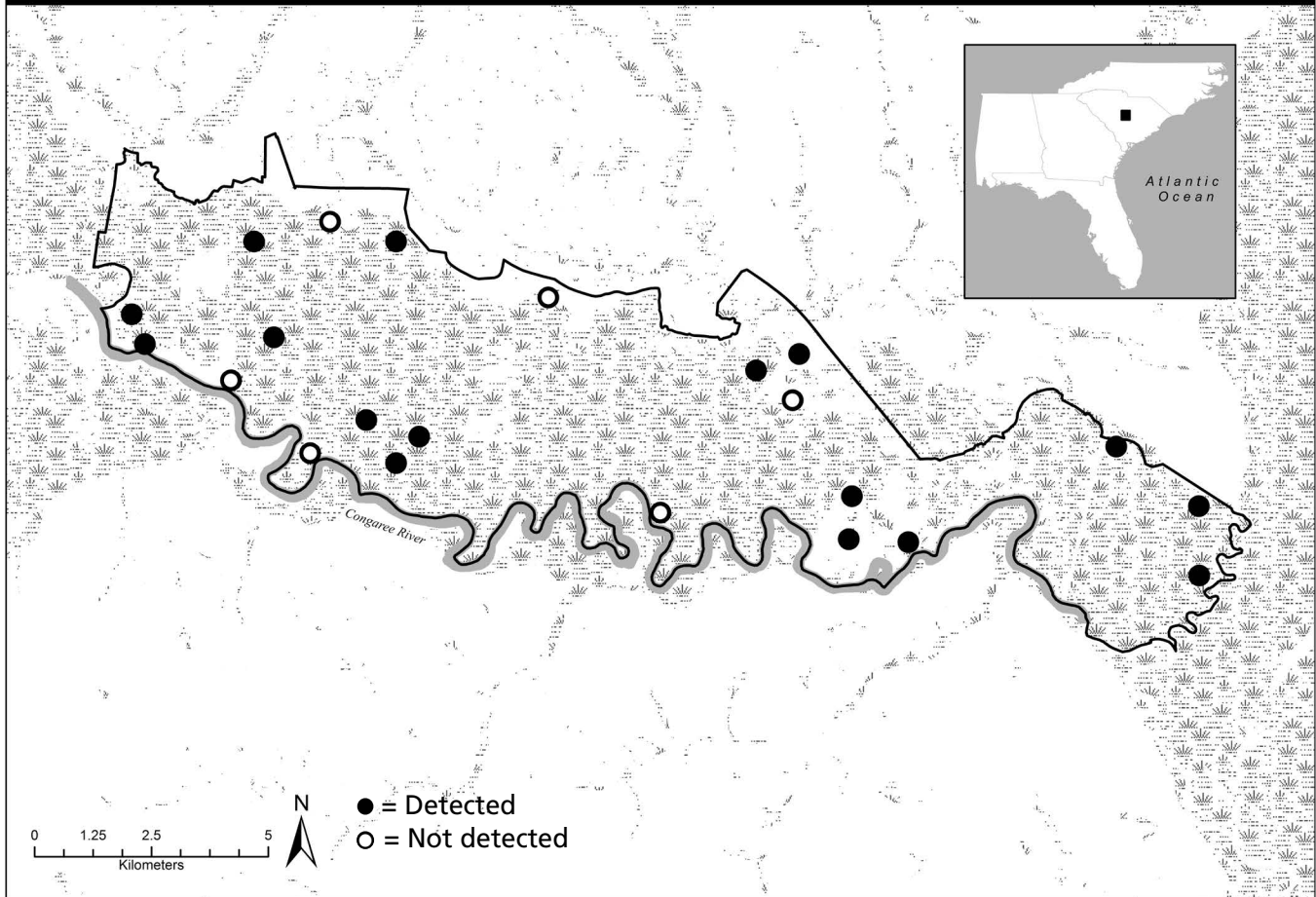


Figure C-13. Sampling locations where Carolina chickadee (*Poecile carolinensis*) was detected at Congaree National Park, 2014.

Carolina Wren
Thryothorus ludovicianus

National Park Service
U.S. Department of the Interior

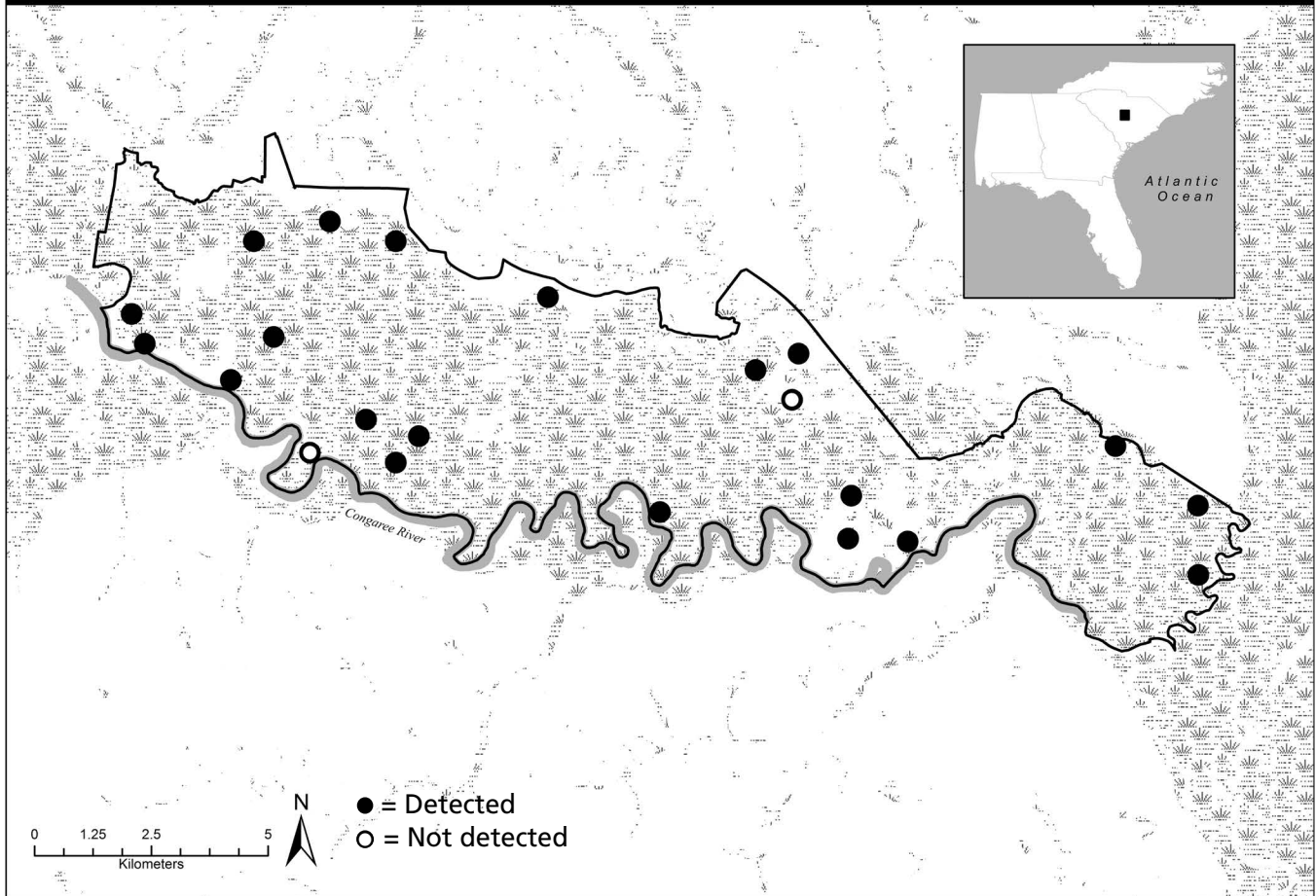


Figure C-14. Sampling locations where Carolina wren (*Thryothorus ludovicianus*) was detected at Congaree National Park, 2014.

Cedar Waxwing
Bombycilla cedrorum

National Park Service
U.S. Department of the Interior

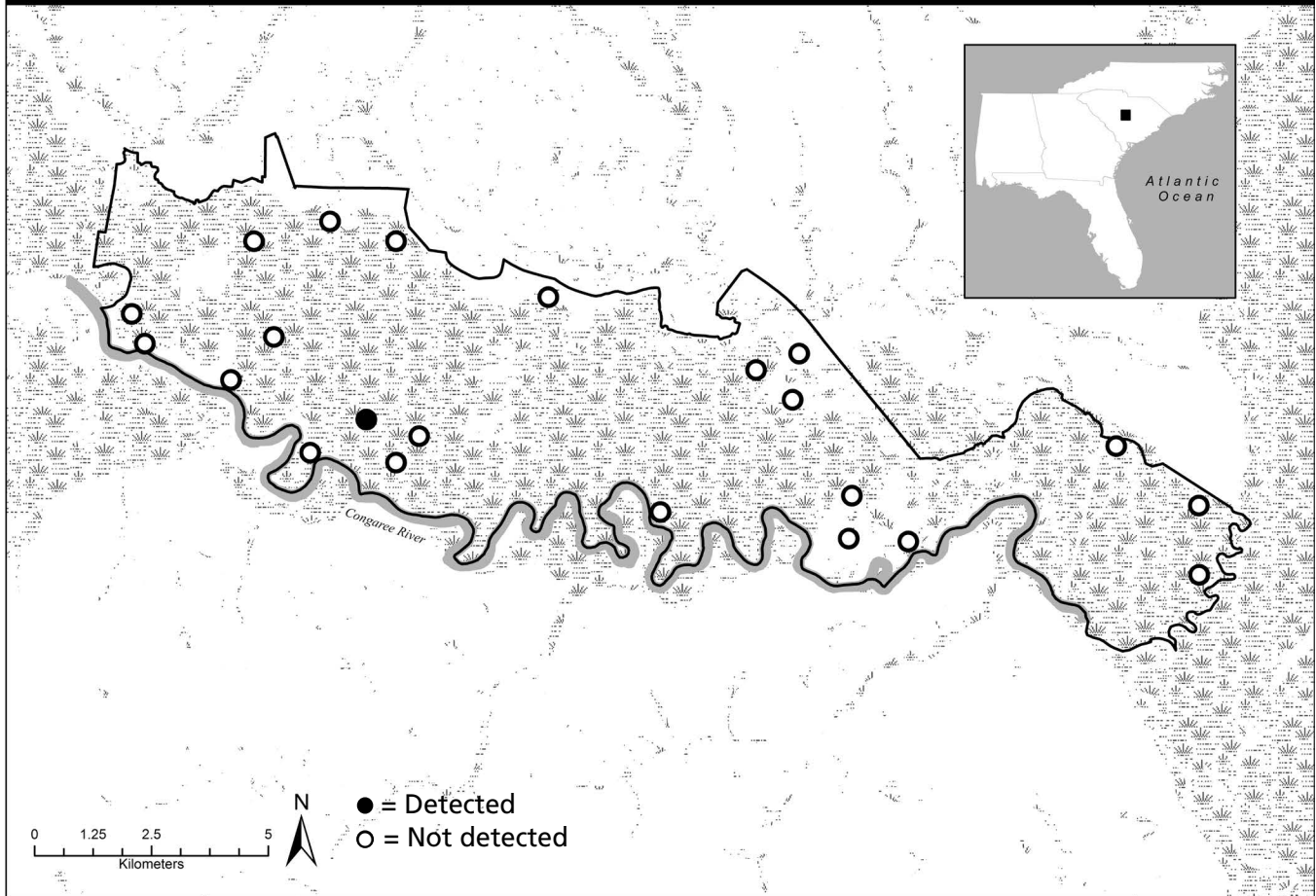


Figure C-15. Sampling locations where cedar waxwing (*Bombycilla cedrorum*) was detected at Congaree National Park, 2014.

Chimney Swift
Chaetura pelagica

National Park Service
U.S. Department of the Interior

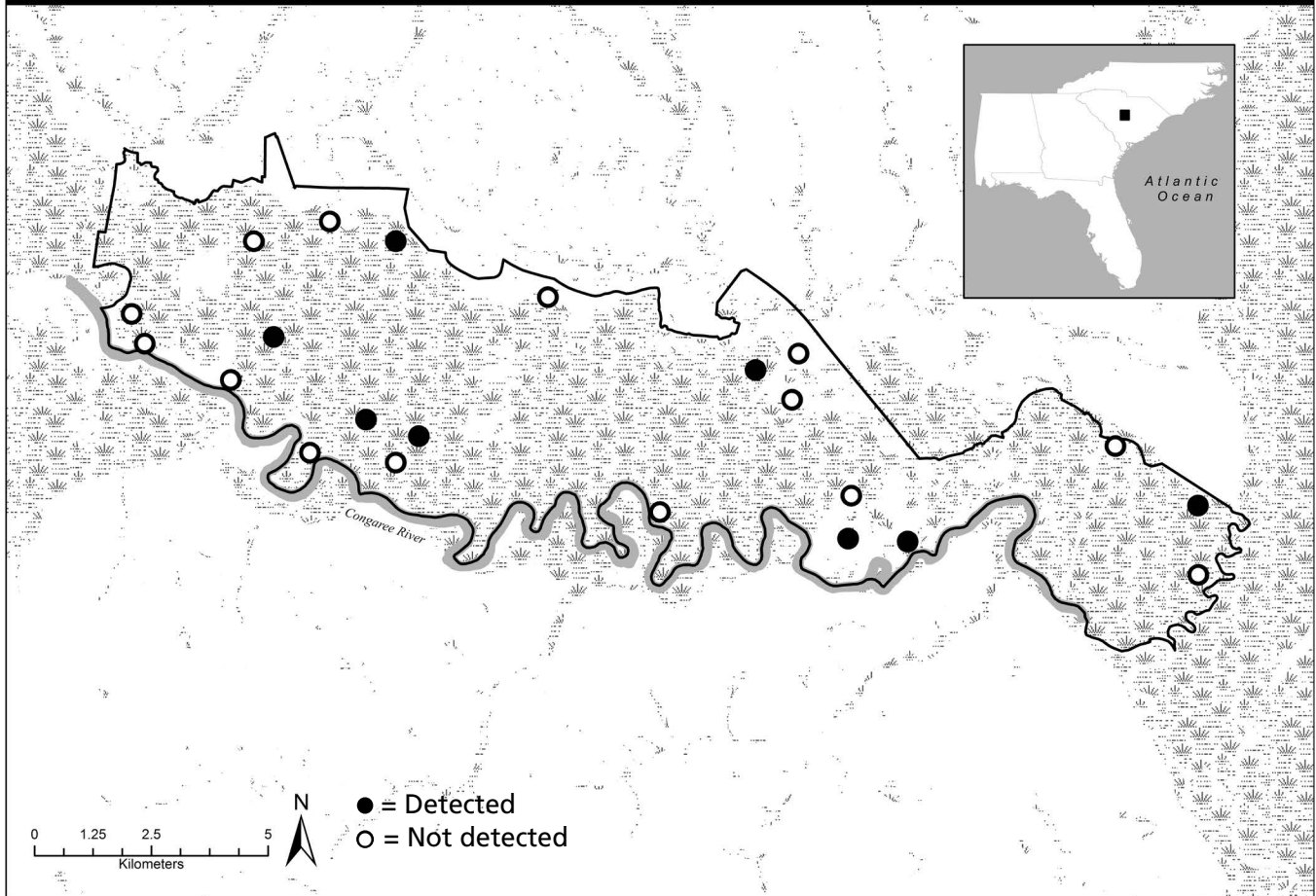


Figure C-16. Sampling locations where chimney swift (*Chaetura pelagica*) was detected at Congaree National Park, 2014.

Common Yellowthroat
Geothlypis trichas

National Park Service
U.S. Department of the Interior

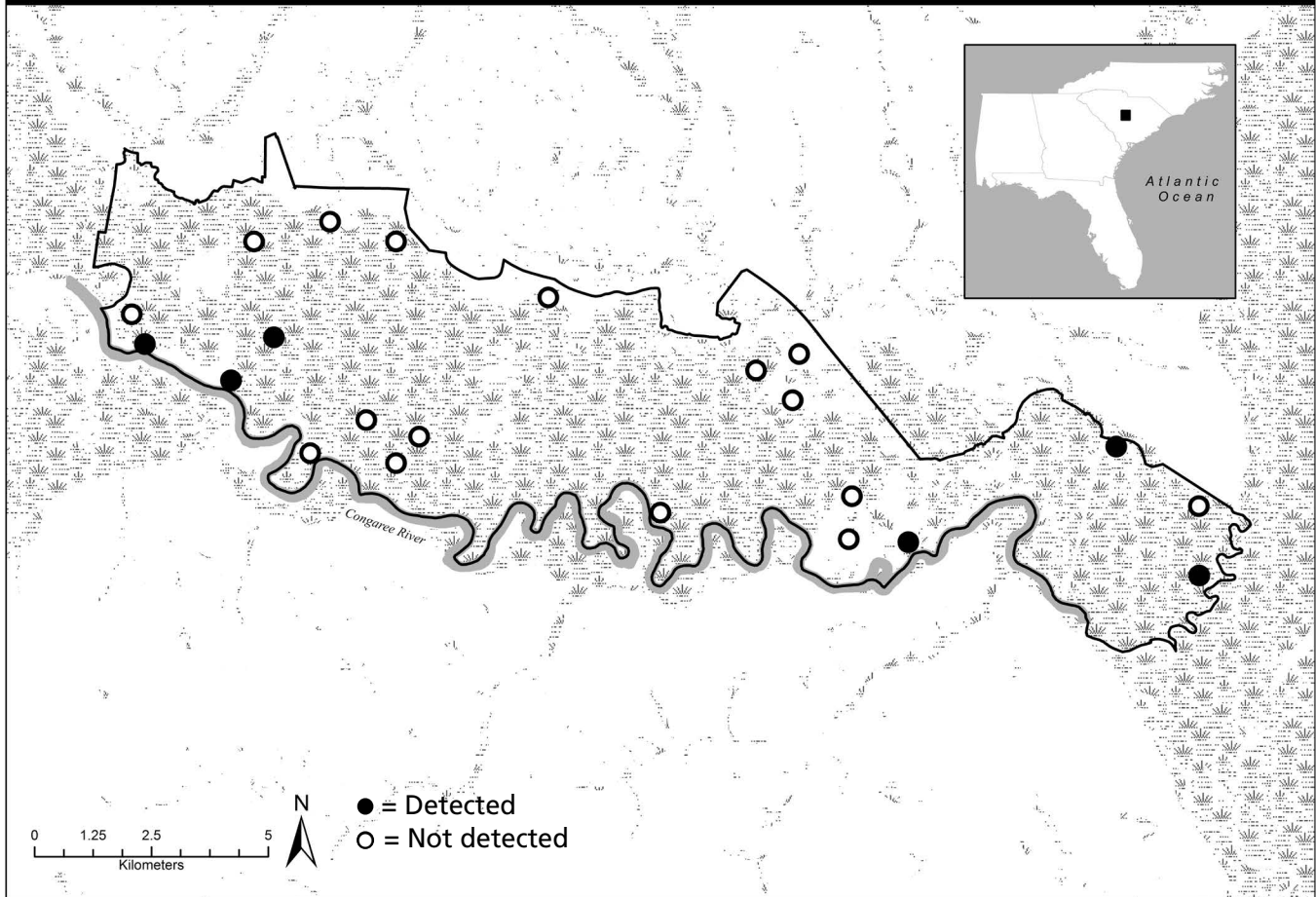


Figure C-17. Sampling locations where common yellowthroat (*Geothlypis trichas*) was detected at Congaree National Park, 2014.

Downy Woodpecker
Picoides pubescens

National Park Service
U.S. Department of the Interior

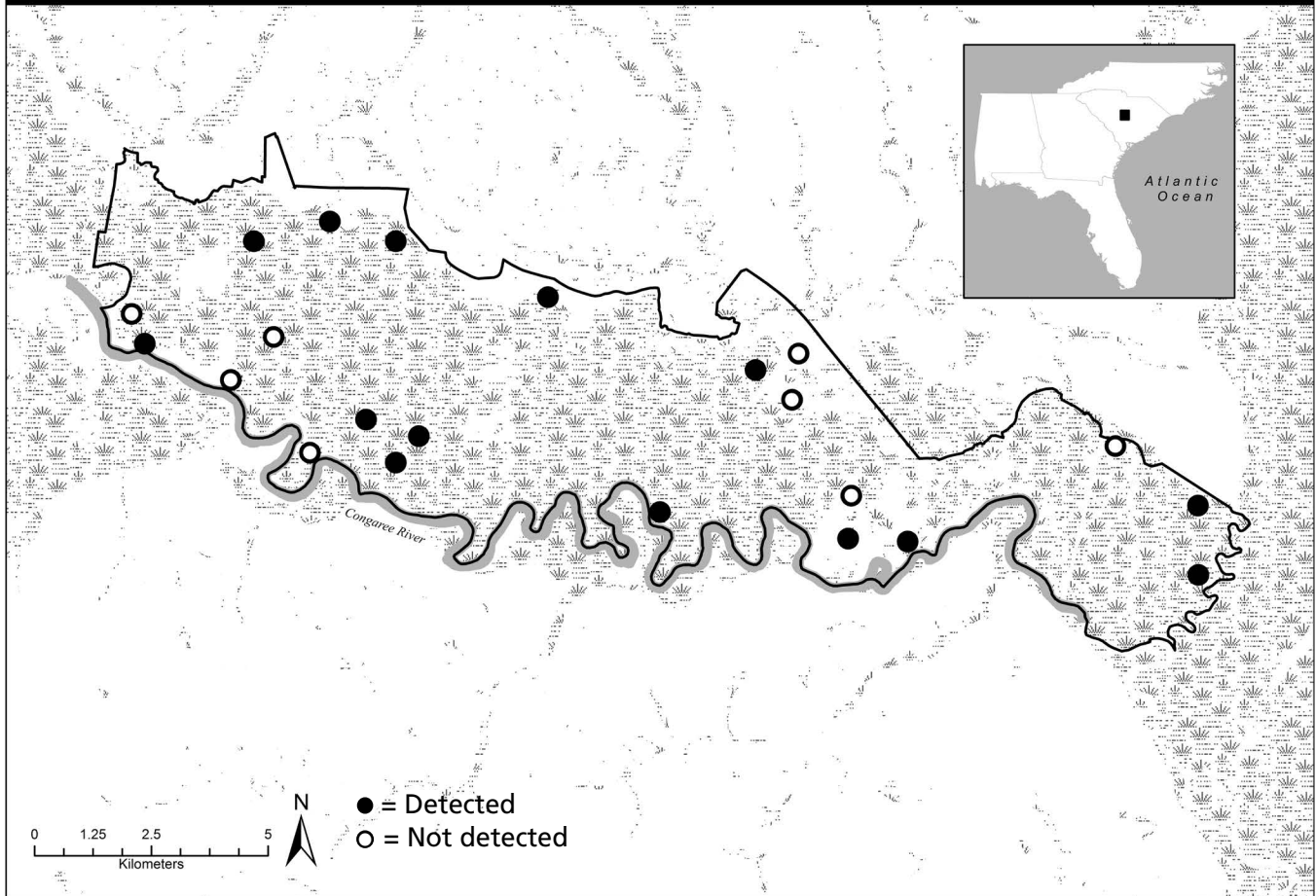


Figure C-18. Sampling locations where downy woodpecker (*Picoides pubescens*) was detected at Congaree National Park, 2014.

Eastern Towhee
Pipilo erythrophthalmus

National Park Service
U.S. Department of the Interior

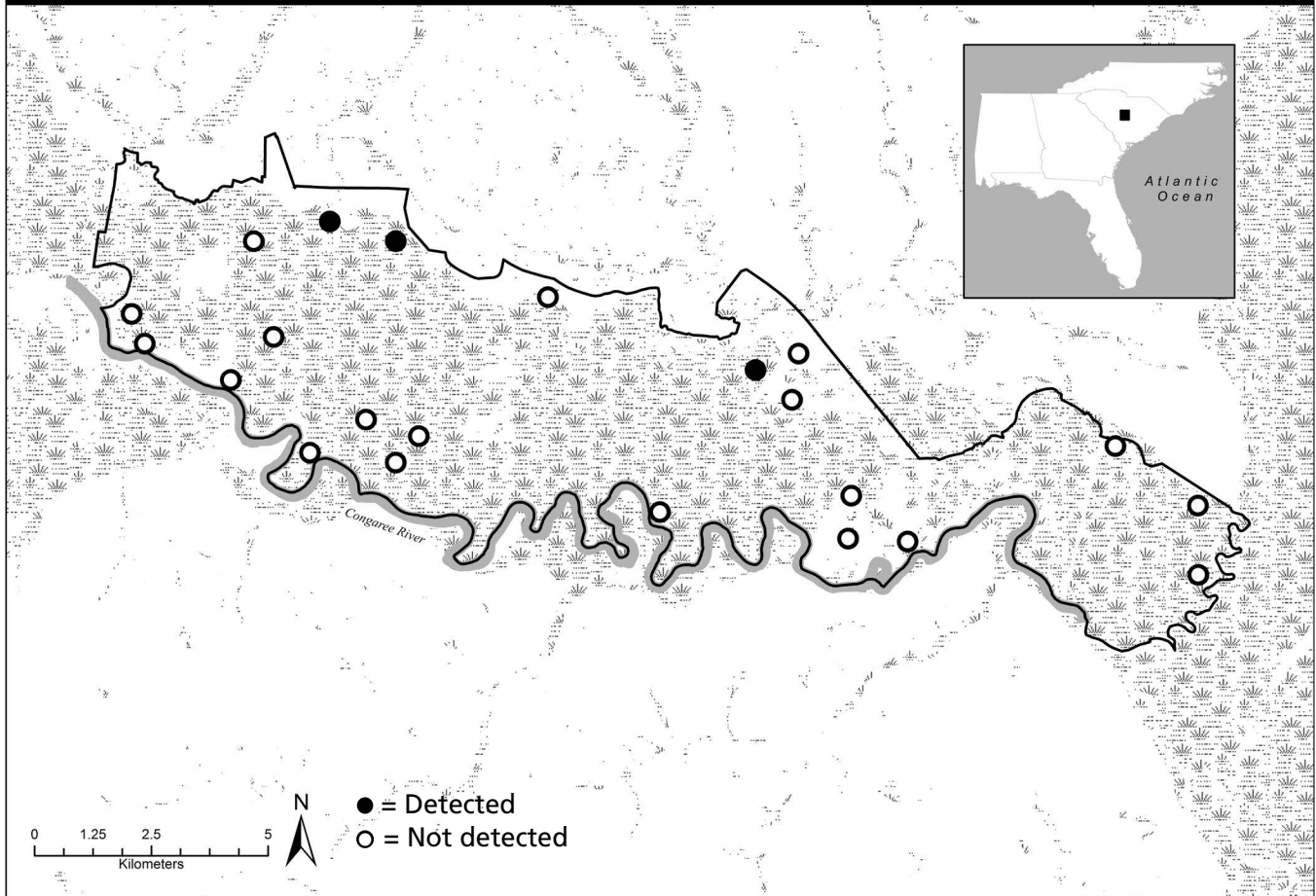


Figure C-19. Sampling locations where eastern towhee (*Pipilo erythrophthalmus*) was detected at Congaree National Park, 2014.

Eastern Wood-Pewee
Contopus virens

National Park Service
U.S. Department of the Interior

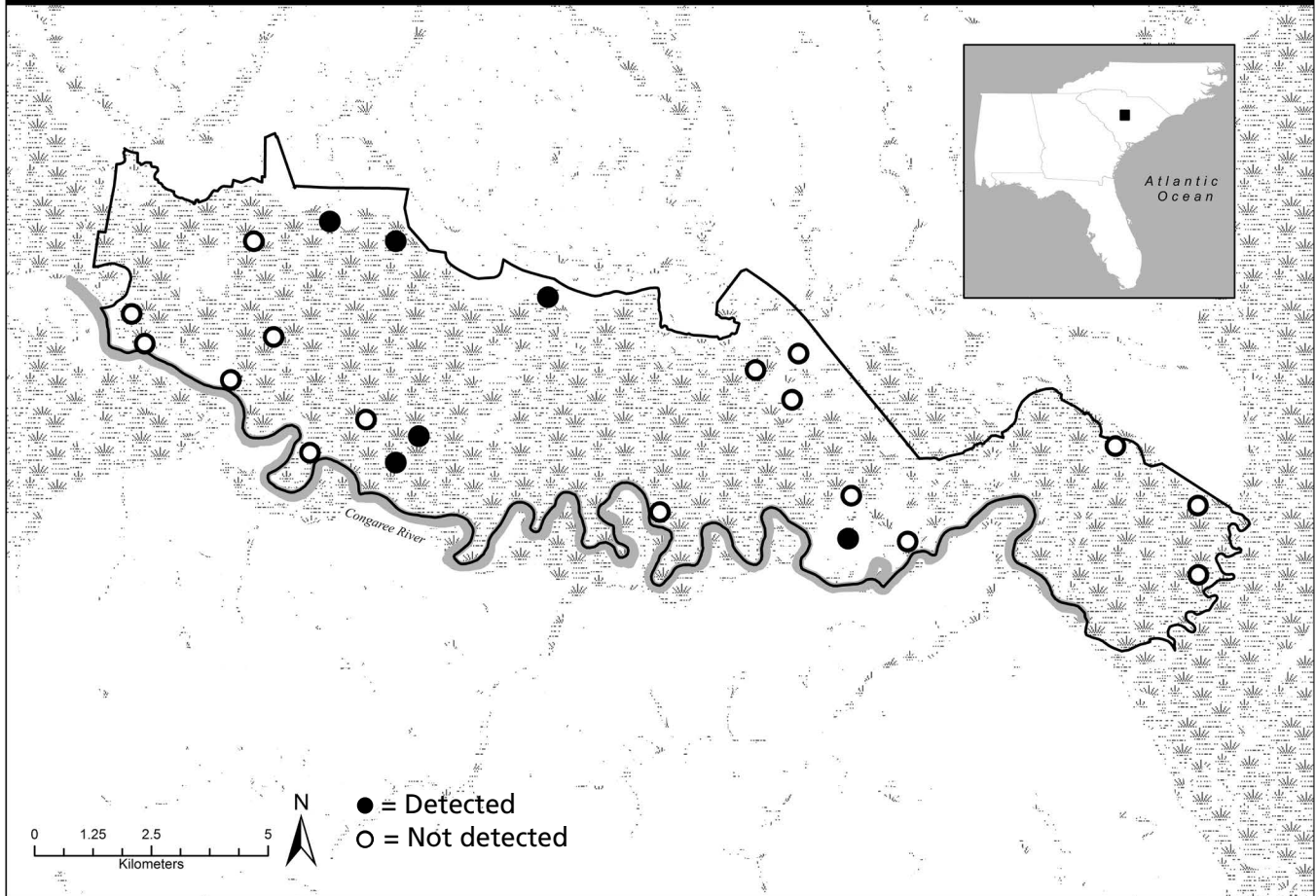


Figure C-20. Sampling locations where eastern wood-pewee (*Contopus virens*) was detected at Congaree National Park, 2014.

European Starling
Sturnus vulgaris

National Park Service
U.S. Department of the Interior

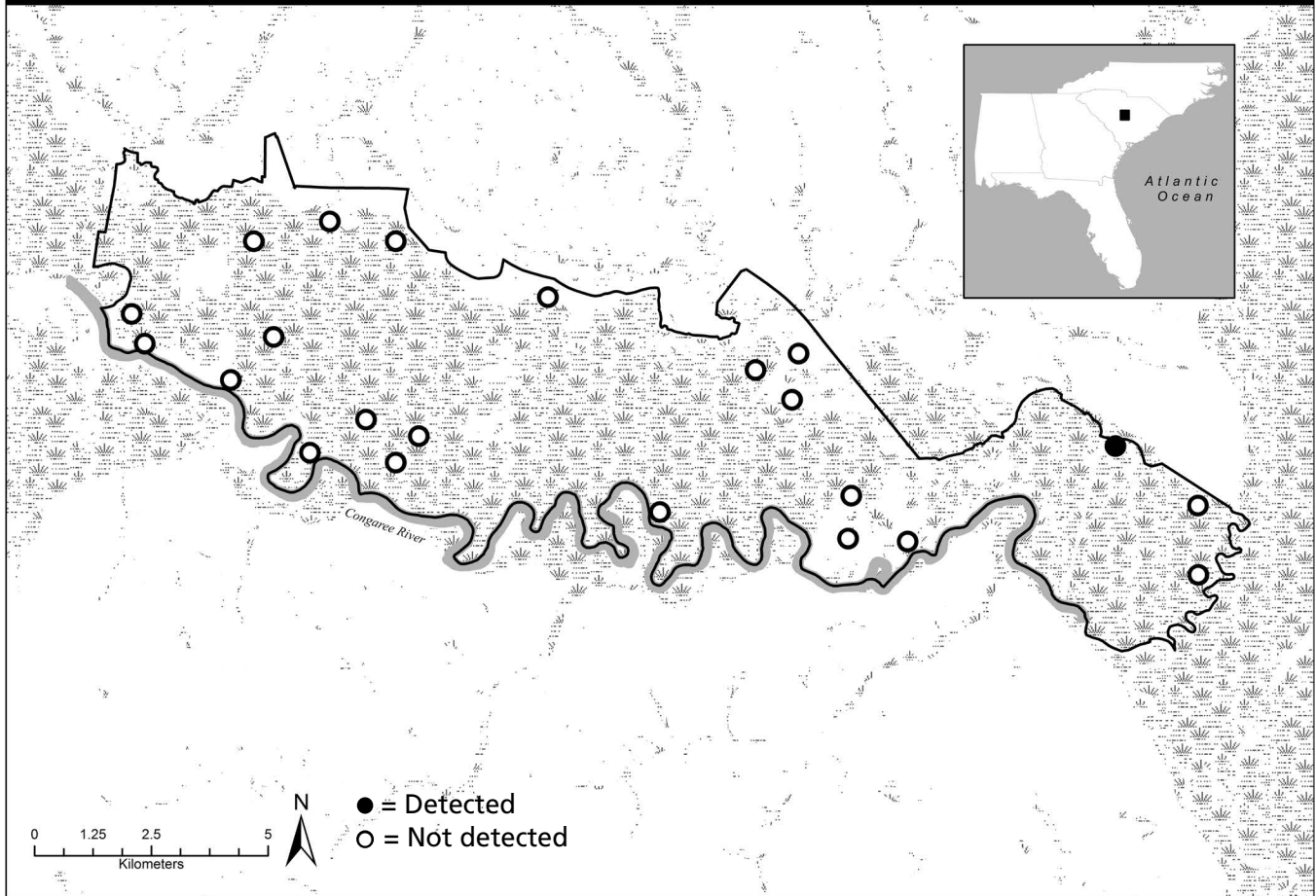


Figure C-21. Sampling locations where European starling (*Sturnus vulgaris*) was detected at Congaree National Park, 2014.

Fish Crow
Corvus ossifragus

National Park Service
U.S. Department of the Interior

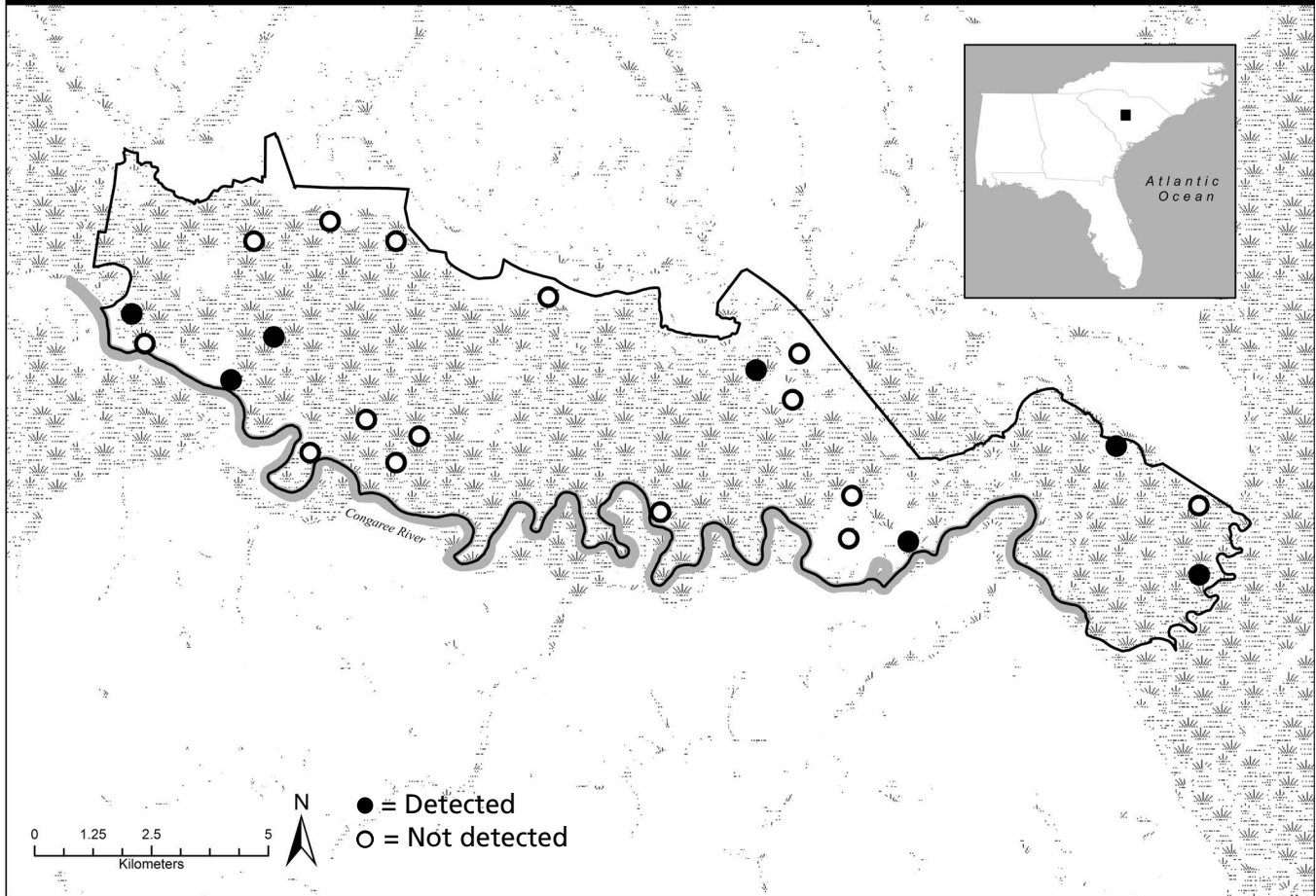


Figure C-22. Sampling locations where fish crow (*Corvus ossifragus*) was detected at Congaree National Park, 2014.

Gray Catbird
Dumetella carolinensis

National Park Service
U.S. Department of the Interior

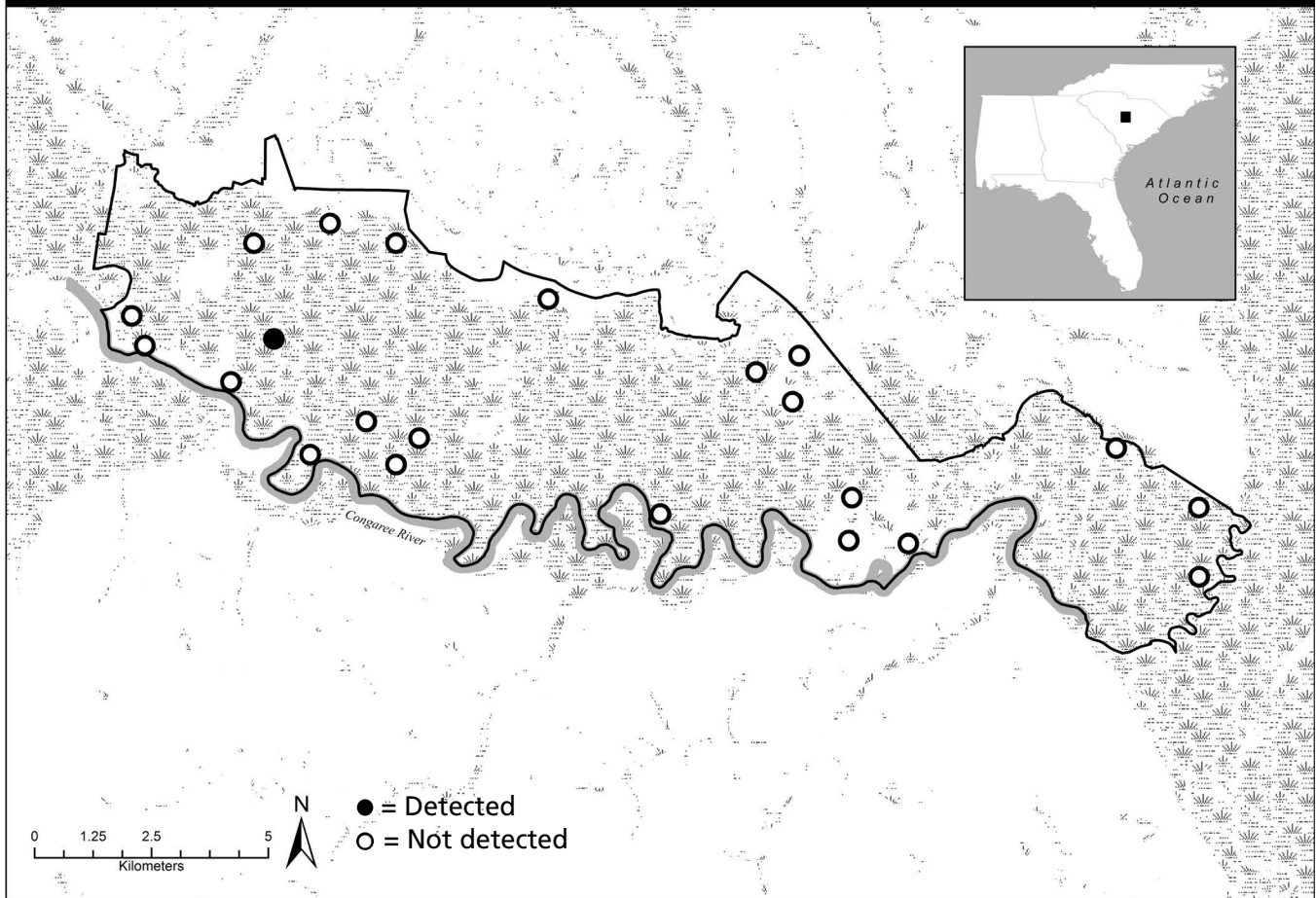


Figure C-23. Sampling locations where gray catbird (*Dumetella carolinensis*) was detected at Congaree National Park, 2014.

Great Blue Heron
Ardea herodias

National Park Service
U.S. Department of the Interior

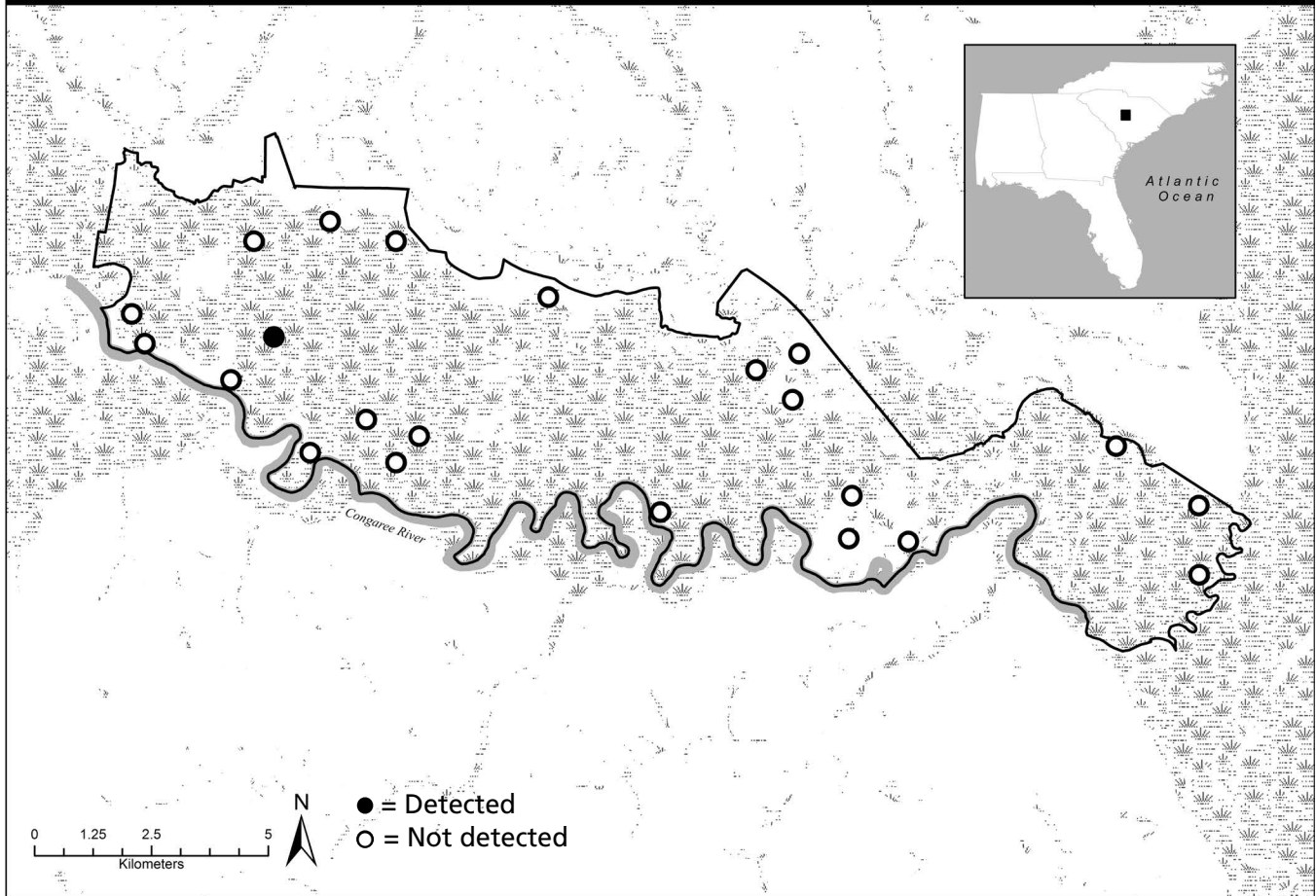


Figure C-24. Sampling locations where great blue heron (*Ardea herodias*) was detected at Congaree National Park, 2014.

Great Crested Flycatcher
Myiarchus crinitus

National Park Service
U.S. Department of the Interior

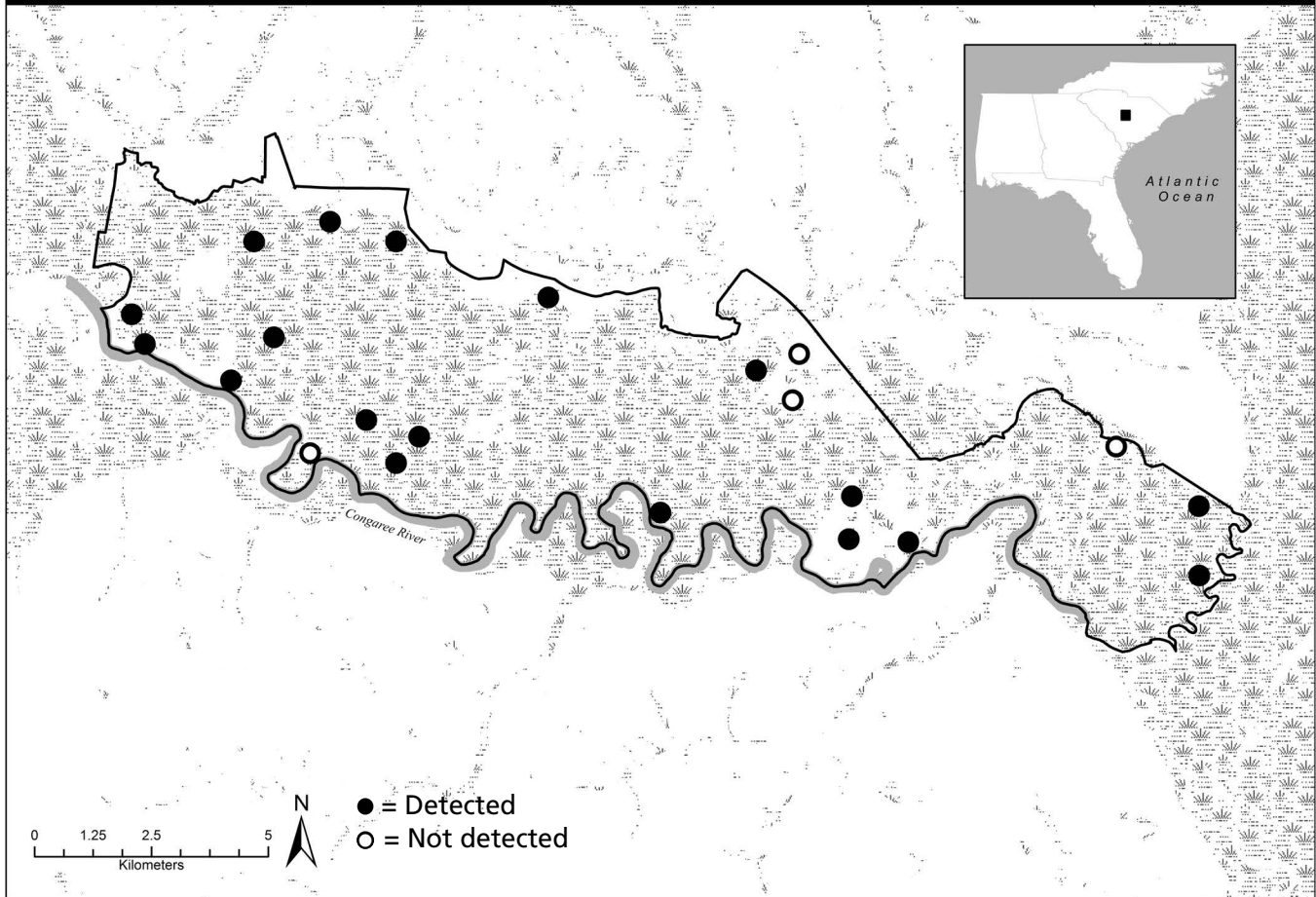


Figure C-25. Sampling locations where great crested flycatcher (*Myiarchus crinitus*) was detected at Congaree National Park, 2014.

Green Heron
Butorides virescens

National Park Service
U.S. Department of the Interior

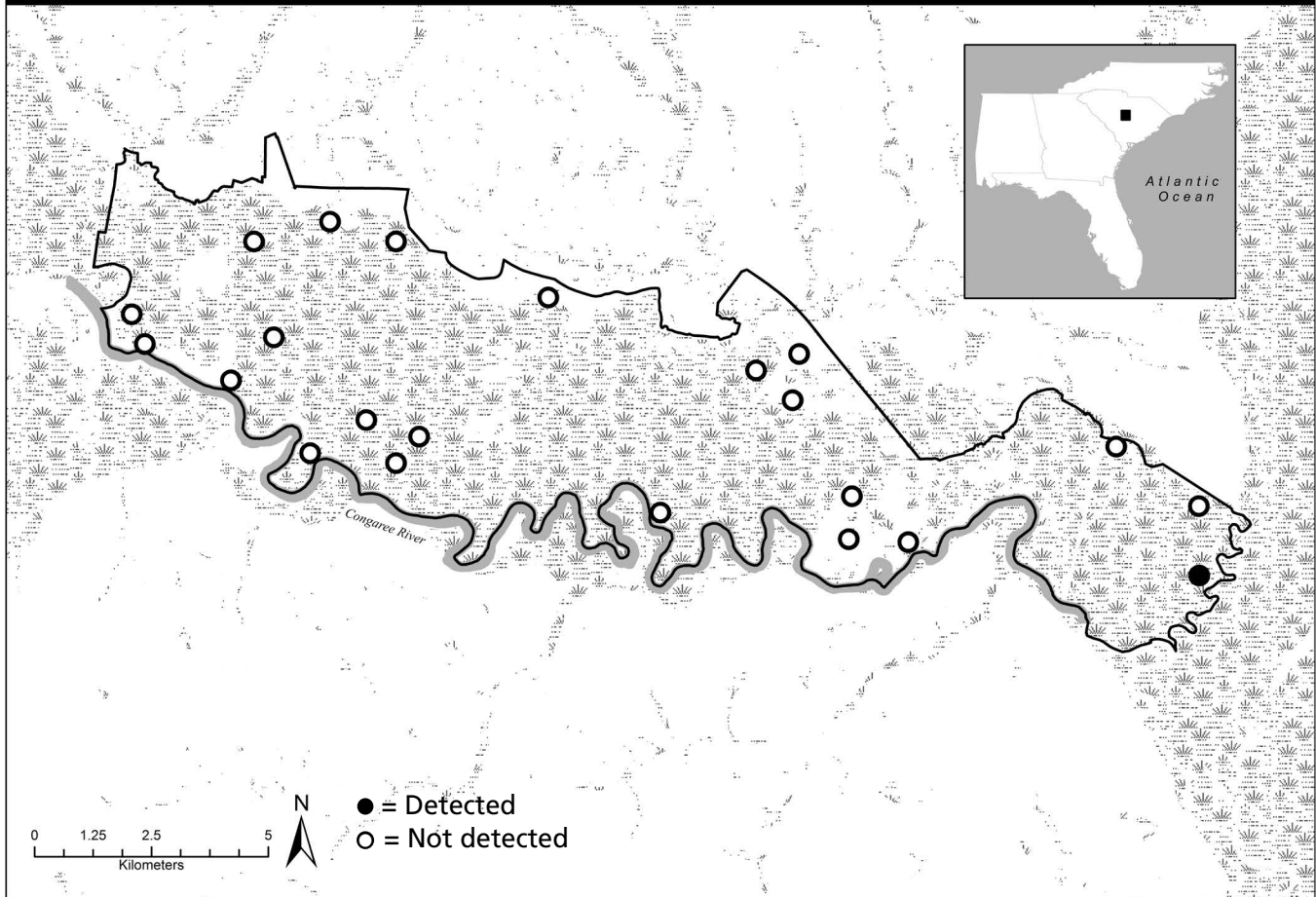


Figure C-26. Sampling locations where green heron (*Butorides virescens*) was detected at Congaree National Park, 2014.

Hairy Woodpecker
Picoides villosus

National Park Service
U.S. Department of the Interior

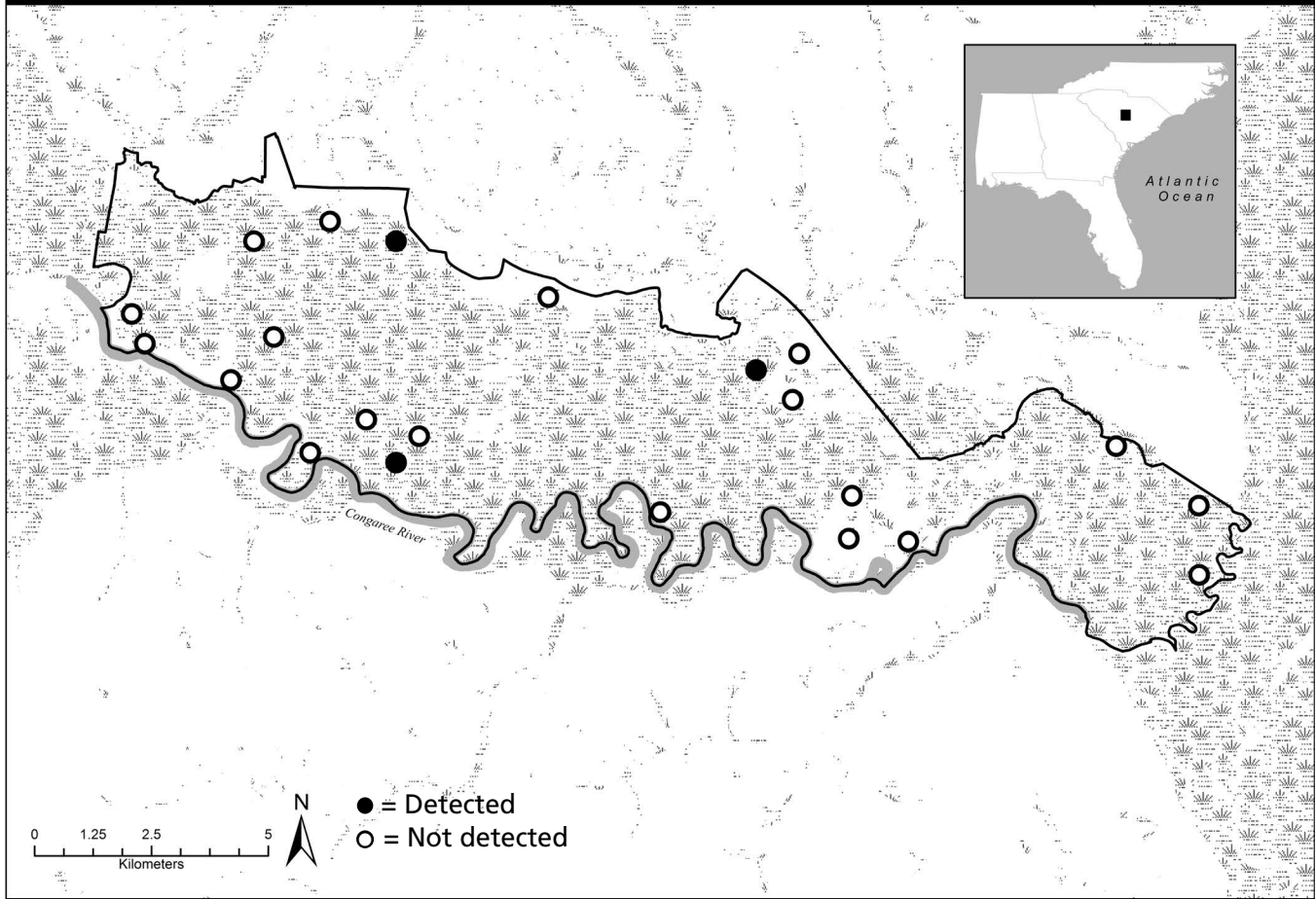


Figure C-27. Sampling locations where hairy woodpecker (*Picoides villosus*) was detected at Congaree National Park, 2014.

Hooded Warbler
Setophaga citrina

National Park Service
U.S. Department of the Interior

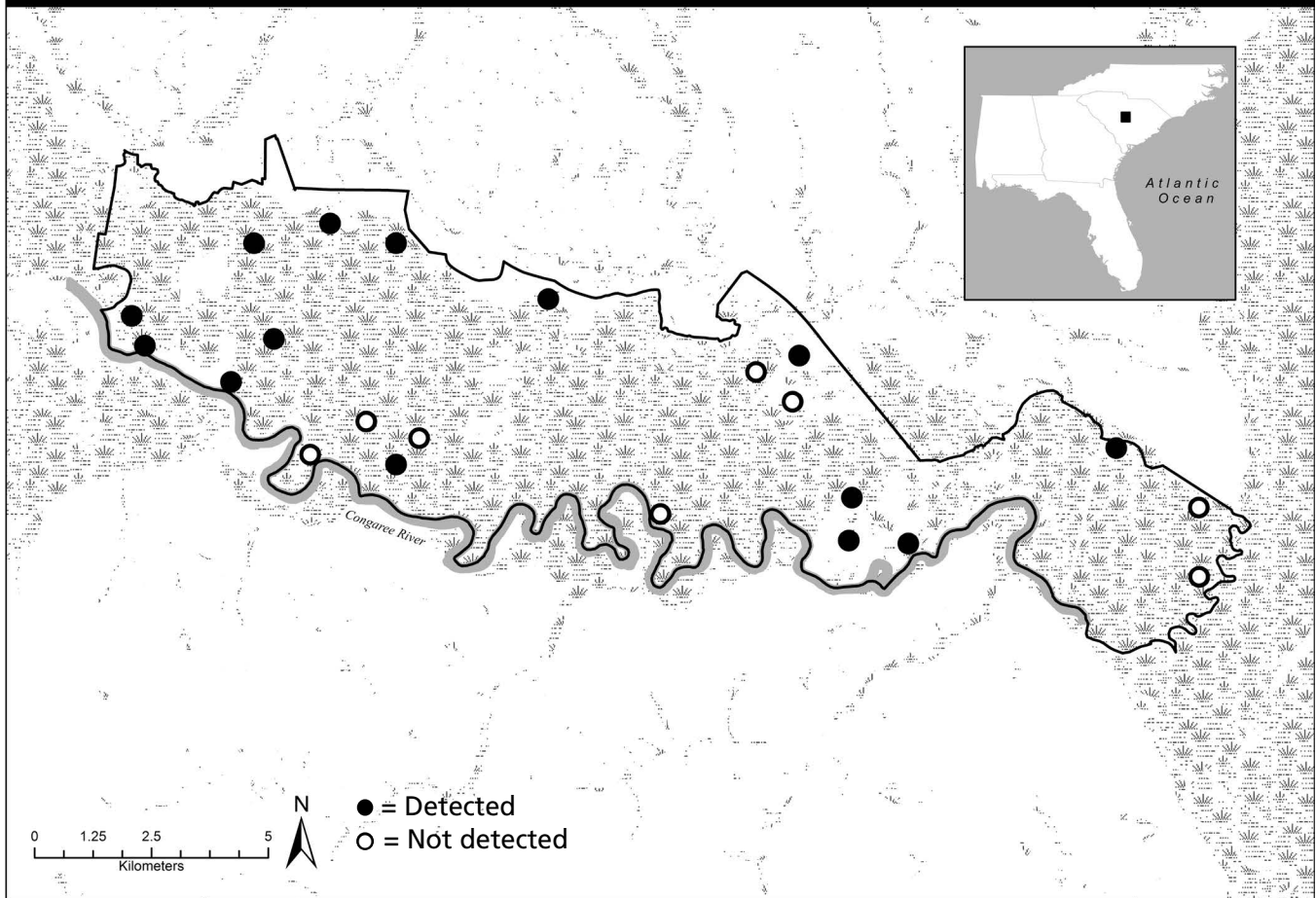


Figure C-28. Sampling locations where hooded warbler (*Setophaga citrina*) was detected at Congaree National Park, 2014.

Indigo Bunting
Passerina cyanea

National Park Service
U.S. Department of the Interior

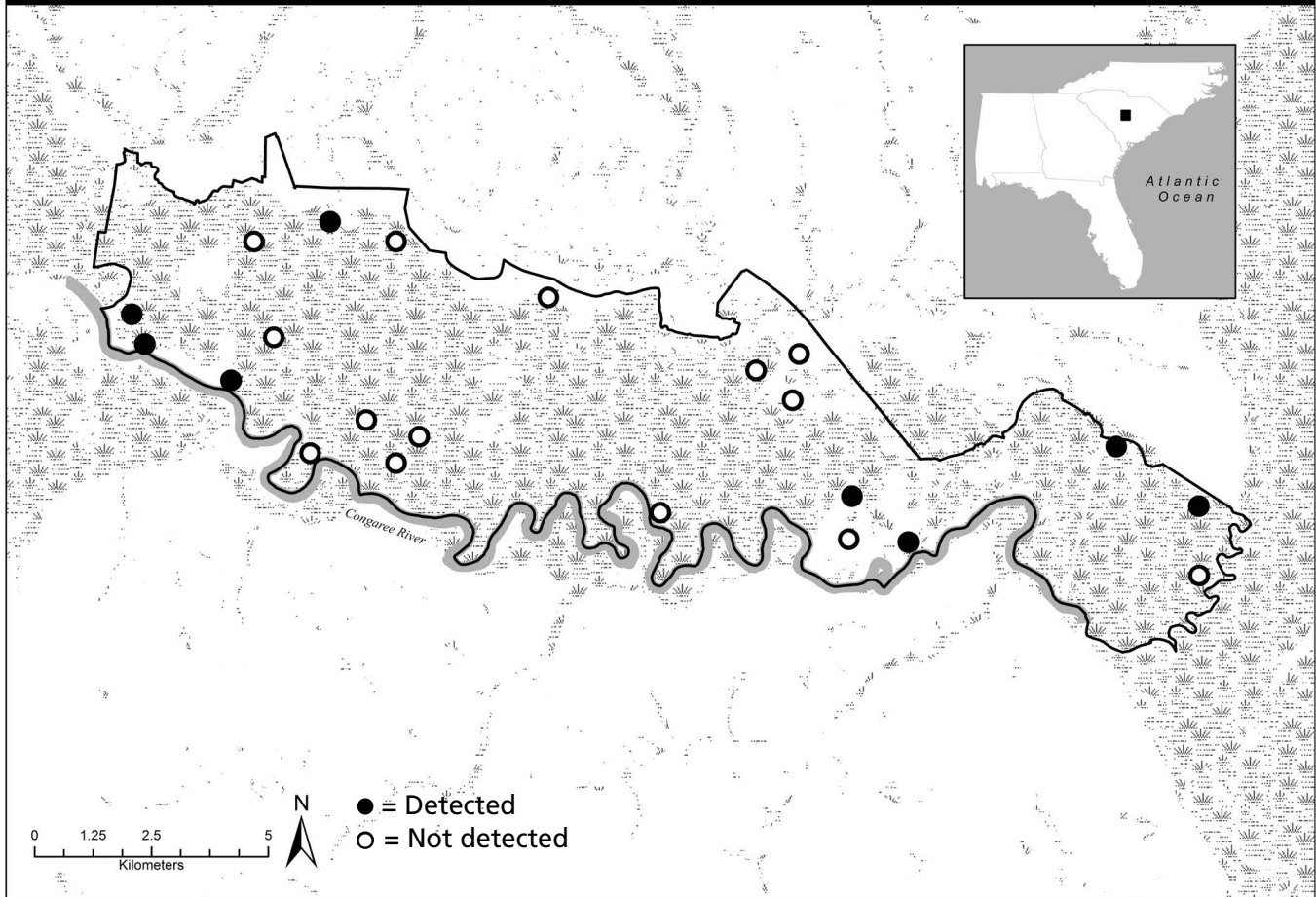


Figure C-29. Sampling locations where indigo bunting (*Passerina cyanea*) was detected at Congaree National Park, 2014.

Louisiana Waterthrush
Parkesia motacilla

National Park Service
U.S. Department of the Interior

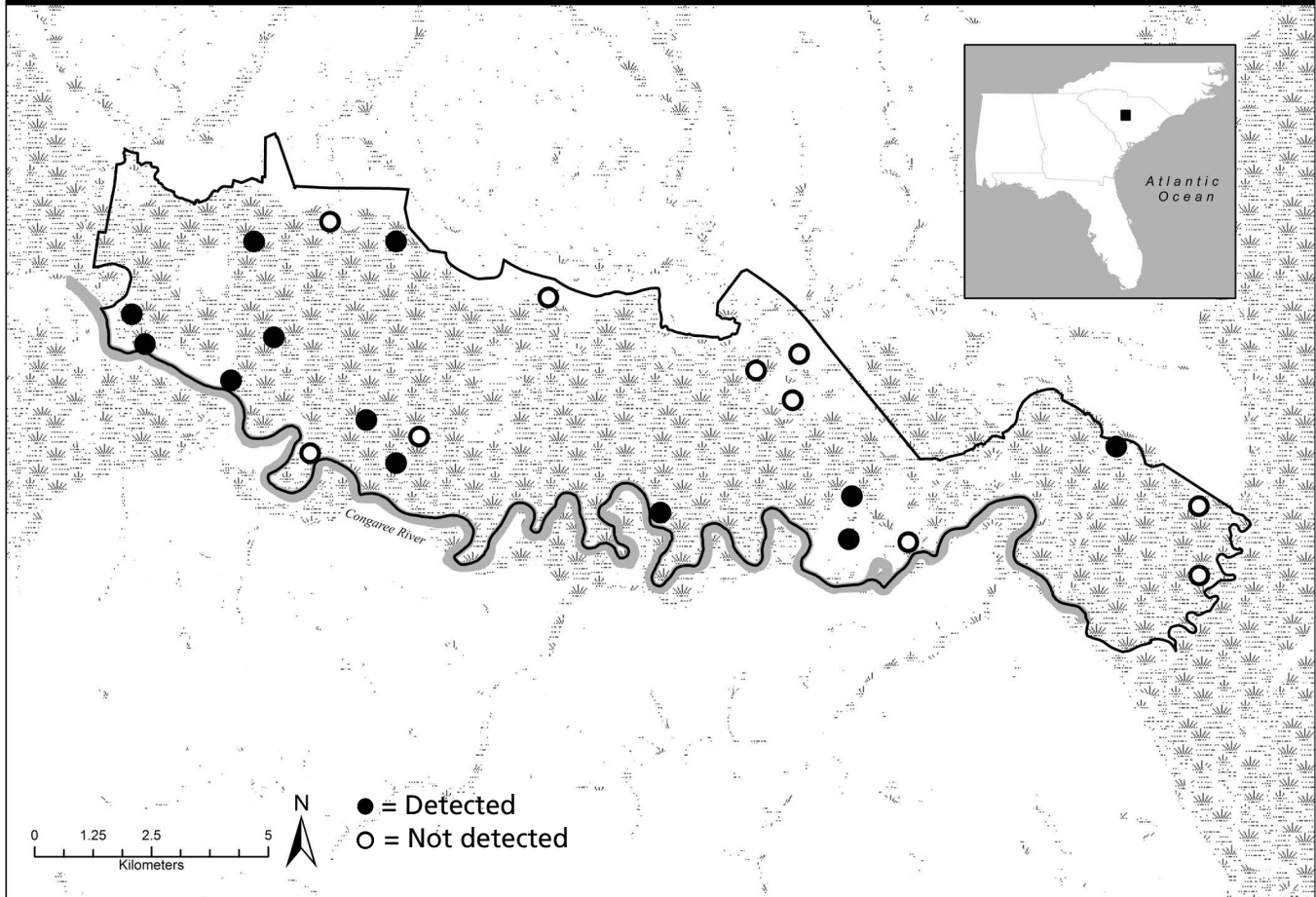


Figure C-30. Sampling locations where Louisiana waterthrush (*Parkesia motacilla*) was detected at Congaree National Park, 2014.

Mourning Dove
Zenaida macroura

National Park Service
U.S. Department of the Interior

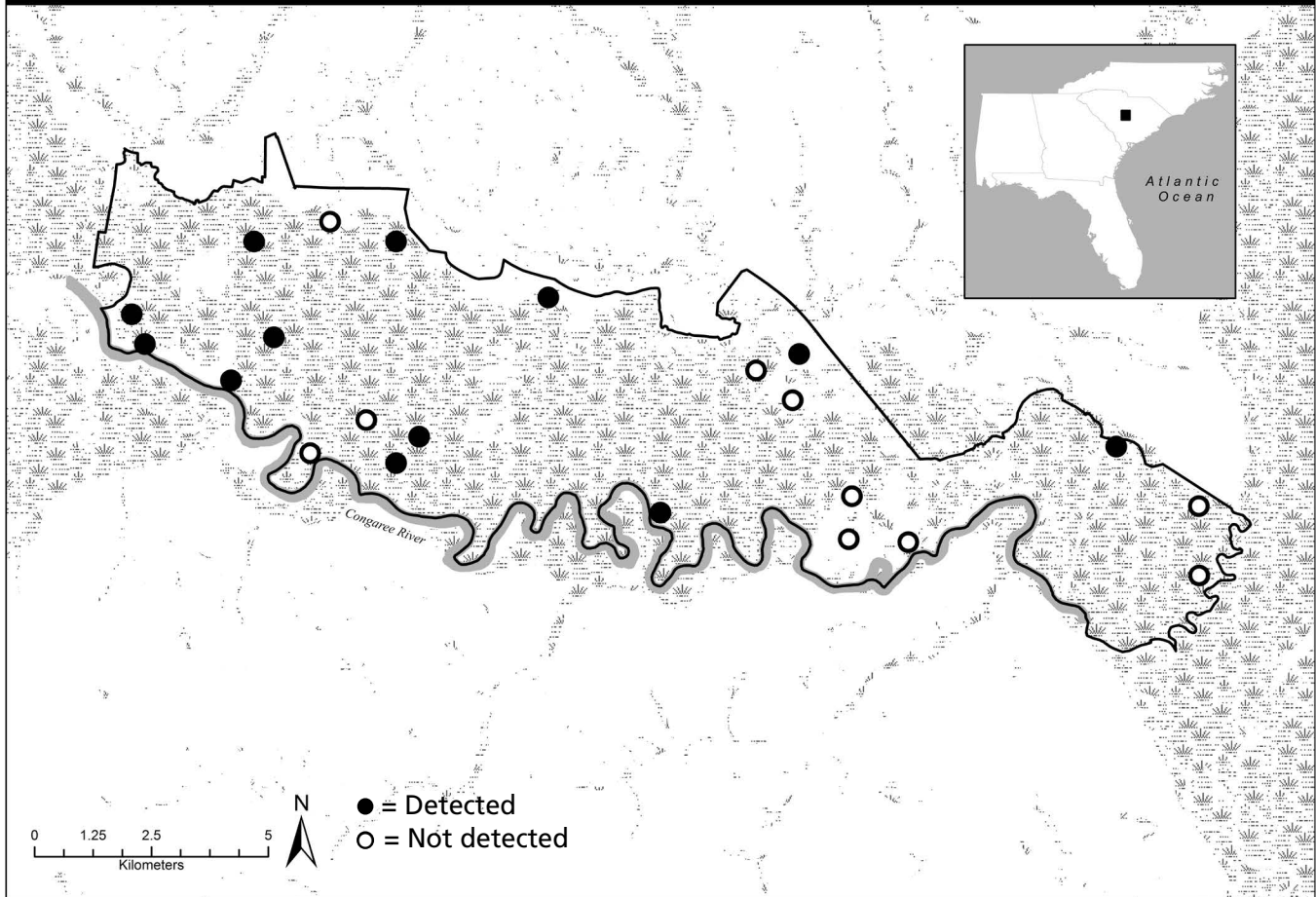


Figure C-31. Sampling locations where mourning dove (*Zenaida macroura*) was detected at Congaree National Park, 2014.

Northern Cardinal
Cardinalis cardinalis

National Park Service
U.S. Department of the Interior

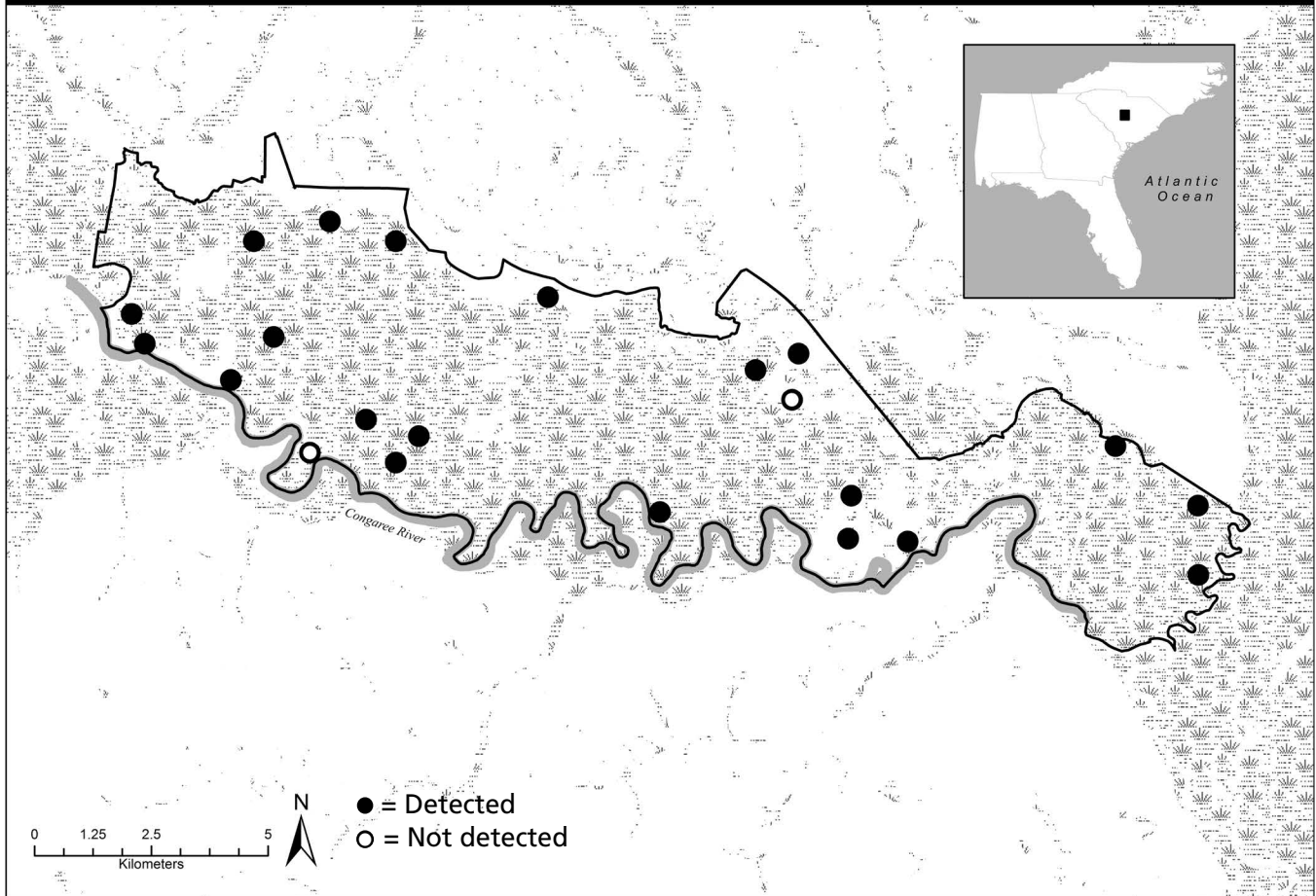


Figure C-32. Sampling locations where northern cardinal (*Cardinalis cardinalis*) was detected at Congaree National Park, 2014.

Northern Flicker
Colaptes auratus

National Park Service
U.S. Department of the Interior

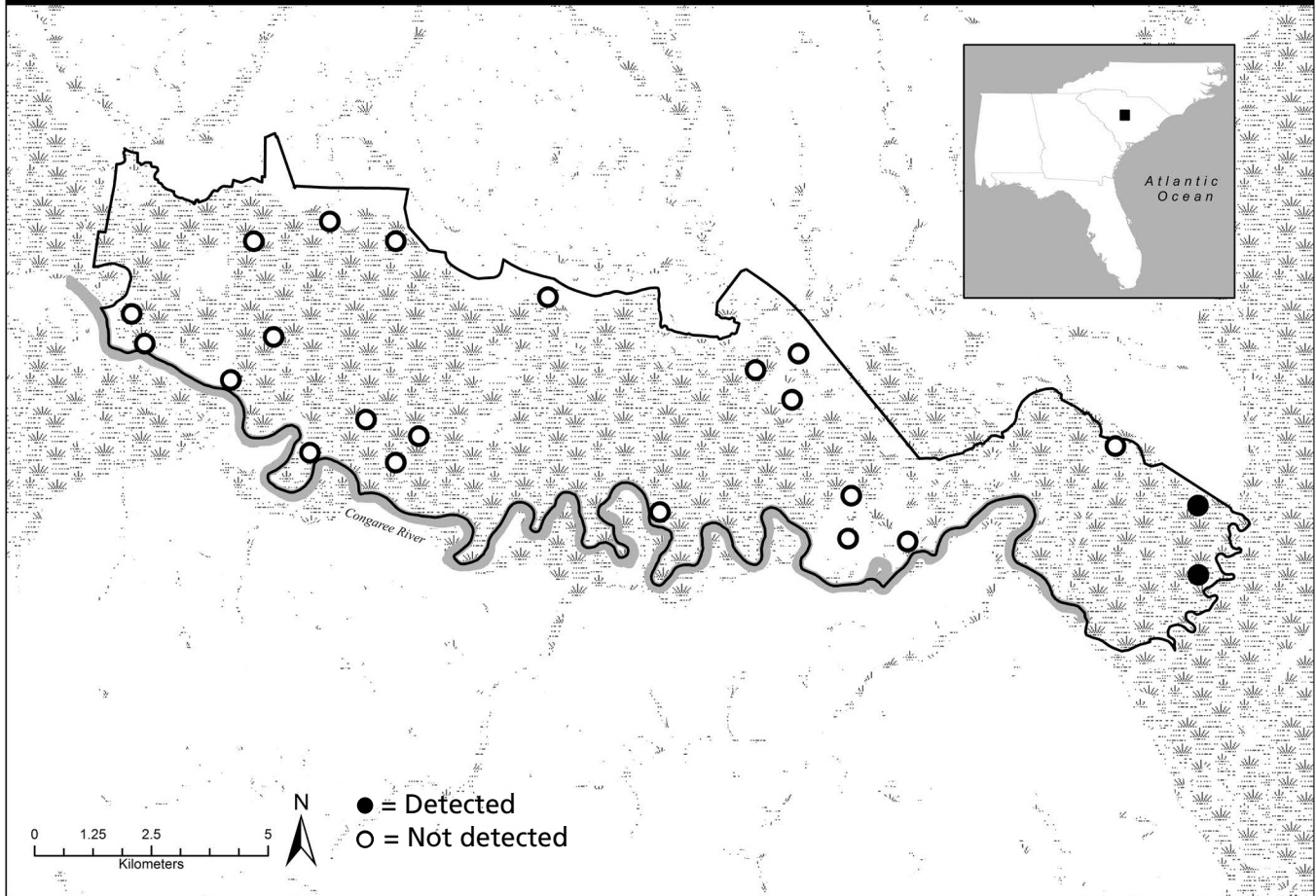


Figure C-33. Sampling locations where northern flicker (*Colaptes auratus*) was detected at Congaree National Park, 2014.

Northern Parula
Setophaga americana

National Park Service
U.S. Department of the Interior

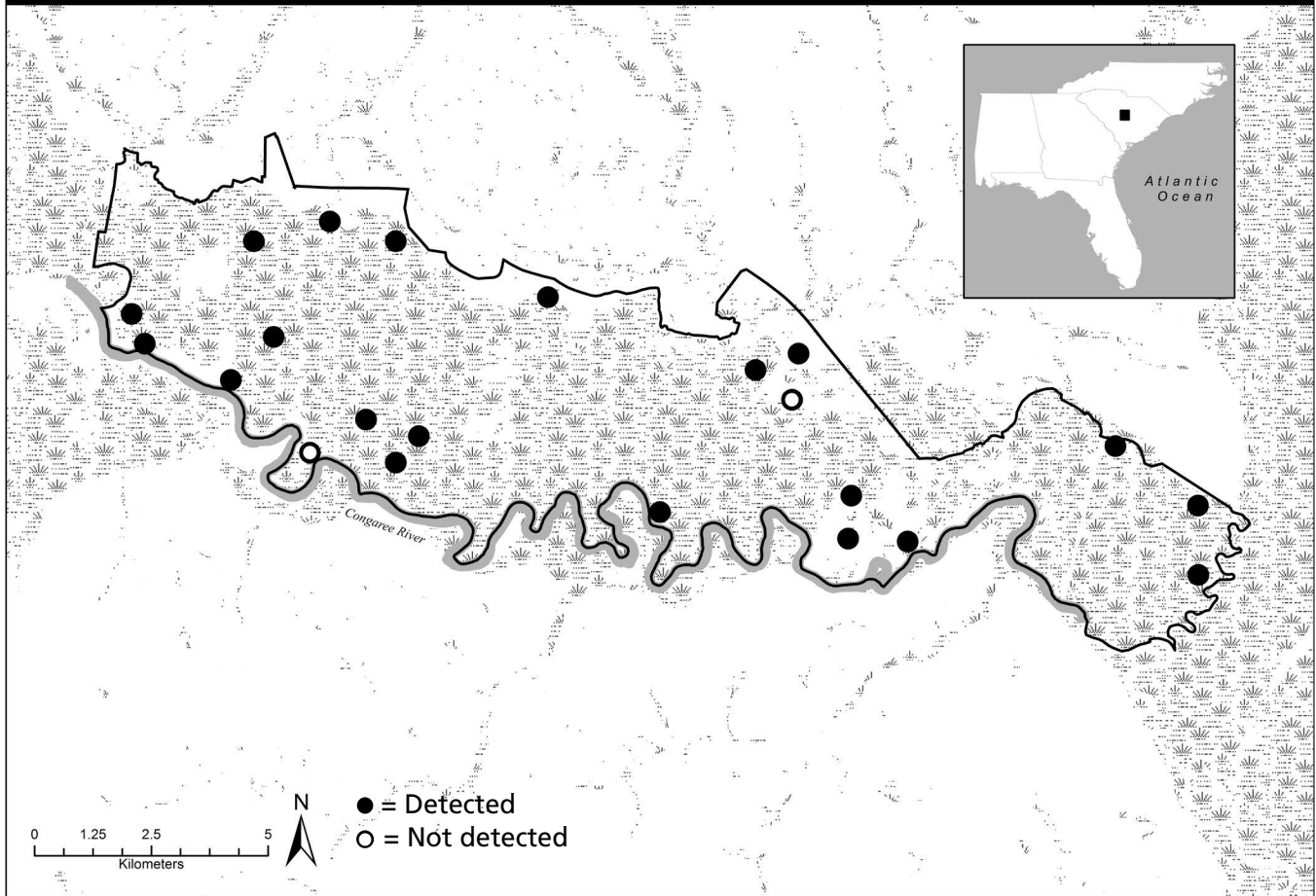


Figure C-34. Sampling locations where northern parula (*Setophaga americana*) was detected at Congaree National Park, 2014.

Osprey
Pandion haliaetus

National Park Service
U.S. Department of the Interior

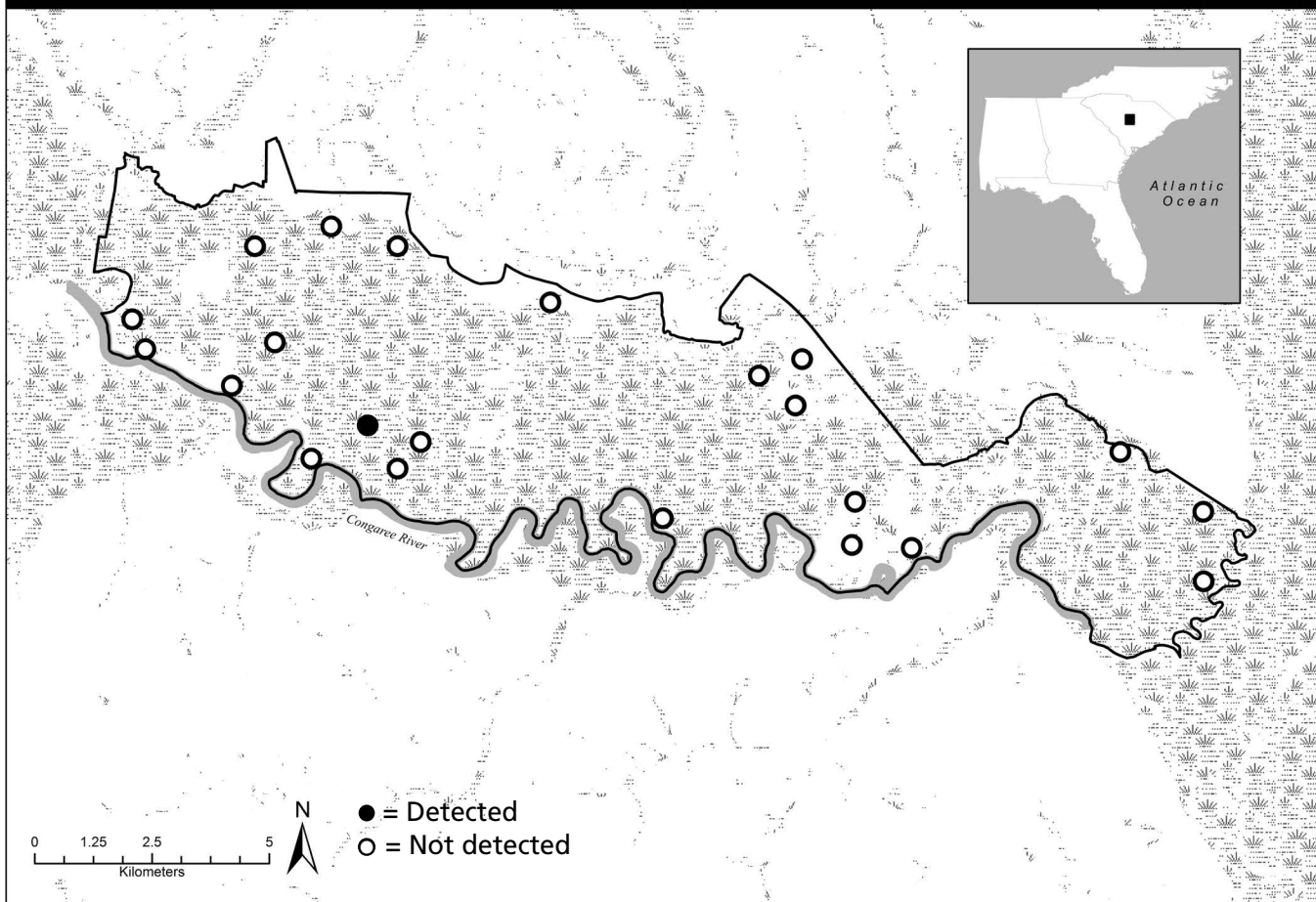


Figure C-35. Sampling locations where osprey (*Pandion haliaetus*) was detected at Congaree National Park, 2014.

Ovenbird
Seiurus aurocapillus

National Park Service
U.S. Department of the Interior

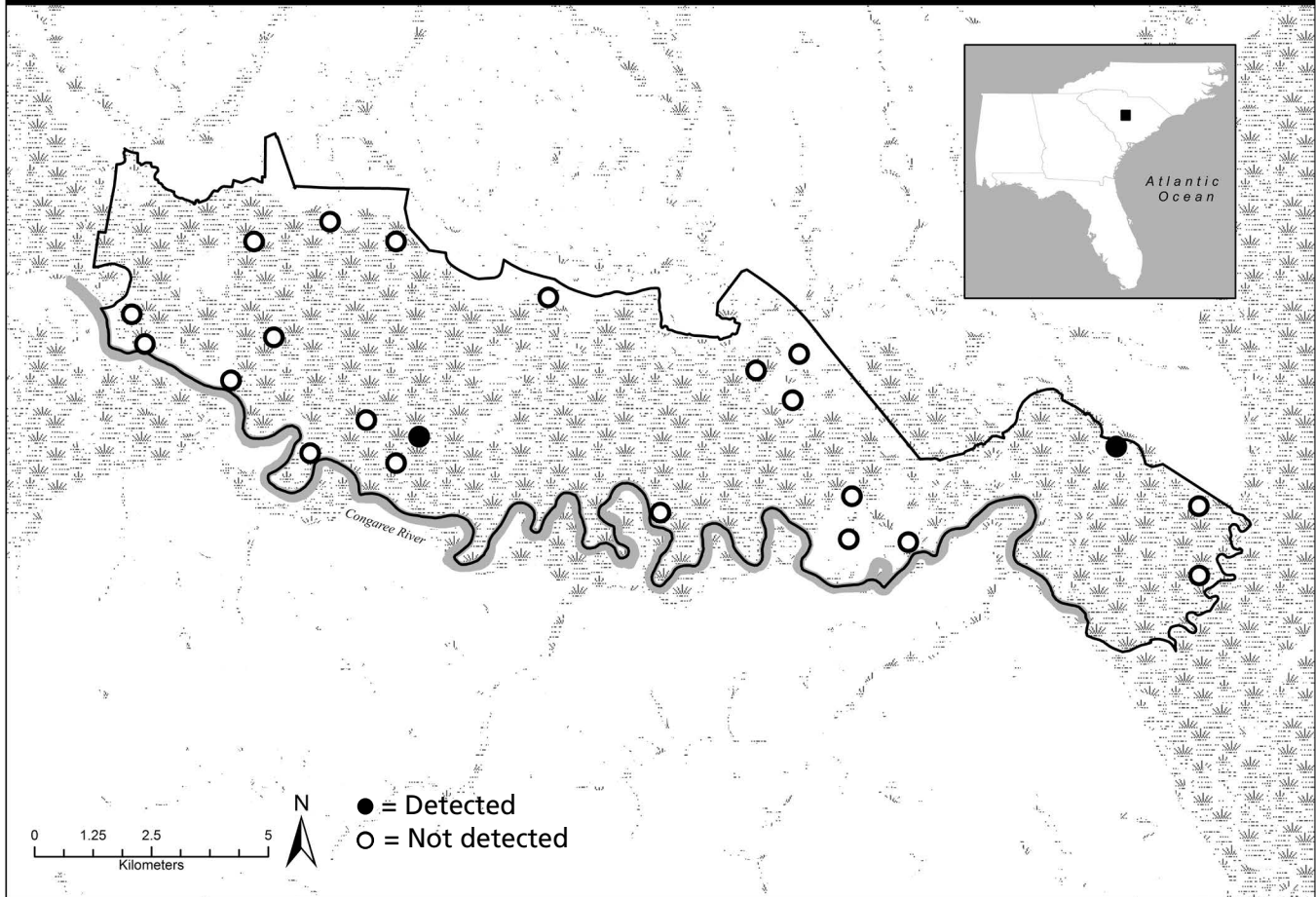


Figure C-36. Sampling locations where ovenbird (*Seiurus aurocapillus*) was detected at Congaree National Park, 2014.

Pileated Woodpecker
Dryocopus pileatus

National Park Service
U.S. Department of the Interior

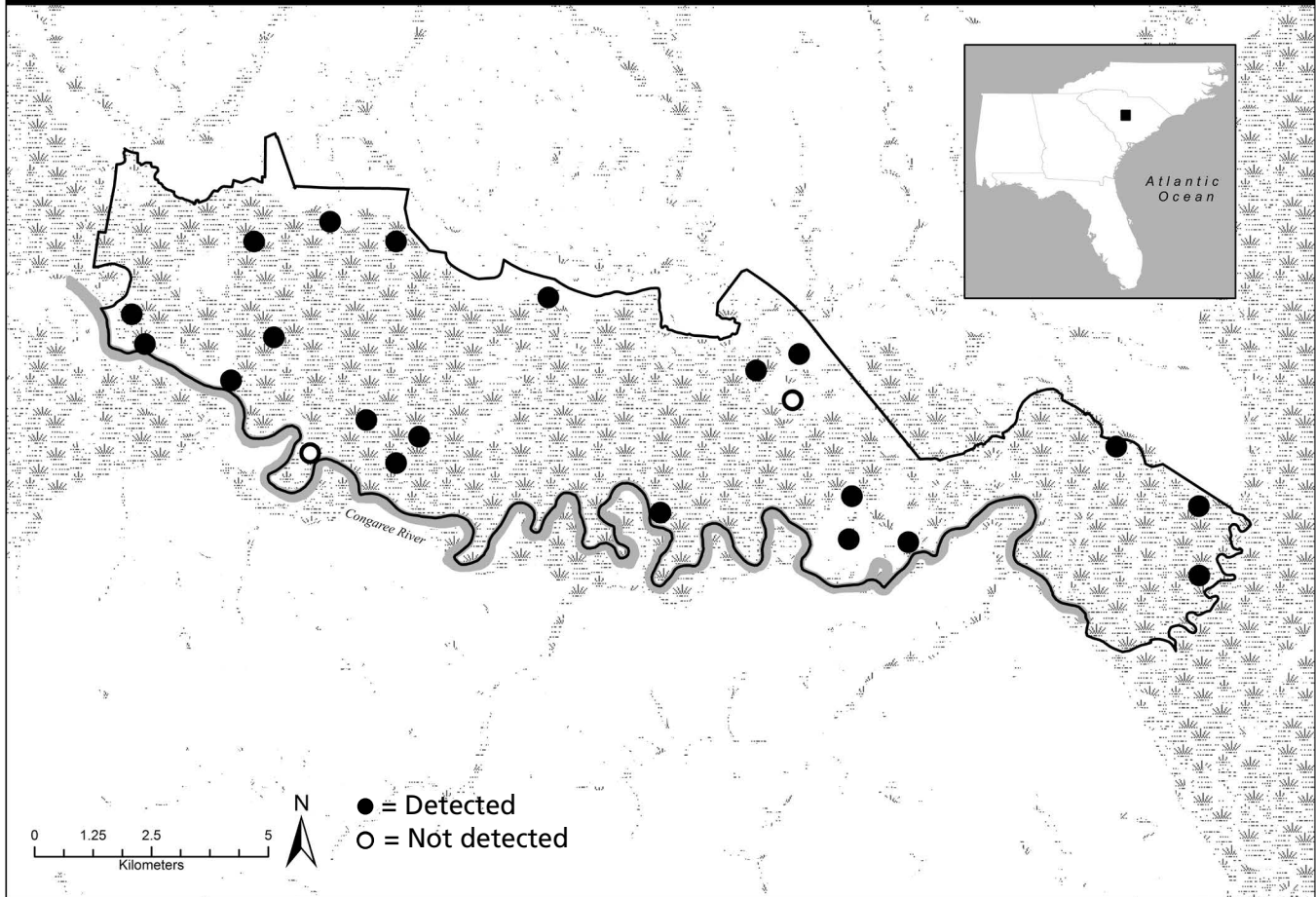


Figure C-37. Sampling locations where pileated woodpecker (*Dryocopus pileatus*) was detected at Congaree National Park, 2014.

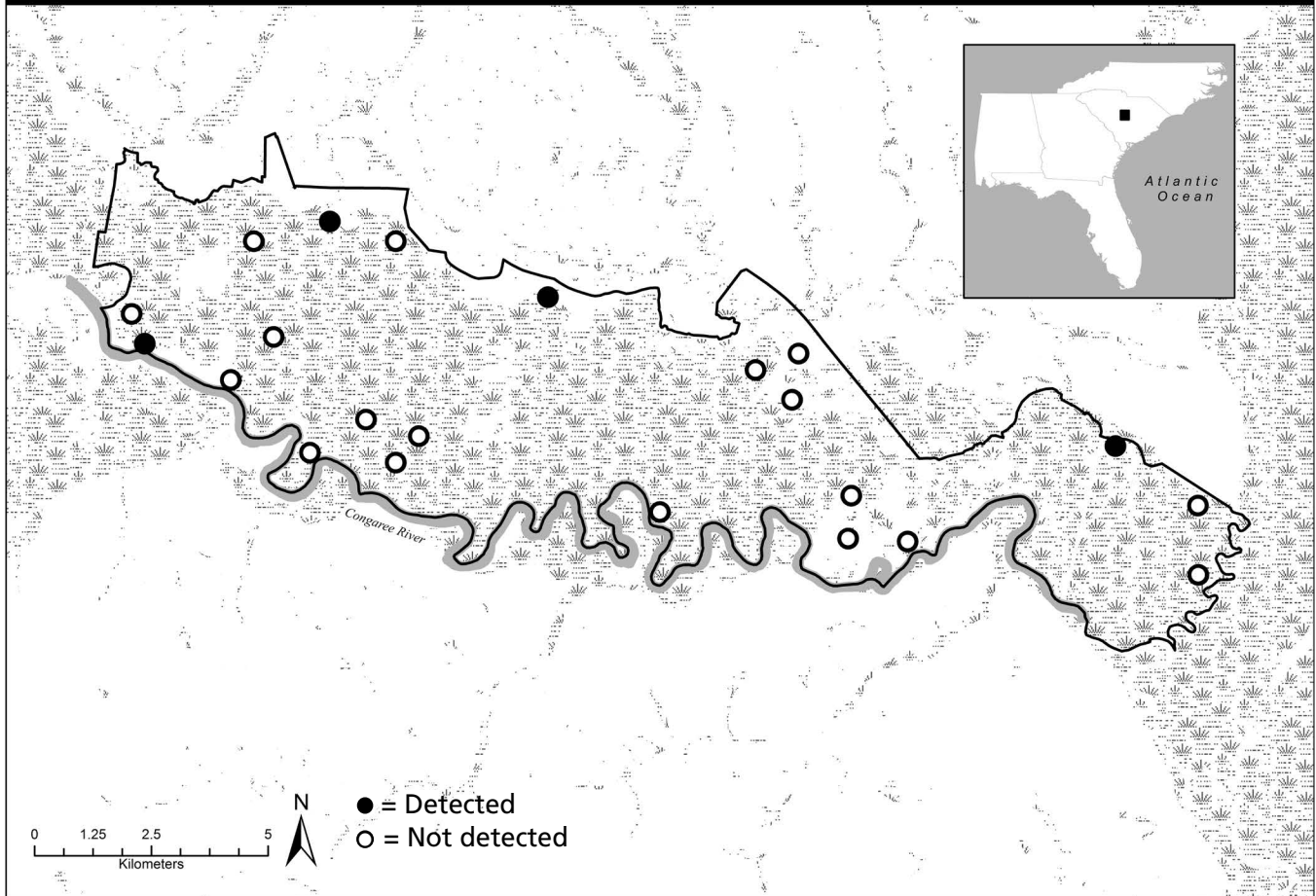


Figure C-38. Sampling locations where pine warbler (*Setophaga pinus*) was detected at Congaree National Park, 2014.

Prothonotary Warbler
Protonotaria citrea

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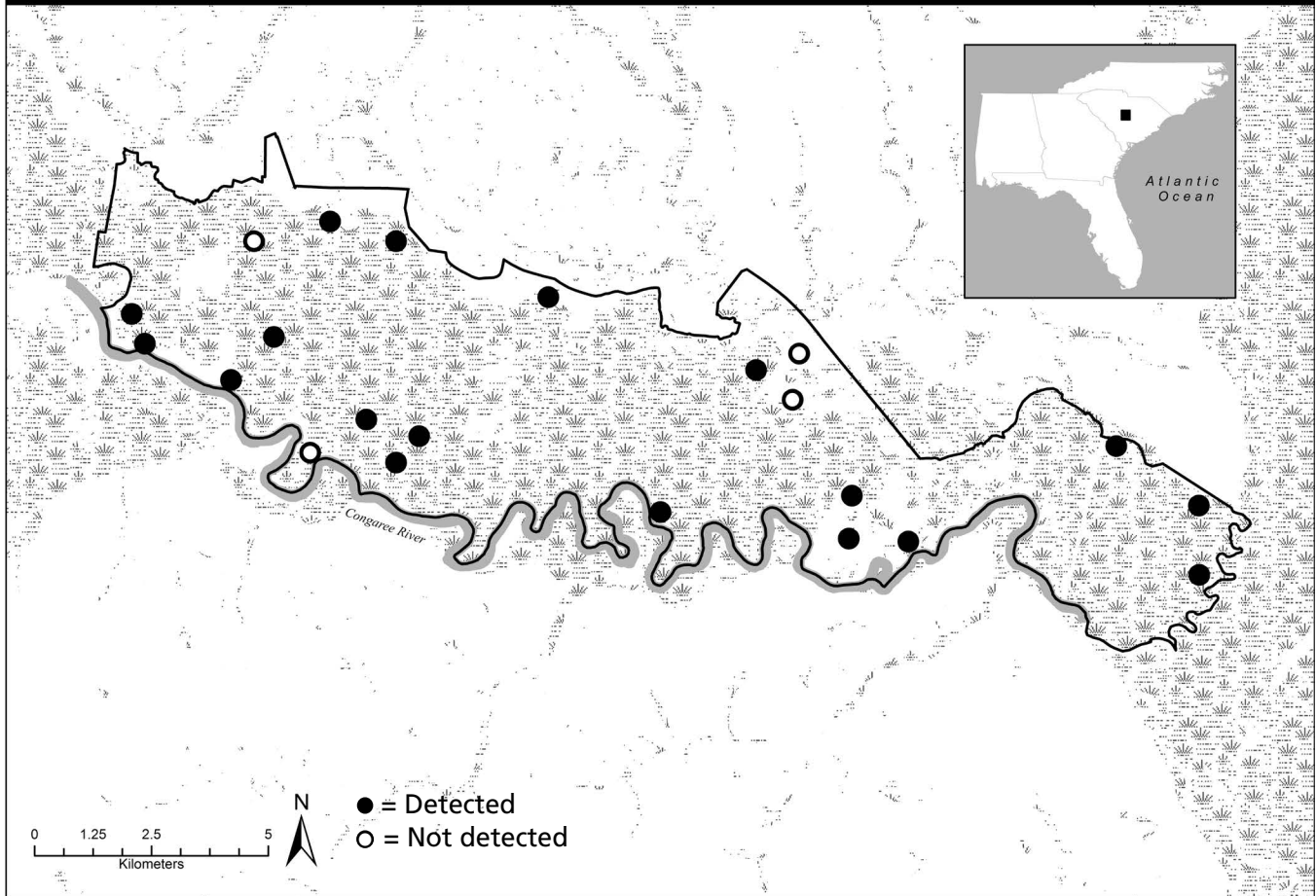


Figure C-39. Sampling locations where prothonotary warbler (*Protonotaria citrea*) was detected at Congaree National Park, 2014.

Red-bellied Woodpecker
Melanerpes carolinus

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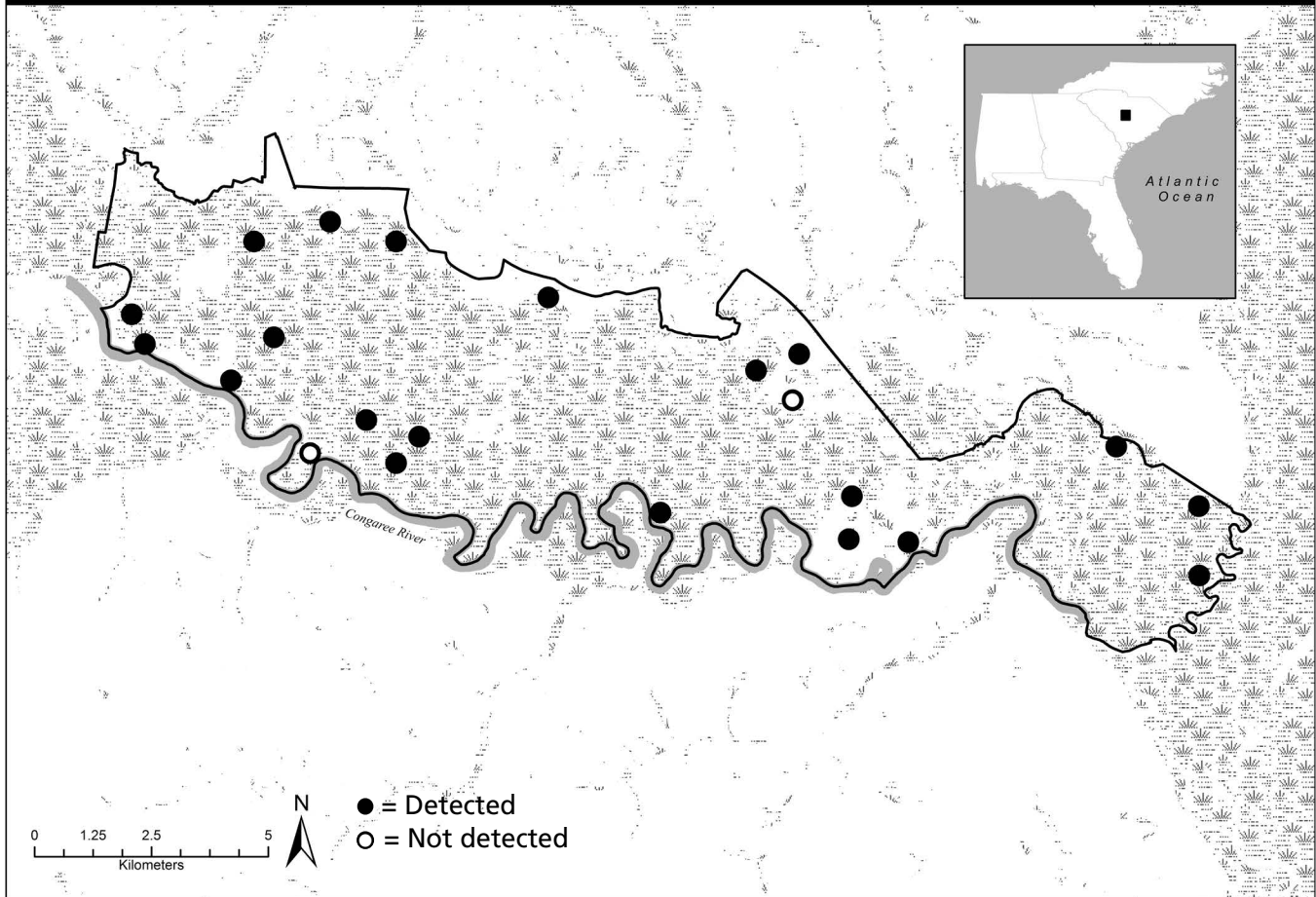


Figure C-40. Sampling locations where red-bellied woodpecker (*Melanerpes carolinus*) was detected at Congaree National Park, 2014.

Red-eyed Vireo
Vireo olivaceus

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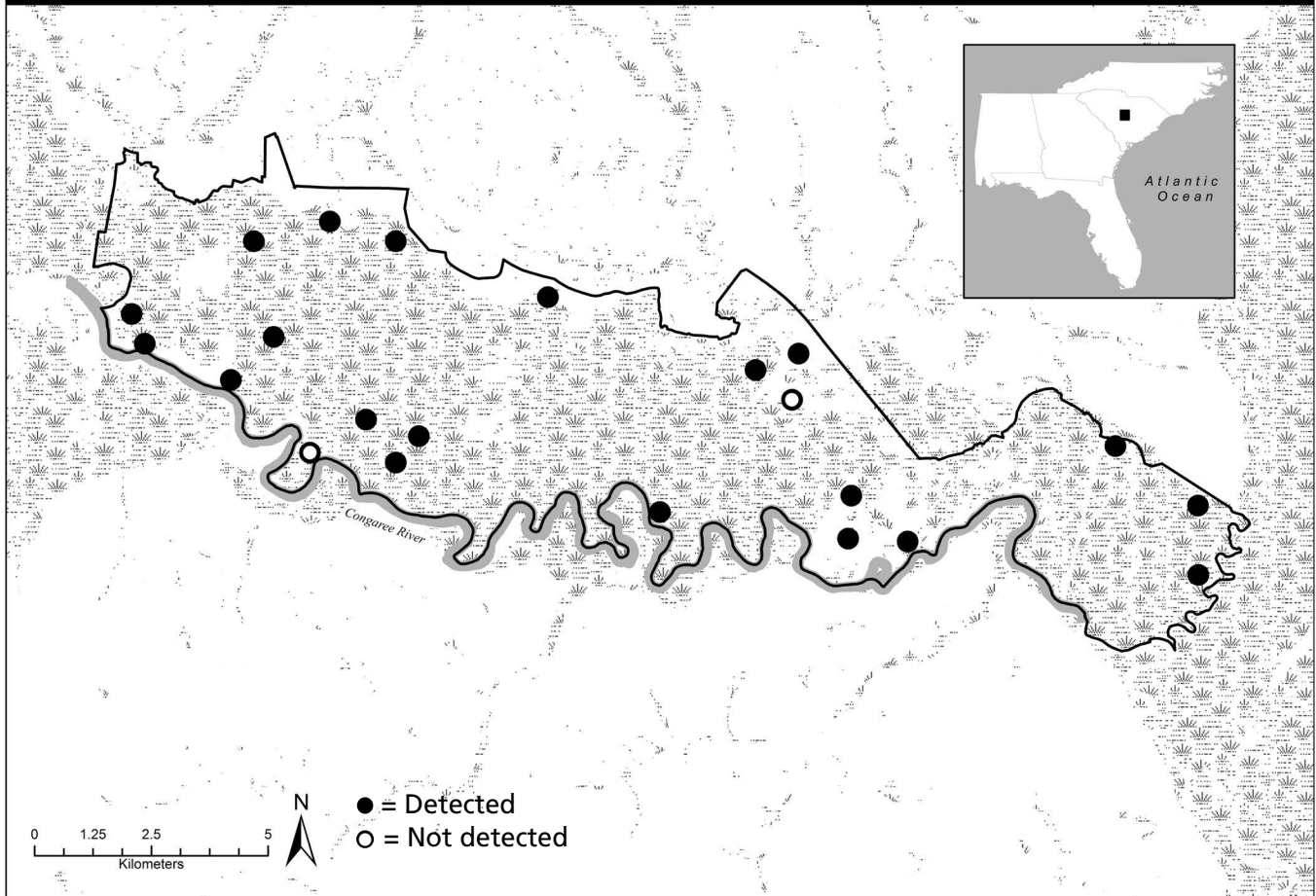


Figure C-41. Sampling locations where red-eyed vireo (*Vireo olivaceus*) was detected at Congaree National Park, 2014.

Red-headed Woodpecker
Melanerpes erythrocephalus

National Park Service
U.S. Department of the Interior

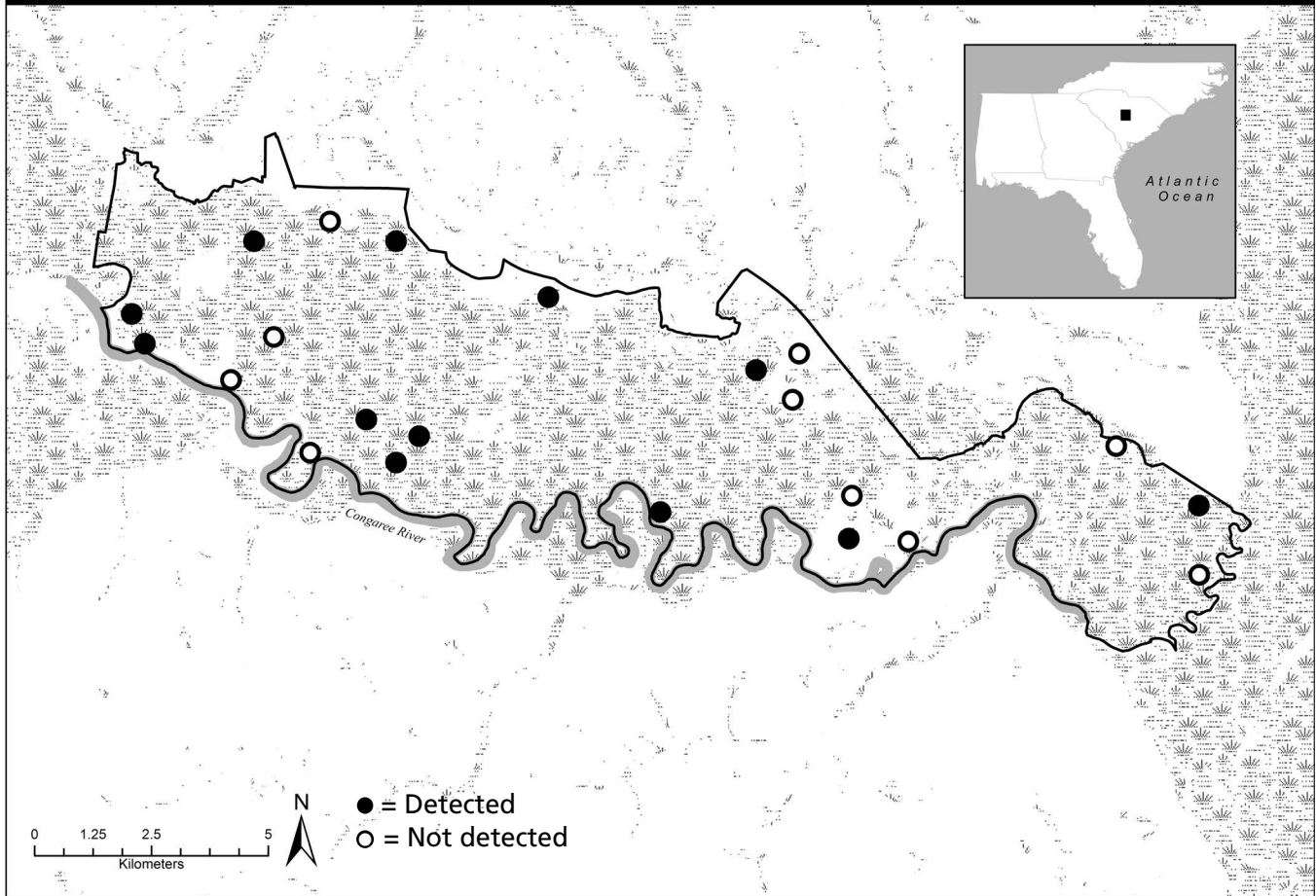


Figure C-42. Sampling locations where red-headed woodpecker (*Melanerpes erythrocephalus*) was detected at Congaree National Park, 2014.

Red-shouldered Hawk
Buteo lineatus

National Park Service
U.S. Department of the Interior

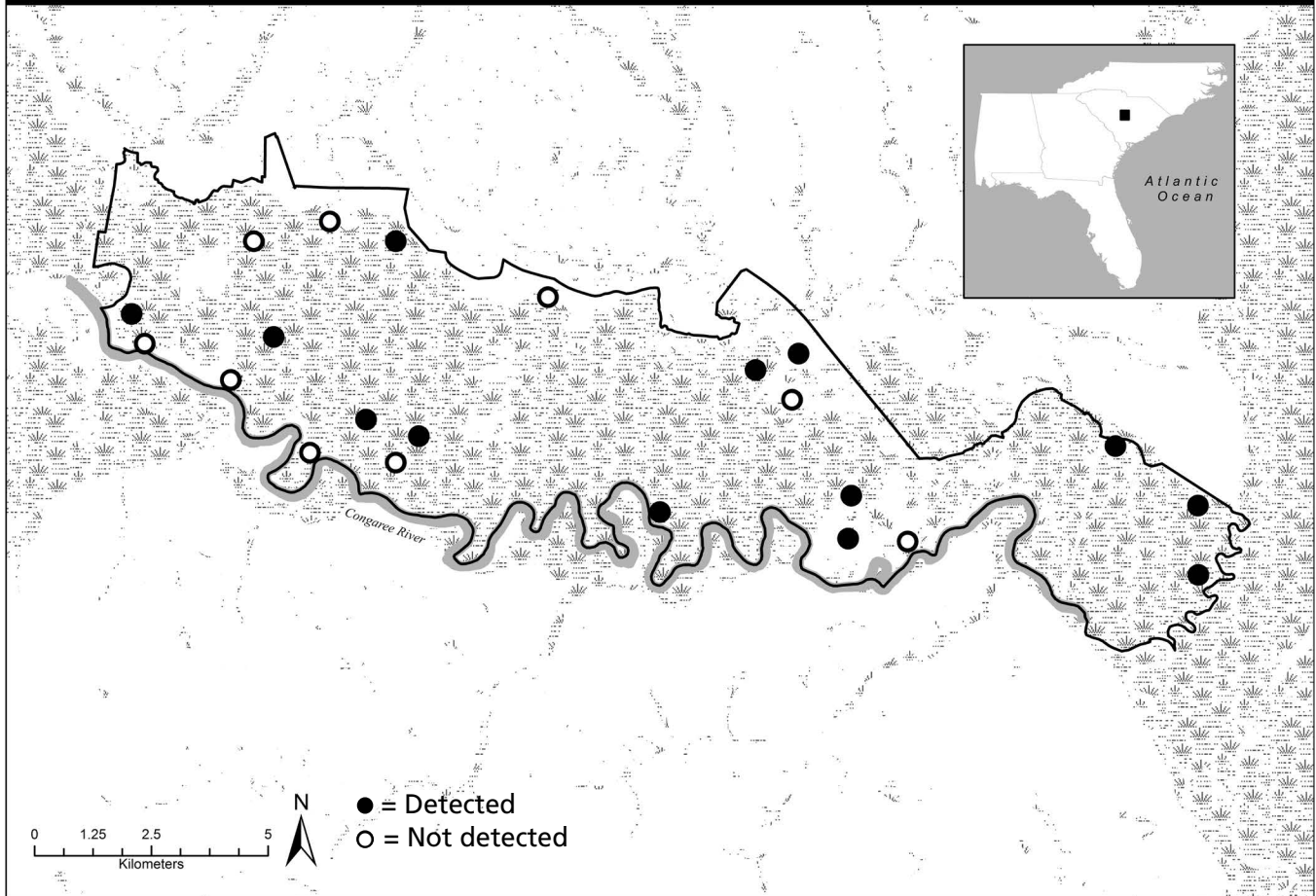


Figure C-43. Sampling locations where red-shouldered hawk (*Buteo lineatus*) was detected at Congaree National Park, 2014.

Red-winged Blackbird
Agelaius phoeniceus

National Park Service
U.S. Department of the Interior

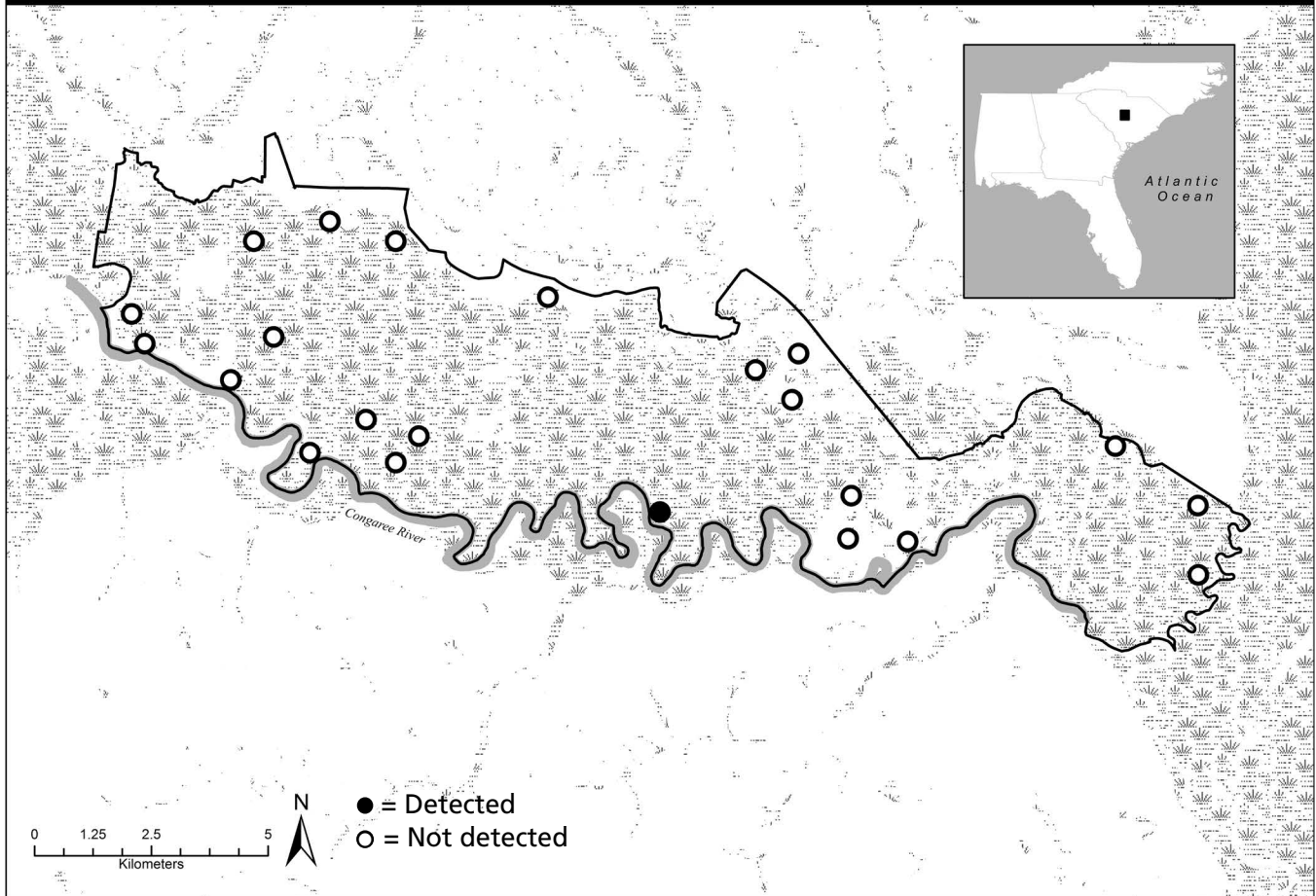


Figure C-44. Sampling locations where red-winged blackbird (*Agelaius phoeniceus*) was detected at Congaree National Park, 2014.

Summer Tanager
Piranga rubra

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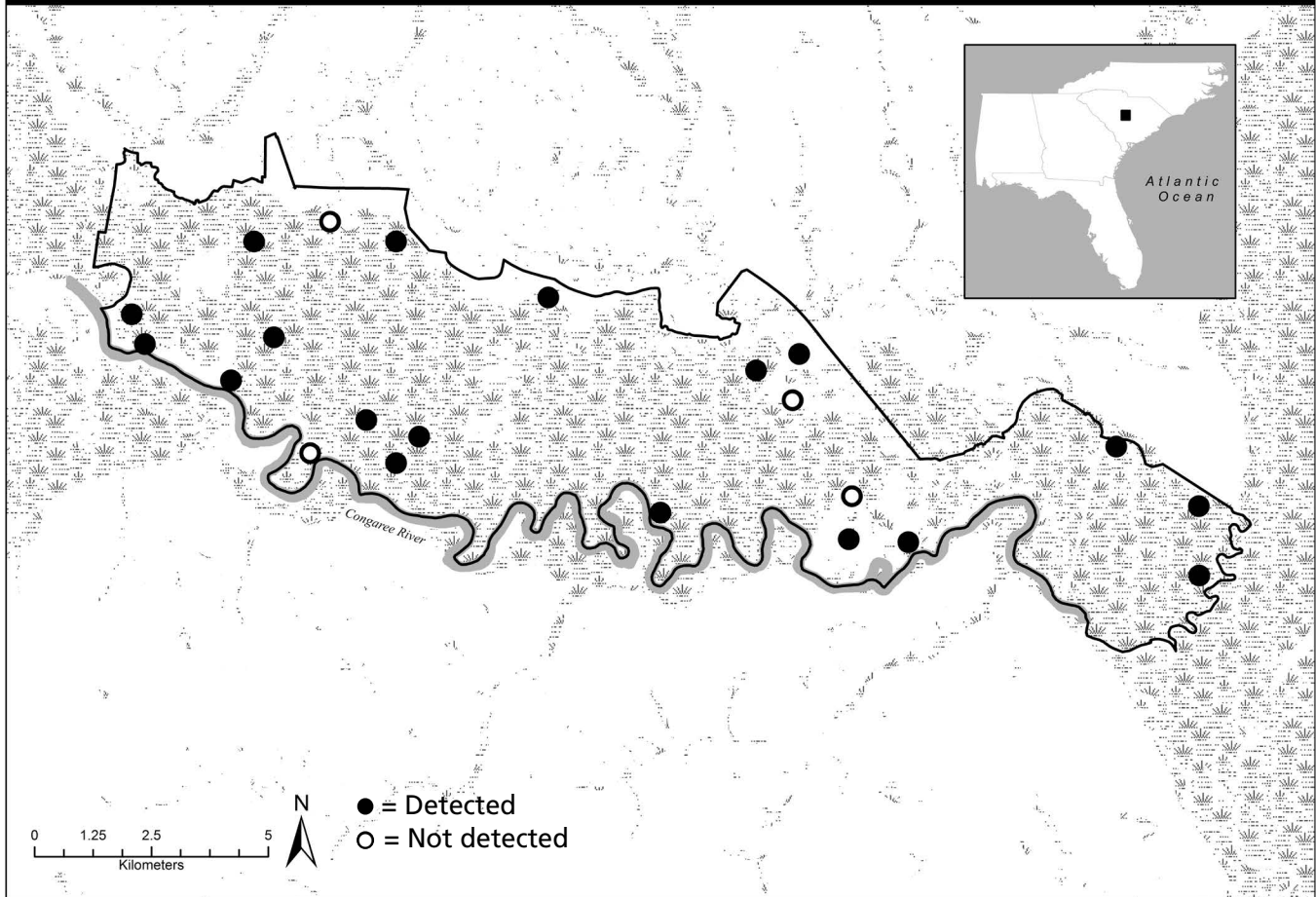


Figure C-45. Sampling locations where summer tanager (*Piranga rubra*) was detected at Congaree National Park, 2014.

Tufted Titmouse
Baeolophus bicolor

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U.S. Department of the Interior

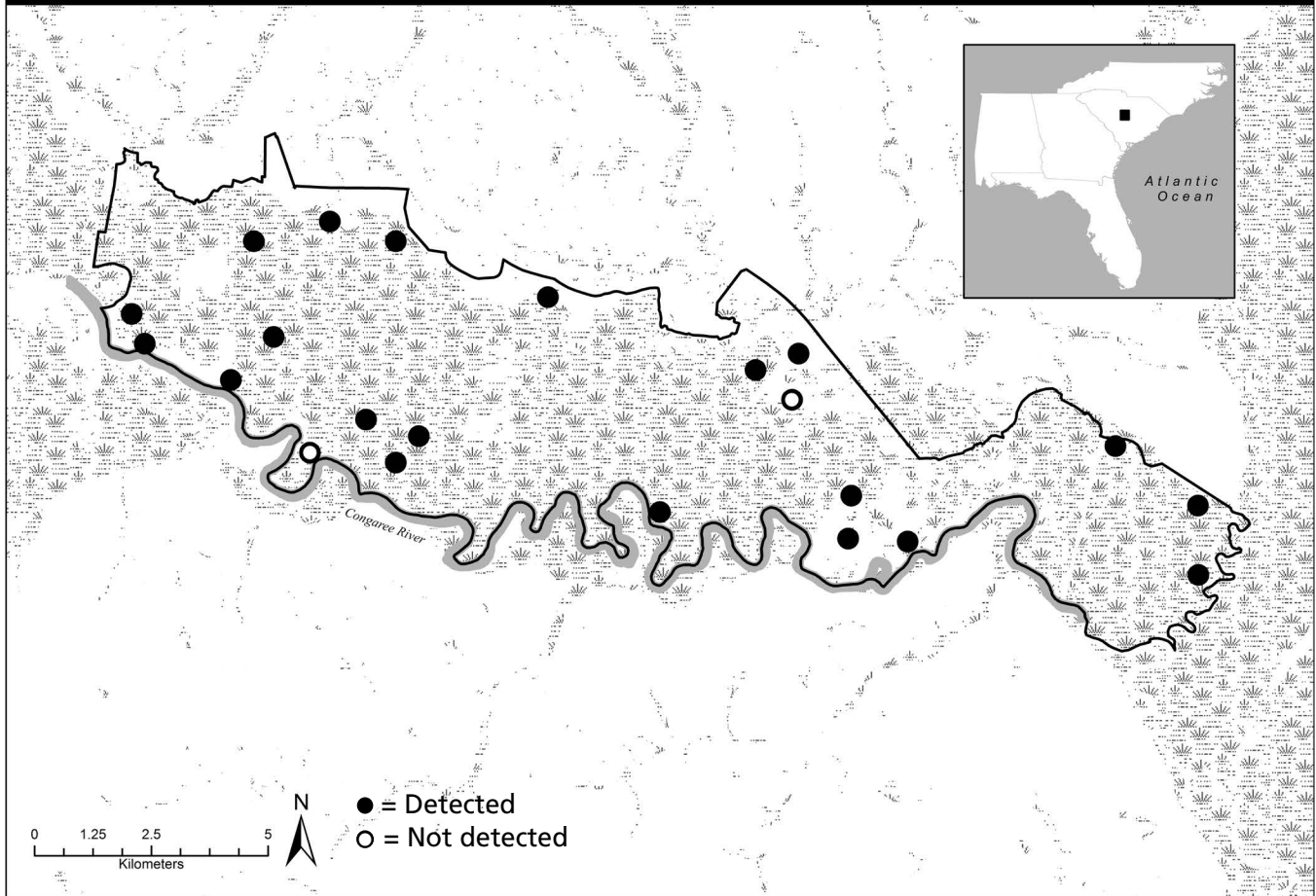


Figure C-46. Sampling locations where tufted titmouse (*Baeolophus bicolor*) was detected at Congaree National Park, 2014.

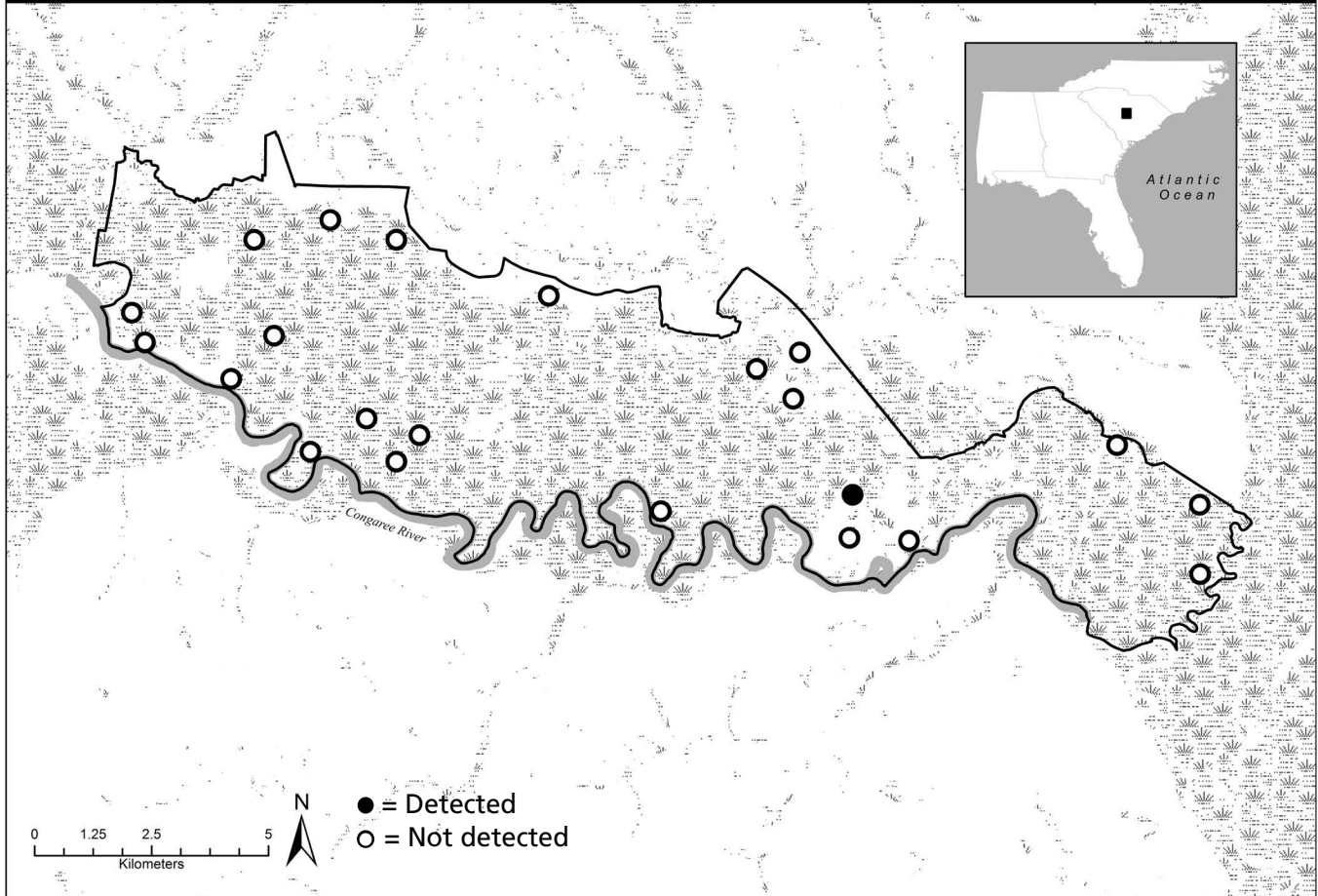


Figure C-47. Sampling locations where veery (*Catharus fuscescens*) was detected at Congaree National Park, 2014.

White-breasted Nuthatch
Sitta carolinensis

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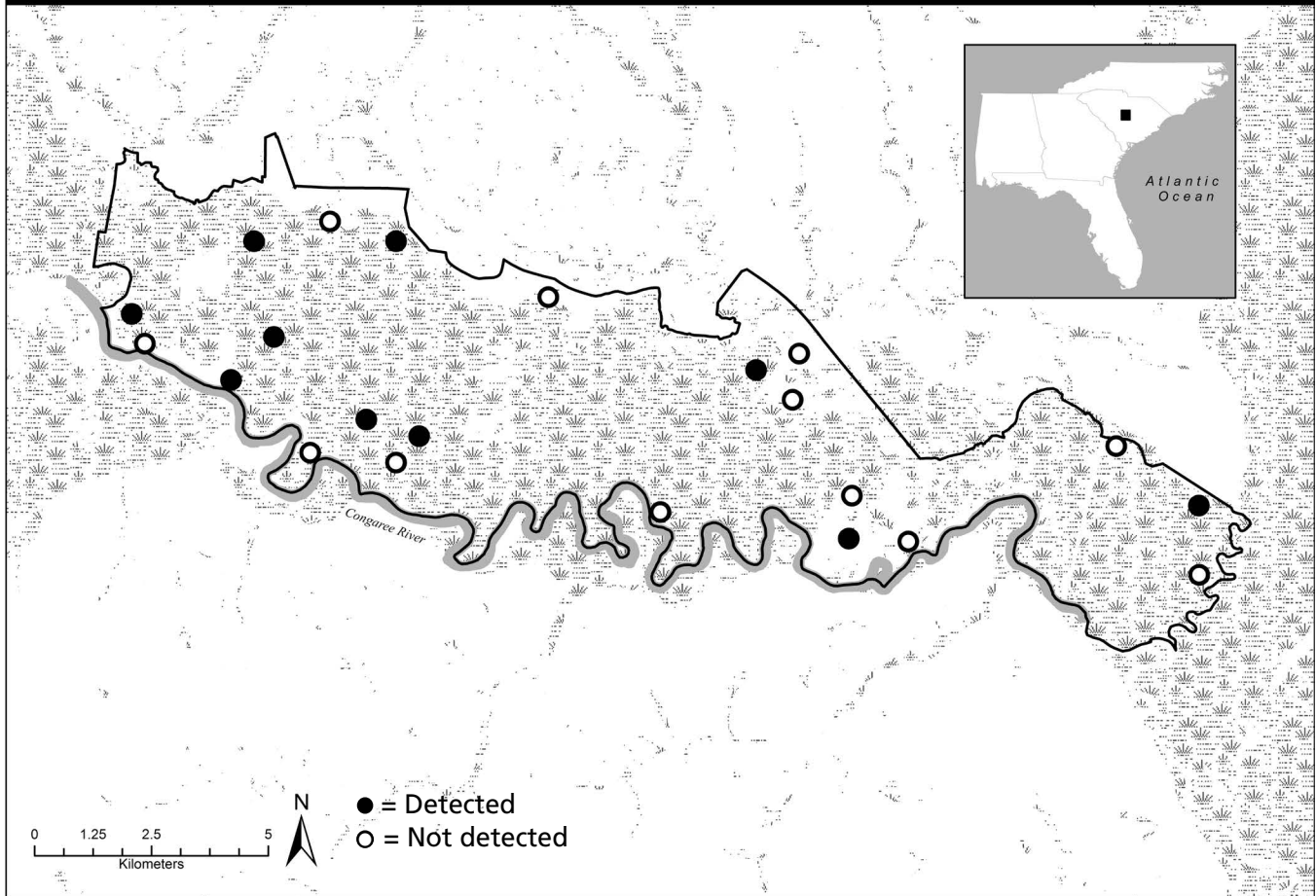


Figure C-48. Sampling locations where white-breasted nuthatch (*Sitta carolinensis*) was detected at Congaree National Park, 2014.

White-eyed Vireo
Vireo griseus

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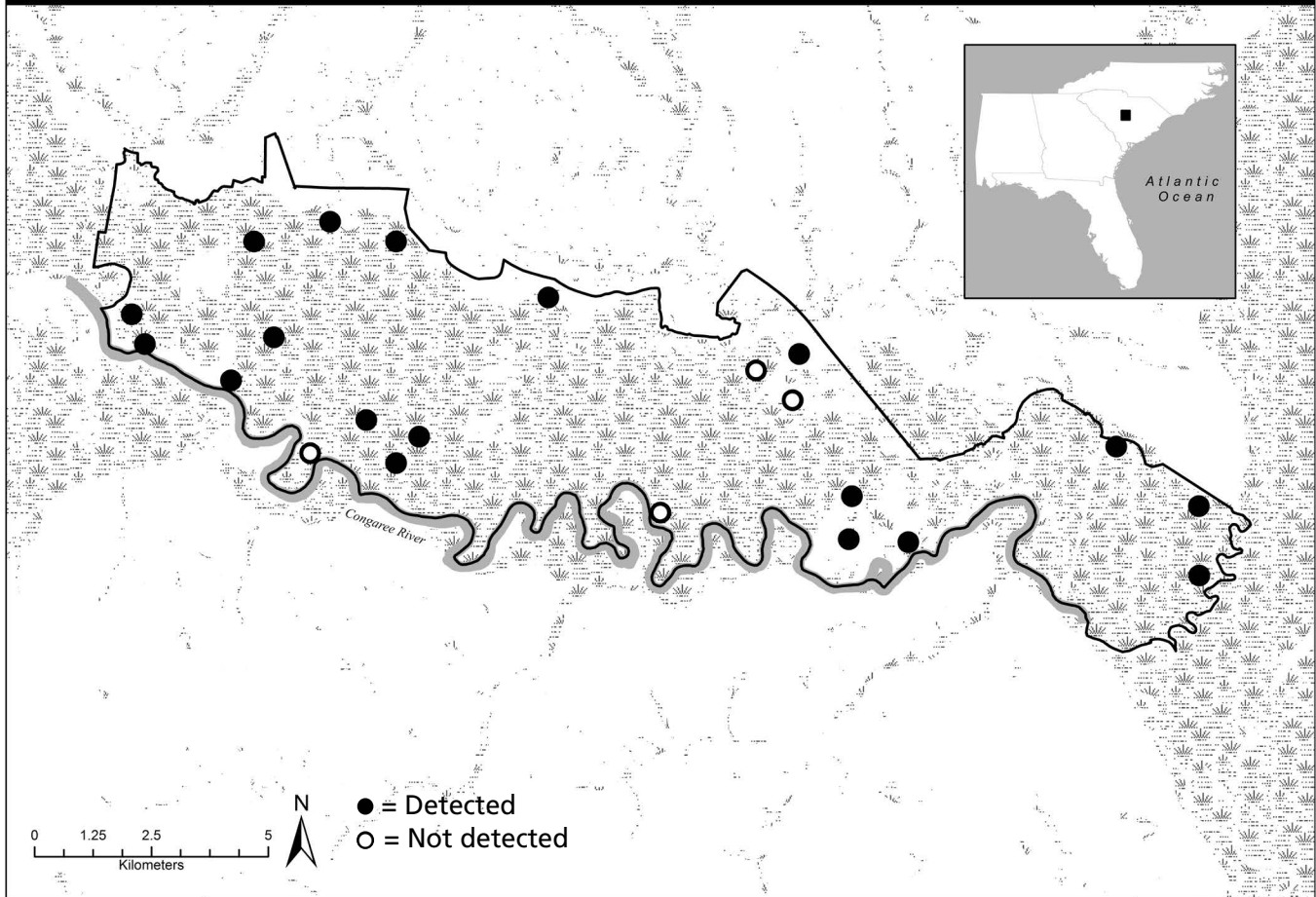


Figure C-49. Sampling locations where white-eyed vireo (*Vireo griseus*) was detected at Congaree National Park, 2014.

Wild Turkey
Meleagris gallopavo

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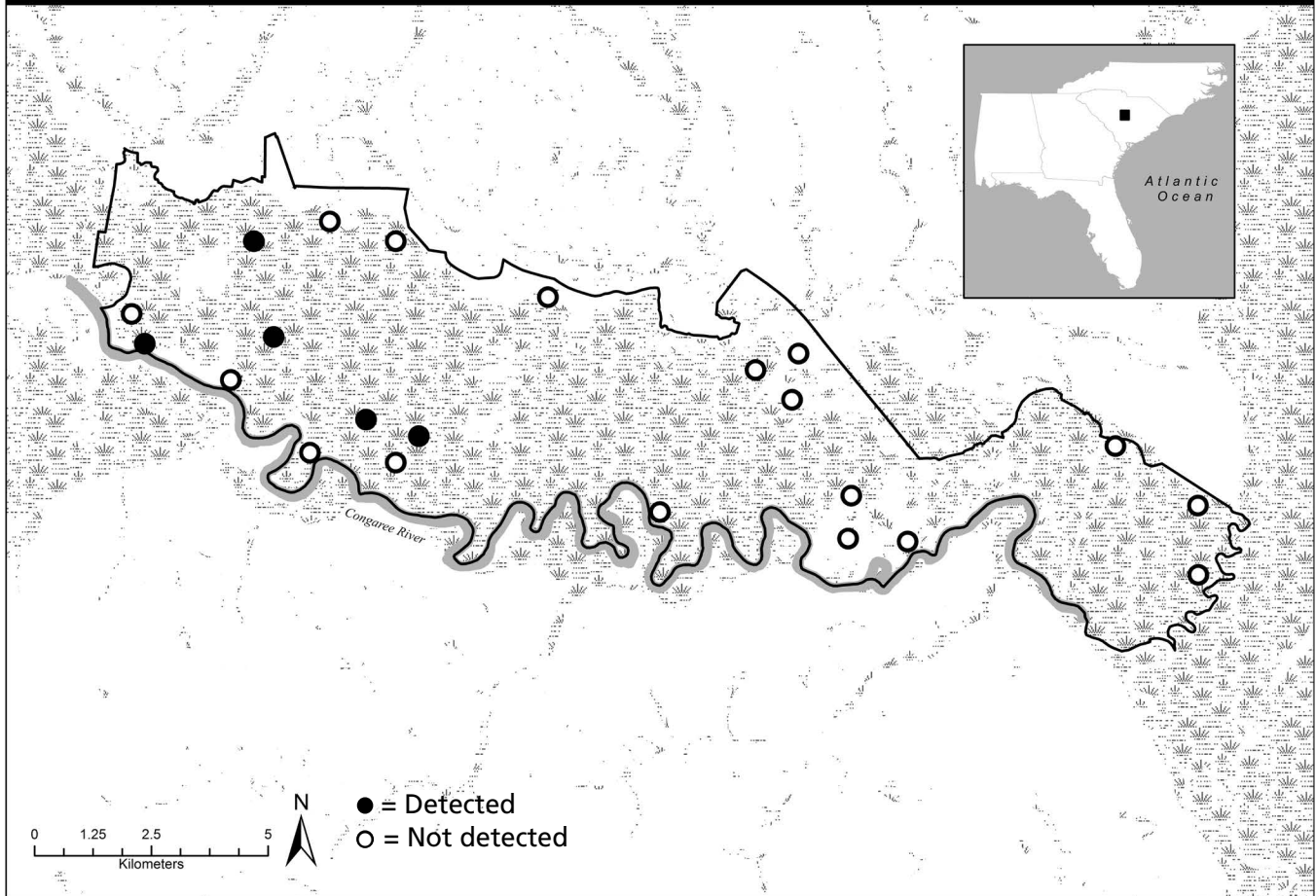


Figure C-50. Sampling locations where wild turkey (*Meleagris gallopavo*) was detected at Congaree National Park, 2014.

Wood Duck
Aix sponsa

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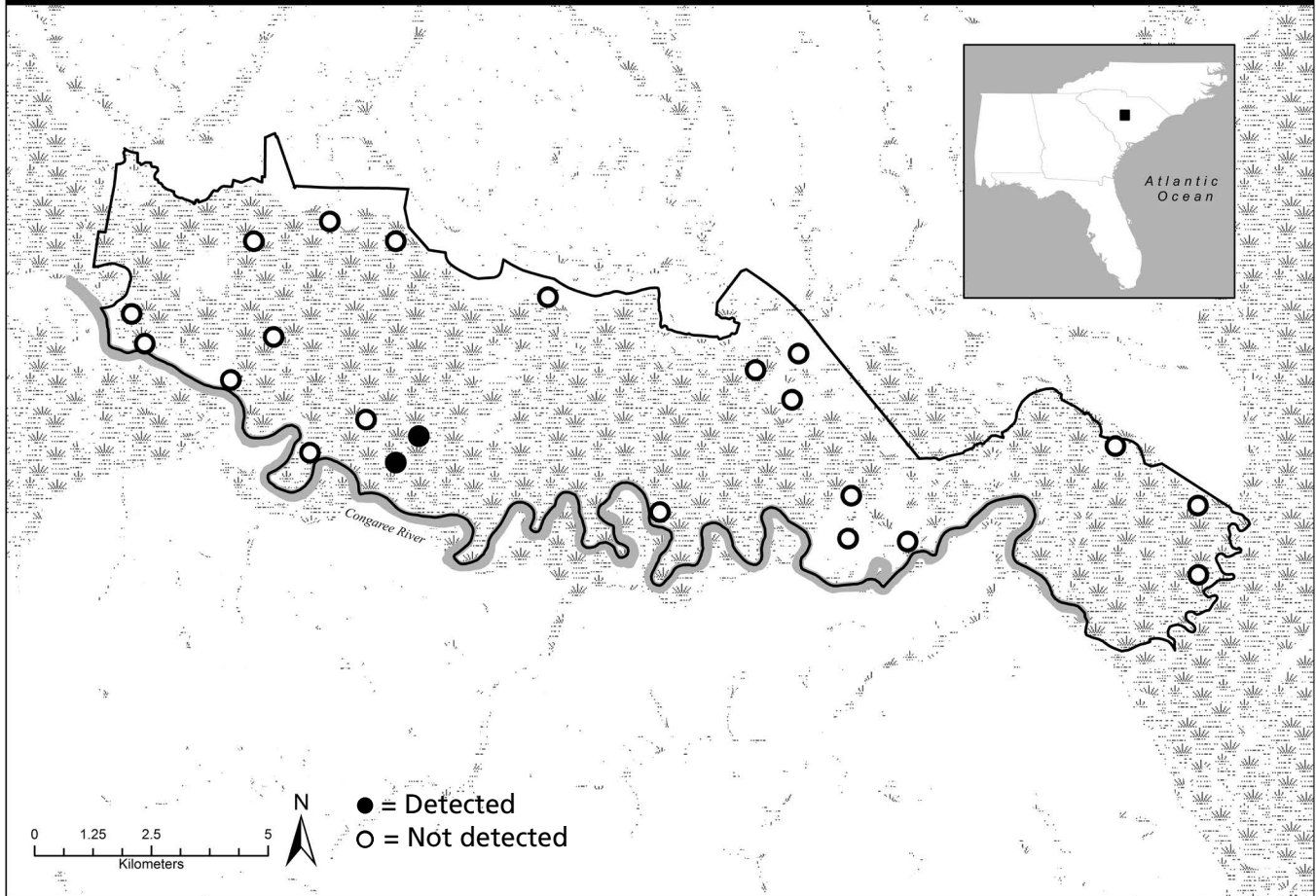


Figure C-51. Sampling locations where wood duck (*Aix sponsa*) was detected at Congaree National Park, 2014.

Wood Thrush
Hylocichla mustelina

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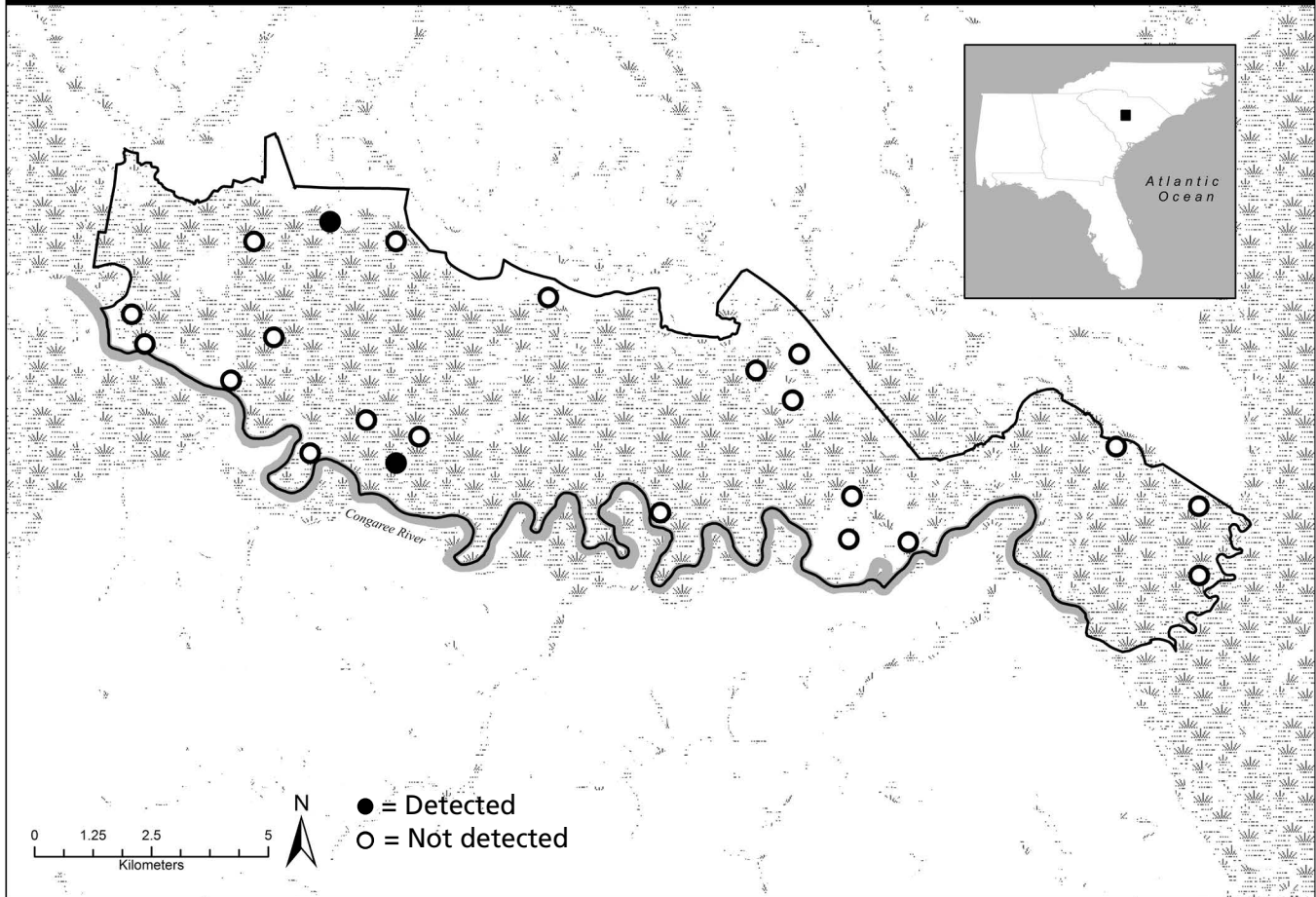


Figure C-52. Sampling locations where wood thrush (*Hylocichla mustelina*) was detected at Congaree National Park, 2014.

Yellow-billed Cuckoo
Coccyzus americanus

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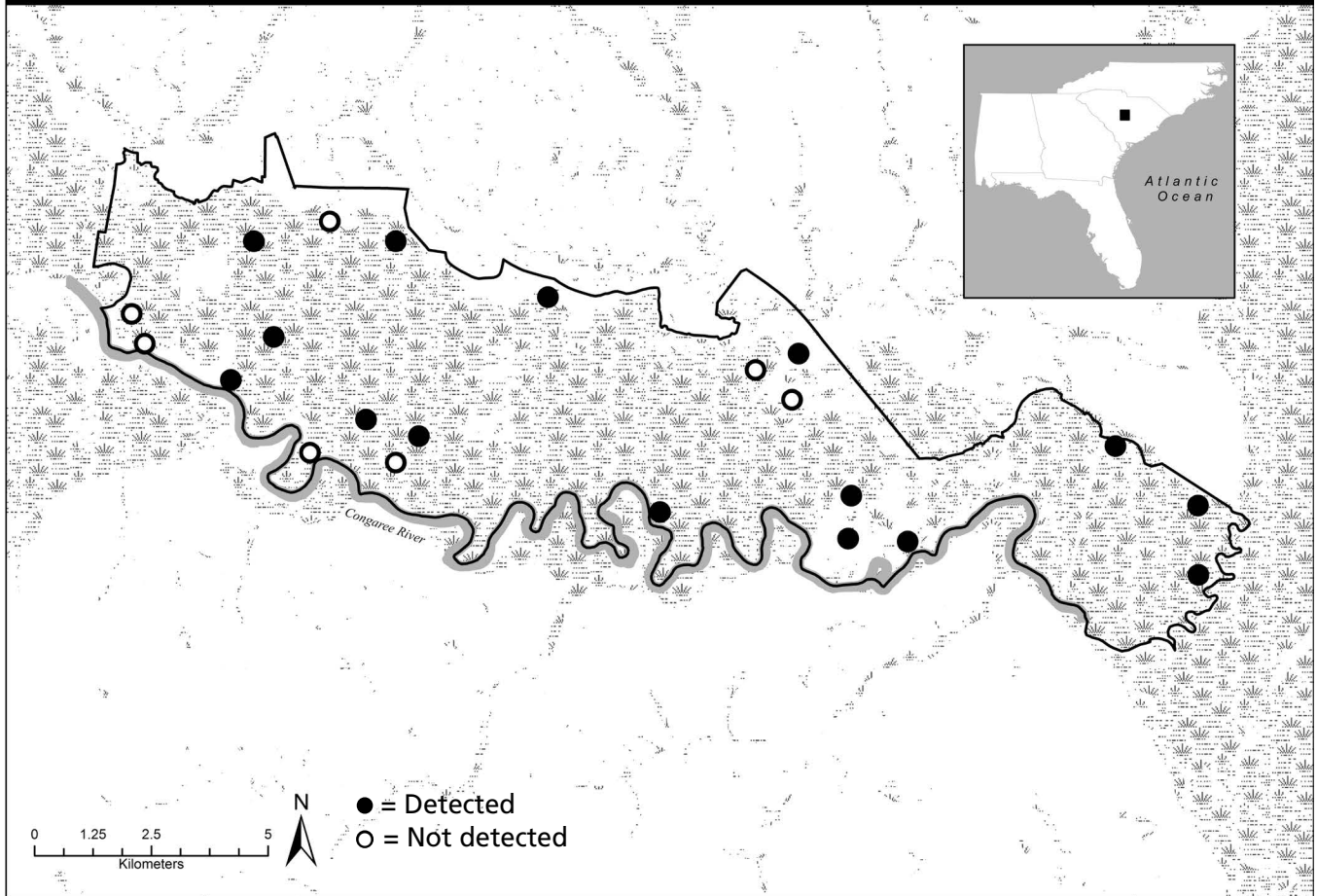


Figure C-53. Sampling locations where yellow-billed cuckoo (*Coccyzus americanus*) was detected at Congaree National Park, 2014.

Yellow-throated Vireo
Vireo flavifrons

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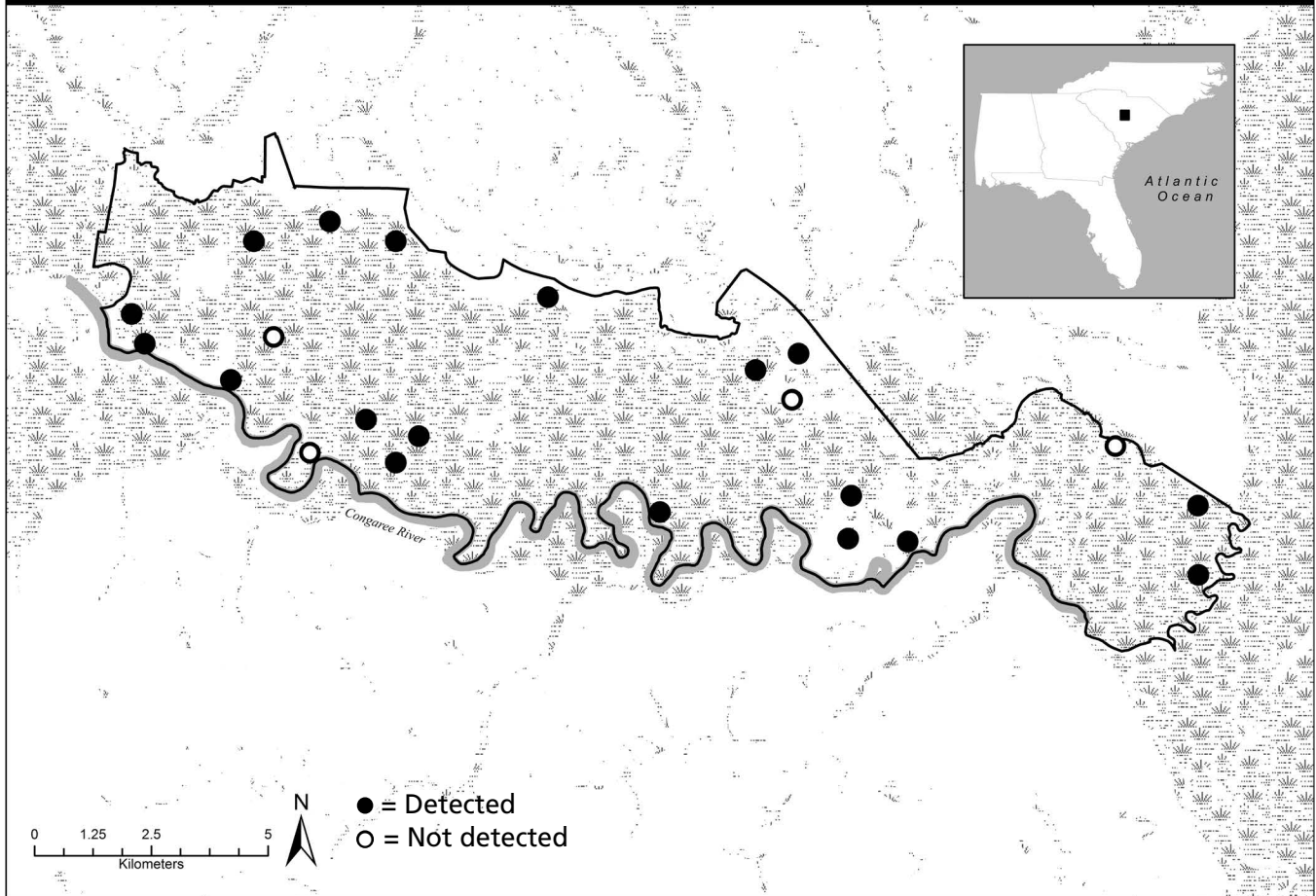


Figure C-54. Sampling locations where yellow-throated vireo (*Vireo flavifrons*) was detected at Congaree National Park, 2014.

Yellow-throated Warbler
Setophaga dominica

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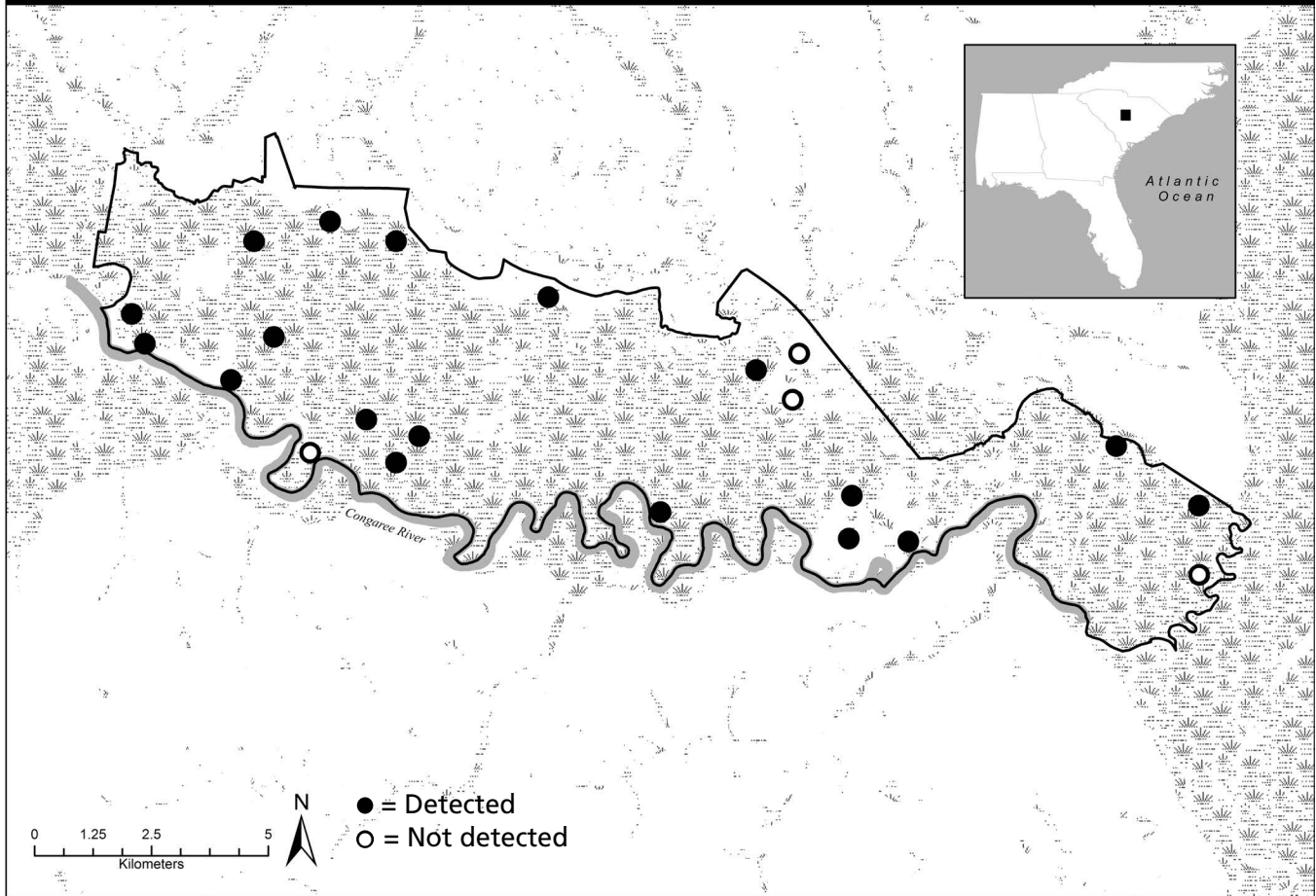


Figure C-55. Sampling locations where yellow-throated warbler (*Setophaga dominica*) was detected at Congaree National Park, 2014.

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

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