



University of Illinois
Institute of Natural Resource Sustainability
William Shilts, Executive Director

ILLINOIS NATURAL HISTORY SURVEY

Brian D. Anderson, Director
1816 South Oak Street
Champaign, IL 61820
217-333-6830

Survey of the distribution, size, and development of canebrakes in southern Illinois

by Jeff Hoover

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INTRODUCTION

Canebrakes (giant cane; *Arundinaria gigantea*) are a critical and unique component of bottomland forest ecosystems (Platt and Brantley 1997), hosting numerous organisms that are species of conservation concern in Illinois (including Swainson's Warblers, *Limnothlypis swainsonii*; swamp rabbits, *Sylvilagus aquaticus*; and golden mice, *Ochrotomys nuttalli*; Eddleman et al. 1980, Thomas et al. 1996, Zollner et al. 2000, Morzillo et al. 2003) while simultaneously reducing sediment runoff (Lee et al. 2003; Schoonover et al. 2005, 2006). However, we know remarkably little about the current status and distribution of canebrakes in Illinois.

Biological diversity in bottomland/riparian forest ecosystems is driven by the complexity and diversity of habitats that occur there. Canebrakes are a major driver of biodiversity within these ecosystems (Platt and Brantley 1997). Many historical accounts indicate that canebrakes were once a dominant landscape feature within riparian ecosystems in the southeastern U.S. at the time of European settlement (see Platt and Brantley 1997 for review). The canebrake ecosystem is nearly non-existent today (see Brantley and Platt 2001 for review of ecosystem decline) and canebrakes are now classified as a critically endangered ecosystem (Noss et al. 1995) with <2% historical extent remaining.

Historically, canebrakes have supported a diverse fauna (Platt et al. 2001). Attempts to reestablish canebrakes using a variety of vegetative planting methods had proved unsuccessful through the 1990s (Feeback and Luken 1992, Pratt and Brantley 1993). Recent advances have resulted in successful techniques for reestablishing canebrakes (J. Zaczek, personal communication), setting the stage for restoration of this critical component of bottomland/riparian ecosystems.

Despite the importance of canebrakes (Gagnon et al. 2007), there is no current or comprehensive information on their status and distribution in Illinois, and regional information on canebrakes is only sketchy (W. C. Hunter, personal communication). Canebrakes typically establish in tree-fall gaps or in more open forest habitats along river edges in bottomland/riparian systems. Canebrakes are ephemeral and typically develop, grow, and regress during a period of 10-25 years. Organisms that depend on canebrakes require other patches of cane nearby (at various stages of growth) for their populations to persist. In other words, as one canebrake regresses (dies out), other canebrakes need to be available for organisms to disperse to. Therefore, a basic knowledge of the spatial distribution and size of different canebrakes is critical to the effective and efficient management of this naturally-ephemeral and patchily-distributed habitat.

In addition to documenting the current location of canebrakes in southernmost Illinois, we focused much of our research effort on Swainson's Warblers. Swainson's Warblers are a Neotropical migratory songbird that breeds in forests (typically bottomland and riparian) throughout the southeastern U.S. and over-winters in the Bahamas, Cuba and the Yucatan Peninsula (Brown and Dickson 1994). Populations of Swainson's Warblers have been declining during the past 3 decades (Somershoe et al. 2003) and some of the northernmost breeding populations in Maryland, Delaware, Missouri, and Illinois have disappeared during this same period (Graves 2001). Population declines have been attributed, in part, to loss of bottomland forest and conversion of bottomland forests to other land uses (Graves 2001). Swainson's warblers are often associated with canebrakes in bottomland forests and are found nearly exclusively in canebrakes in the northern portion of their breeding range

(southern Illinois/Missouri) (Brown and Dickson 1994). Population declines in concert with loss of canebrake habitat within bottomland forests have contributed to making this species a top conservation priority (Hunter et al. 1993, Thompson et al. 1993). Presently, Swainson's Warblers are a species of conservation priority in the Partners in Flight (PIF) Bird Conservation Regions (BCRs) that include or are adjacent to southern Illinois (Mississippi Alluvial Valley BCR, Central Hardwoods BCR, and Southeastern Coastal Plain BCR). This bird is therefore a species for which there is both regional and continental conservation concern (<http://www.rmbo.org/pif/jsp/BCRmap.asp>).

In Illinois, Swainson's Warblers are classified as state-endangered and on the list of Illinois Conservation Priority Birds as part of the Illinois Wildlife Action Plan (IWAP) (<http://dnr.state.il.us/ORC/WildlifeResources/theplan/birds.asp>). In this research project, we 1) documented the size and spatial distribution of canebrakes in southernmost Illinois, 2) surveyed existing stands of cane for Swainson's Warblers (a canebrake specialist listed among the Species in the Greatest Need of Conservation (SGNC), and 3) surveyed cane and non-cane habitat to determine whether any other species of breeding birds had an affinity for cane.

METHODS

General Methodology

We documented the spatial distribution and size of canebrake habitat in southernmost Illinois. We initially obtained information on the location of known canebrakes from a network of staff from state/federal/private conservation agencies and organizations, birdwatchers, etc., and also used infrared digital images from winter over-flights provided to us by the staff at the Cypress Creek National Wildlife Refuge to identify additional areas to check for canebrakes. We used GPS units to record the 1) approximate location of the center, and 2) size of each canebrake found. Canebrakes were then scored on a scale of 1-5 (1 being small, sparse and short canebrakes; 5 being large, dense and tall canebrakes) based on additional information (e.g. height, stem density) collected for each canebrake

(see Detailed Methodology below for specifics on research protocols). The primary focus was on publicly-held land. The location and score of canebrakes are now being mapped onto existing habitat databases using the GIS and ARCINFO capabilities available at INHS, and this data will be available in September of 2010 (and will be updated as additional canebrakes are added in the future).

During the breeding season (mid-May through June) in each of 2 years (2008, 2009), birds within and outside of canebrakes were surveyed to document the effects of canebrakes on the density and diversity of birds. Also during 2009, song playbacks were used to survey >100 of the most promising canebrakes for Swainson's Warblers.

Detailed Methodology

Study Area and Searches for Canebrakes: This research was conducted within the 7 southernmost counties within Illinois, including Alexander, Jackson, Johnson, Massac, Pope, Pulaski, and Union. This area includes lands managed by the Shawnee National Forest, Cache River Wetlands Joint Venture (USFWS, IDNR, TNC, DU), as well as other state- and federally-owned land (e.g. Union County Conservation Area, Horseshoe Lake Conservation Area). Canebrakes are typically located along watercourses in bottomland/riparian ecosystems, or along forest/field-edge ecotones, and we therefore concentrated our search efforts in these habitat types. We traveled along as many navigable streams/rivers as possible within the study area by kayak, hiked through some areas that were not conducive to travel by water, and drove several back-roads looking for canebrakes along forest edges. In some of the wider forested floodplains (>500m) we also hiked the floodplain forest on either side of the watercourse in search of canebrakes occurring within the forest away from the stream channel or along the outer edge of the floodplain forest.

Measuring Canebrake Attributes: We geo-located (using GPS) the location of the approximate center of each stand of cane we found during our searches. For each well-defined canebrake greater than 10-m in length and/or width, we measured the following attributes: approximate length and width

of the canebrake; estimated stem density (stems/m²) and average height of the canebrake. The location and a canebrake score (from 1 to 5) are now being mapped onto existing habitat databases using the GIS and ARCINFO capabilities available at INHS. Each canebrake received a score based on the overall size (area), stem density and height. Canebrakes that were small (e.g. <200m²), sparse (e.g. stem density <10 per m²) and short (e.g. <2m tall) received low scores whereas those that were large (e.g. >500m²), dense (e.g. stem density >20 per m²) and tall (e.g. >2m tall) received higher scores. We by no means found every canebrake, and intend to continue to update this information as we become aware of additional canebrakes.

Bird Surveys: Birds within and outside of 30 canebrakes were surveyed during the breeding season (May-June 2008 and 2009) using a standardized point-count method (Ralph et al. 1995). We conducted a point-count in the approximate center of each canebrake, and at a location near to but outside of each canebrake (150m from the edge of the canebrake). This allowed us to compare the diversity and density of birds between canebrake and non-canebrake habitats within the forest. For these surveys we used a modified version of the point-count method and recorded information for 10 minutes at points that are at least 150 m apart. Each day, point counts began half an hour after sunrise and continued until points to be surveyed that day were completed (always before 1030 h). At each point, we recorded the species, vocalization (song, call, chip, etc.), compass direction, and distance of each bird heard or observed. We visited each census point one time during the breeding season. Point counts were not conducted on days when it is raining or when wind speeds exceed 10 mph. Data from these censuses resulted in a list of the species present in canebrake and non-canebrake habitat (diversity) as well as a density estimate for each species.

Playback Surveys for Swainson's Warblers: Swainson's Warblers are a Neotropical migratory songbird that breeds in forests (typically bottomland and riparian) throughout the southeastern U.S. and over-winters in the Bahamas, Cuba and the Yucatan Peninsula (Brown and Dickson 1994). Swainson's Warbler males sing within their breeding territories and defend their territories by

aggressively chasing away intruding males of the same species (conspecifics). Therefore, these birds show a strong response to audio playbacks of a conspecific male's song. We conducted playback surveys for Swainson's Warblers at all of the >100 canebrakes we found and visited, looking for any evidence of the presence of a territorial male and/or a breeding pair. We broadcast a recorded song of a male Swainson's Warbler through a CD or MP3 player and an attached compact speaker system. The song was looped on the CD or MP3 file and played for two bouts of 5-min each, with a 5-min interval of silence between each bout (total 15-min trial period). We did the audio playback at each of the canebrakes during the breeding season (May-July) in 2009. For each playback, the song was broadcast sometime between the hours of 0630 and 1030. The song was broadcast from near the edge of the canebrake inward. Observers recorded any response to the playback (e.g., counter-song from male Swainson's Warbler, approach by warbler) during each trial. If a Swainson's Warbler was thought to have been heard or possibly seen, observers attempted to verify presence of male and/or female. Every canebrake that we visited during the project was surveyed for Swainson's Warblers.

RESULTS AND DISCUSSION

As mentioned above, a map with the location of the >100 canebrakes visited is still in the process of being completed but will be sent along as soon as possible. This map will be a fluid document and we will continue to update this map in the coming years as we become aware of additional canebrakes and as some canebrakes regress. The largest, most intact canebrakes (those ranking 4 or 5) tended to occur in bottomland and riparian forests along watercourses, particularly those along the upper Cache River, the Post Creek cutoff, the Bellrose Waterfowl Preserve, the lower Cache River just south of Ullin, and along Hutchin's, Cave and Cedar Creeks in the western Shawnee National Forest. We will update the canebrake map annually and submit it to IDNR each fall.

Breeding Bird Point Counts

Breeding birds were surveyed in 30 canebrakes and also at 30 non-canebrake points that were 150 m away from each canebrake. On average these canebrakes were 1300 m² in area, 2.3 m tall, having a stem density of 19 stems per m², with 50% canopy cover overhead. Thirty-eight species were detected in and near the canebrakes whereas 36 were detected at the points away from the canebrakes (Table 1). Of the 17 species that tend to have an affinity for disturbed or early successional forest habitat (in bold in Table 1), 14 were more common at the canebrake points than at the non-canebrake points (Table 1). These species included Hooded Warblers (scientific names given in Table 1) and Swainson's Warblers that were only detected at canebrake points, as well as other species like White-eyed Vireos, Indigo Buntings and Kentucky Warblers that occurred at higher densities at canebrake points than at non-canebrake points. The species listed just above, with the exception of Kentucky Warblers, will actually use the cane as a nesting substrate, as will the Northern Cardinal and Wood Thrush. Other species including Kentucky Warblers, Common Yellowthroats, and Rufous-sided Towhees build their nests on the ground within the dense structure of canebrakes. Along with these many bird species, golden mice are also known to use canebrakes extensively, including building their nests in the cane itself. We observed golden mouse nests in 12 of the many canebrakes we visited, and we were not intentionally searching for them.

Many of the bird species mentioned above will use the protection of the dense structure of canebrakes within the forest for rearing their broods (from the time their chicks have left the nest to when they become independent). In addition, some species that do not necessarily nest in the cane may preferentially move into nearby canebrakes to rear their broods there (e.g. Carolina Wrens and Prothonotary Warblers). A variety of other bird species that nest in the sub-canopy or canopy may also occur more commonly at canebrake points, not because they use the canebrakes directly, but because they are associated with the more-open canopy (40-70% canopy cover) that is also a precursor to the establishment of robust stands of cane. The canopy- and sub-canopy-nesting birds that prefer some but not complete canopy cover include the Acadian Flycatcher, Great-crested Flycatcher, American

Redstart, Cerulean Warbler, and Yellow-throated Vireo. It is apparent from the results of the point counts that the canebrakes contribute much to the diversity of the breeding bird community within bottomland and riparian forests. The canebrakes add tremendously to the structural complexity of habitat within the forest ecosystem, thereby greatly enhancing the biodiversity.

Swainson's Warbler Surveys

We searched for Swainson's Warblers in over 100 canebrakes in southernmost Illinois. We found two territorial males during the 2009 breeding season. A detailed account of the search effort and the observations associated with these two males is given in the Appendix at the end of this report. The Appendix is a paper "in press" in Meadowlark, which is the Illinois Ornithological Society's flagship journal. One of the two males was found near but not in a canebrake, defending a territory within a 200-m wide "doghair" stand of early-successional restored forest that was wedged between two stands of mature bottomland forest located within the Cache River State Natural Area. There was no evidence of a female with this male. The other male was on a territory within one of the largest and densest canebrakes in the western Shawnee National Forest, and a nest and a female were also observed. This was the first evidence of nesting for Swainson's Warblers in Illinois in over a decade. Within the large canebrake where this bird held territory and where its nest was found, we also found nests of a Hooded Warbler, White-eyed Vireo, Indigo Bunting, Northern Cardinal, and golden mouse. This was a shining example of how individual canebrakes can provide valuable resources for a variety of organisms. The exact locations of each of these territorial males have not been released to the general public to reduce the likelihood of the birds being harassed by well-intentioned bird-watchers wanting to add the species to their Illinois life-list. There were males on territory in the very same locations in the 2010 breeding season.

The presence of these few territorial males provides some hope that if canebrakes increase in number and size in southern Illinois, then Swainson's Warbler numbers may increase. Moving forward

we will continue to survey canebrakes each summer in an effort to better document the number of Swainson's Warblers on breeding territories each year and whether particular canebrakes are occupied across several consecutive years. This information will be important to the development and implementation of canebrake management and enhancement activities. This also sets the stage for future research to try to attract more Swainson's Warblers to the canebrakes that exist on the landscape. The technique of using "call-boxes" that are placed in particular habitat and that broadcast male territorial song is known to attract focal bird species to places where they currently are not breeding. This process is called con-specific attraction. It is possible that use of call-boxes placed in canebrakes in the spring and early summer could attract other male (and possibly female) Swainson's Warblers to some of the larger canebrakes that currently are unoccupied.

Future Directions

The use of call-boxes to attract Swainson's Warblers to unoccupied canebrakes is just one example of a future research project that can now be easily implemented because of our survey of the canebrake habitat in southernmost Illinois. Our canebrake survey has already become a springboard to additional research in canebrakes, and botanists at INHS (J. Ebinger, R. Larimore, P. Marcum, et al.) are now in the process of measuring the botanical attributes of the 10 best (largest, densest, tallest) canebrakes known to us. As they complete their inventory and assessment, this information will be passed along to IDNR.

Our research can now provide information on the current status of canebrake habitat to the many conservation agencies and organizations in Illinois that have as a stated management priority the maintenance and restoration of this valuable and unique habitat. As these canebrakes continue to be mapped out, scientists can directly study the effects of spatial distribution and size of canebrakes on populations of the diverse, yet often rare, organisms that reside in canebrakes. Knowledge of canebrake distribution will also assist conservation agencies and organizations with prioritizing where

and when to establish canebrakes. Continuation of this research should 1) foster multi-agency cooperation to create a large-scale network of canebrake habitat once the current distribution is known, 2) facilitate studies by scientists who want to study the diverse organisms that use canebrake habitat and document the importance of canebrakes to bottomland/riparian ecosystems, and 3) promote collaborations between agency staff who implement canebrake management/restoration plans and scientists who can monitor the responses of wildlife populations to these conservation actions that create/enhance canebrakes. In addition, this research will be a valuable component of the habitat/wildlife management plans of numerous conservation organizations in Illinois (e.g. IDNR, USFWS, USDAFS, TNC) and can assist in the development of ecoregional and regional plans to enhance canebrake habitat.

Information collected in Illinois will be shared with resource managers interested in conserving canebrake habitat in nearby states (e.g. Missouri and Kentucky) and in associated ecoregions (e.g. Lower Mississippi River Alluvial Valley) and Bird Conservation Regions (e.g. Central Hardwoods, Southern Coastal Plain). While there is currently little organized or coordinated effort to inventory canebrake habitat in these other areas, we hope that our efforts in Illinois serve as an example and act as a springboard to the development of inter-state and regional plans to locate, inventory, reestablish and conserve canebrakes in bottomland forest ecosystems.

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Table 1. List of species detected during breeding bird point-counts in cane and non-cane forest habitats. Species in bold are those that have an affinity for disturbed habitat or successional habitat within forests.

Species (listed alphabetically)	Scientific Name	Density (number per 10 ha) in Forest Habitat	
		Cane	Non-cane
Acadian Flycatcher	<i>Empidonax virescens</i>	5.1	3.8
American Crow	<i>Corvus brachyrhynchos</i>	0.3	1.6
American Goldfinch	<i>Carduelis tristis</i>	1.0	0.6
American Redstart	<i>Setophaga ruticilla</i>	1.0	0.3
Bell's Vireo	<i>Vireo bellii</i>	0.0	0.3
Blue-gray Gnatcatcher	<i>Poliptila caerulea</i>	4.5	2.9
Blue Grosbeak	<i>Guiraca caerulea</i>	0.3	0.0
Blue Jay	<i>Cyanocitta cristata</i>	0.0	0.3
Brown Creeper	<i>Certhia americana</i>	0.3	0.6
Brown-headed Cowbird	<i>Molothrus ater</i>	1.3	1.0
Carolina Chickadee	<i>Poecile carolinensis</i>	3.5	1.9
Carolina Wren	<i>Thryothorus ludovicianus</i>	3.5	1.0
Cerulean Warbler	<i>Dendroica cerulea</i>	0.3	0.0
Common Grackle	<i>Quiscalus quiscula</i>	1.9	1.3
Common Yellowthroat	<i>Geothlypis trichas</i>	1.6	1.0
Downy Woodpecker	<i>Picoides pubescens</i>	1.3	0.6
Eastern Wood-Pee-wee	<i>Contopus virens</i>	2.2	2.2
Great-crested Flycatcher	<i>Myiarchus crinitus</i>	2.2	1.3
Gray Catbird	<i>Dumetella carolinensis</i>	0.0	0.3
Hairy Woodpecker	<i>Picoides villosus</i>	0.3	0.3
Hooded Warbler	<i>Wilsonia citrina</i>	1.0	0.0
Indigo Bunting	<i>Passerina cyanea</i>	7.0	5.1
Kentucky Warbler	<i>Opornis formosus</i>	2.8	1.6
Northern Cardinal	<i>Cardinalis cardinalis</i>	5.7	4.5
Northern Parula	<i>Parula americana</i>	3.2	2.9
Prothonotary Warbler	<i>Protonotaria citrea</i>	3.2	3.5
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	1.0	2.5
Red-eyed Vireo	<i>Vireo olivaceus</i>	1.3	0.6
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	0.3	0.3
Red-shouldered Hawk	<i>Buteo lineatus</i>	0.3	0.0
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	2.5	1.3
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>	1.0	0.3
Song Sparrow	<i>Melospiza melodia</i>	0.3	0.0
Summer Tanager	<i>Piranga rubra</i>	1.0	0.0
Swainson's Warbler	<i>Limnothlypis swainsonii</i>	0.3	0.0
Tufted Titmouse	<i>Baeolophus bicolor</i>	3.2	2.5
White-breasted Nuthatch	<i>Sitta carolinensis</i>	2.2	1.3
White-eyed Vireo	<i>Vireo griseus</i>	5.4	2.5
Wild Turkey	<i>Meleagris gallopavo</i>	0.0	0.3
Wood Thrush	<i>Hylocichla mustelina</i>	1.3	0.0
Yellow-breasted Chat	<i>Icteria virens</i>	0.6	1.6
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	0.0	1.6
Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>	0.3	0.0
Yellow-throated Vireo	<i>Vireo flavifrons</i>	1.3	0.6
Yellow-throated Warbler	<i>Dendroica dominica</i>	0.0	1.0
Total number of species		38	36

APPENDIX

Swainson's Warbler survey in southern Illinois

Article *In Press* in the Illinois Ornithological Society's journal Meadowlark:

Introduction

Commonly associated with large canebrakes (giant cane; *Arundinaria gigantea*), Swainson's Warblers (*Limnothlypis swainsonii*) are often difficult to observe within the densely vegetated bottomlands of the Southeastern United States (Brown and Dickson 1994). Due to the secretive nature of this species, accurate breeding distributions are challenging to determine. Population trends derived from the North American Breeding Bird Survey (BBS) indicate Swainson's Warbler populations have likely decreased throughout the Mississippi Alluvial Plain (Hunter et al. 1993) and Midwestern United States (Thompson et al. 1993) over the past forty years. Habitat loss and degradation of wet deciduous forests and large canebrakes have influenced population declines of this habitat specialist (Brown and Dickson 1994). Many populations on the northern edge of the species distribution (e.g. southern Illinois) have observed dramatic reductions or extirpation (Graves 2001). However, the warbler's secretive nature and preference for often inaccessible habitat make it likely that many individuals to undetected.

Although not known as a breeding species in Illinois until the 1950's, Eddleman et al. (1980) discovered 36 singing males while surveying the Cave Creek Valley in Jackson County. Subsequent searches within the valley revealed a population decline throughout the 1980's (Robinson 1996) and the species was consequently classified as state endangered and added to the list of Conservation Priority Birds as part of the Illinois Wildlife Action Plan (IWAP). With the last known breeding populations disappearing in the early 1990's (Kleen et al. 2004), individual observations in southern Illinois during 1991-2008 have been sporadic (Table 1). Given that observations have occurred

recently in southern Illinois our primary objectives of this research were (1) to document the current distribution of Swainson’s Warblers in southern Illinois; and (2) to determine the breeding status of located individuals.

Table 1. Written accounts of Swainson’s Warbler observations in Illinois.

Date	Details	Location	Publication*
2008 6 July – 27 August	1-2 males singing	Alexander County (Near Thebes)	M 18:1:35
2007 19 July	1 male heard	Johnson County	M 17:1:34
2005 6-8 May	Male photographed	Wabash County	M 14:4:156
2004 29 June – 5 July		Johnson County	M 14:1:36
2001 “summer”	Some evidence for breeding	Southern Illinois	M 11:1:37
1999 “summer”	Possibly heard	Pope County	M 9:1:36

*Indicates the volume, issue, and page number in the journal Meadowlark.

Methods

Swainson’s Warbler surveys were conducted within the Cache River State Natural Area, Cypress Creek National Wildlife Refuge (CCNWR), Shawnee National Forest (SNF), Horseshoe Lake State Fish and Wildlife Area and private properties located in the southern region of Illinois. Following the habitat characteristics of breeding Swainson’s Warblers previously recorded in Illinois, southern Missouri and eastern Arkansas, we defined potentially suitable habitat as canebrakes or shrub thickets near water with high stem density resembling that of canebrakes (Eddleman et al. 1980, Brown et al. 2009). Specific suitable habitat patches surveyed were located by using historical breeding sites (Robinson 1996), infra-red maps produced during recent winter aerial surveys conducted by CCNWR, and searching for previously unknown canebrakes within floodplains and bottomlands of southern Illinois. A few canebrakes in SNF were surveyed by volunteers from the Shawnee Audubon Society.

At each canebrake located within the study areas, we used 5-minute call-playback surveys to determine the presence of Swainson’s Warblers. Songs were broadcast adjacent to canebrakes using audio recordings provided by the Macaulay Library of Natural Sounds (Cornell Lab of Ornithology,

Ithaca, NY) and an MP3 player with portable speakers. Songs used were from a male recorded 28 April, 1957 in West Virginia (recordist: William W. H. Gunn) and chip notes used were from a different male recorded 7 April, 1981 in Louisiana (recordist: Theodore A. Parker III).

Nest searches were conducted with one to three people in appropriate nesting habitat (i.e. cane or dense vines) where male Swainson's Warblers were detected. For each bout of nest searching, searchers used behavioral cues and visual inspection of all nest-like objects to detect the presence of nesting activity.

Results

Song playback surveys of 115 distinct patches with suitable habitat throughout the southern Illinois study areas detected Swainson's Warblers in two specific patches (1.7% of total surveyed) during 19 May through 27 July 2009. Within these two specific patches, behavioral observations and nest searching resulted in:

Individual Accounts

On 2 June, 2009, while searching for canebrakes in a swamp located in southern Johnson County, the potential song of a Swainson's Warbler was heard about 200m from an observer's location. This individual was singing within a recently planted (< 10 years) IDNR forest regeneration plot with a tree density resembling the stem-density associated with most observed canebrakes. After using song playback, the bird was confirmed to be a male Swainson's Warbler and the bird repeatedly responded aggressively within close range (often < 4 m). A subsequent playback survey of the area and immediate vicinity on 12 June failed to detect the presence of the male. However, on 22 June, the same male (determined by distinctive song quality) was relocated without song playback about 100 m from the previous location in similar habitat.

Nest searching for this individual was conducted on 29 June and 15 July. On each visit, two researchers followed the singing male without playback for nearly four hours. No observations of a female or behaviors indicating nesting activity were detected. While observing this male foraging at close range, we heard the quiet “subsong”, a barely audible variable warbling described as sounding similar to American Goldfinches (*Carduelis tristis*) (Brown and Dickson 1994). Although many nests of other species were located within this specific habitat, no putative Swainson’s Warbler nest was located.

On 12 July, a singing male Swainson’s Warbler previously located by volunteer Rhonda Rothrock of the Shawnee Audubon Society, was relocated in the SNF in Jackson County. Initially observed singing at a height of 5m in a tree adjacent to a large canebrake, the male moved into the canebrake after 5 minutes of unobstructed observation. Based on specific areas where the male repeatedly sang, we focused nest searching efforts in two areas within the canebrake. After about 3 hours of searching, we found a fairly bulky nest woven into center branches next to a cane stem 1m above ground (see photo). This inactive nest closely resembles the structure, size and location of a Swainson’s Warbler nest (T. J. Benson pers. comm.). Shortly after locating the nest, the male flew directly over the nest and began singing rapidly. After following the male for another hour, we failed to detect additional potential nests or female Swainson’s Warblers.

Upon returning to the probable Swainson’s Warbler nest on 27 July, eggs or any new signs of activity at the nest were not detected. The male was singing about 150 m from this location and immediately responded to playback. The male responded to broadcasted call notes by chipping rapidly from the ground within 5m. This interaction attracted a family of Hooded Warblers (*Wilsonia citrina*) and a second Swainson’s Warbler that also chipped loudly nearby. No intraspecific aggressive interactions were observed as the two Swainson’s Warblers appeared to cooperatively chip near the playback. While the two birds chipped from the ground or low perches we were unable to identify any distinctive differences in appearance. After two minutes the birds dispersed in the same direction.

Although the male continued to sing for the next hour, we were unable to relocate the second Swainson's Warbler or any other signs of breeding activity in the area.

Discussion

During this study only two male and one probable female Swainson's Warblers were detected in southern Illinois. Repeated observations and behavior suggest these individuals were actively defending territories throughout the summer and were not transients. Although we were unable to confirm breeding in either occupied habitat patch, the behavior, presence of a Swainson's Warbler pair and potential nest strongly suggests a breeding attempt in the SNF. A lack of intraspecific aggression or differential appearance between the Swainson's Warbler pair suggests the second (non-singing) individual was probably a female, however, by late July the possibility of a recently molted hatch-year bird or another male cannot be ruled out.

Swainson's Warblers continue to occur rarely (e.g., 1.7% of total patches surveyed in this study) in appropriate habitat and at very low densities in southern Illinois. Due to the elusive habits of this species and large home-range size (range 1.55 to 30.75 ha, mean = 9.38 ha) (Anich et al. 2009), some birds may not have responded to playback resulting in a significant bias. In 1992, however, similar survey methods used in southern Missouri, one of the nearest extant populations to Illinois, reported 29% of canebrakes were occupied by Swainson's Warblers (Thomas et al. 1996).

Why Swainson's Warblers are now exceedingly rare along the northern periphery of their historical breeding range remains unclear. Major factors potentially influencing the Swainson's Warbler population decline in southern Illinois include habitat loss and the negative effects of brood parasitism by the Brown-headed Cowbird (*Molothrus ater*). The habitat structure that once supported a Swainson's Warbler population in the 1970's has likely changed over time. Loss of suitable canebrakes in the Shawnee National Forest may have influenced Swainson's Warbler habitat selection decisions, therefore causing dispersal of some individuals. Habitat fragmentation in the Shawnee

National Forest also increases the chance of brood parasitism by Brown-headed Cowbirds (Hoover et al. 2006). With low fledging success, 0.6 warbler offspring fledged when simultaneously raising a cowbird (Benson et al. 2010), the Swainson's Warbler population may have been dramatically affected by brood parasitism. Historically at low densities, Swainson's Warblers in Illinois may not be able to cope with the multiple effects of habitat alteration and cowbird parasitism.

Naturally ephemeral, canebrake habitat tends to wink in and out of existence over the course of several years or even decades as the forest canopy becomes more or less open. The canebrake where the pair of birds and nest were observed was particularly well-developed and was larger in area, greater in stem density, and taller than nearly all of the other canebrakes surveyed. A growing interest in managing for or promoting canebrakes in bottomland forests in southern Illinois will undoubtedly improve the chances of having several breeding pairs of Swainson's Warblers in Illinois in the future. The presence of these few territorial males provides some hope that if canebrakes increase in number and size in southern Illinois, then Swainson's Warbler numbers may increase. Moving forward we will continue to survey canebrakes each summer in an effort to better document the number of Swainson's Warblers on breeding territories each year and whether particular canebrakes are occupied across several consecutive years. This information will be important to the development and implementation of canebrake management and enhancement activities.

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Author's Note

Specific Swainson's Warbler observation locations were intentionally omitted from this article in an attempt to help protect the probable nesting pair and possible future populations. Birders attempting to search for this species are asked to exercise discretion when using playback to locate this species in Illinois. The "Code of Birding Ethics" (American Birding Association) cautions birders to avoid advertising, using playback and, stressing rare and endangered birds, especially when nesting.

Matt Mckim-Louder
Institute of Natural Resource Sustainability
Illinois Natural History Survey and
Natural Resources and Environmental Sciences
University of Illinois
mckimlou@illinois.edu

Jeffrey Hoover
Institute of Natural Resource Sustainability
Illinois Natural History Survey
University of Illinois
jhoover@inhs.uiuc.edu

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