Fire and Birds in the Central Hardwood Landscape

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Abstract

Fire is often viewed as destructive of wildlife and wildlife habitat, because it can cause dramatic change. The perception of catastrophic fire that burns up forests and kills wildlife has been fostered to enlist public support for suppressing fires. A message that is much more difficult to convey is that when fire is removed from the landscape important wildlife habitat can be slowly and subtly eliminated from ecosystems that depend on the frequent occurrence of fire.

Many fire-dependent communities—shortleaf pine forests, barrens, glades, prairies, balds, and oak savannas—are embedded in the extensive and diverse central hardwood landscape. Approximately 232 species of birds (119 breeding, 44 wintering, and 69 year-round residents) reside in this landscape. Some of the rarer bird species in the region are closely tied to fire-dependent habitats. The status of the Red-cockaded Woodpecker (*Picoides borealis*) is tenuous in pine forests of Kentucky and Oklahoma where fire has been suppressed for much of the century. Efforts to reintroduce fire to restore the open-structured, pine-dominated forests are hopeful signs for the species. Grassland birds are one of the most rapidly declining groups of species in North America. Habitat conversion has eliminated many of the grassland communities within the Central Hardwoods region, but plant succession in the absence of fire has also degraded habitat suitability for many grassland birds. Numerous preserves are being established to retain the rare biota of these grasslands. Many oak-dominated forests and oak woodland- savanna mosaics are slowly shifting to greater proportions of trees more associated with mesic conditions, such as maples (*Acer* sp.), and canopy closure. These shifts in structure and composition bring attendant changes in the avian community. Fire—with proper consideration of the potential effects on small populations of birds and invertebrates and the tradeoffs in bird species that will be favored—is an essential tool for habitat maintenance for some of the rare and declining birds in the Central Hardwoods region.

Introduction

A diverse array of vegetation communities that have experienced frequent fire for millennia are scattered throughout the extensive Central Hardwoods forest region (Hicks 1998; Braun 1950; Braun 1950; Hicks 1998; Anderson and others 1999). Some of these communities were fragmented and highly dispersed (e.g., balds) and some were extensive (e.g., the Kentucky barrens). The structure and plant composition of some of these communities was largely shaped edaphic conditions (Quarterman and others 1993), but fire played an important role to arrest succession and control brush and saplings as soils developed (Deselm and Murdock 1993). Lightning-started fires played a role in creating some of these habitats, but Native Americans undoubtedly used fire frequently and pervasively to create the open habitats found by early European colonists (Bonnicksen and others 1999; Askins 1999). Timber harvest, fire suppression, and plant succession have dramatically changed the composition of some of these plant communities, and, in the process, the avian comunities. Excellent descriptions of some of the grassland preserves in the Central Hardwoods region (e.g., Tennessee) can be found at: http://www.tnc.org/infield/State/Tennessee/

The purpose of this paper is to provide a brief overview of the avifauna of the region, including species that have become extinct or extirpated, to explore the bird species composition of three general vegetation communities that were shaped by frequent fires—shortleaf pine (*Pinus echinata*) forests, grassland/shrubland communities (balds, barrens, and glades), and open oak woodlands and savannas—and to discuss the effects on birds of use of prescribed fire in the management and restoration of these communities.

The Central Hardwoods Avifauna

Hicks (1998) uses four of Braun's (1950) forest types to define the Central Hardwoods region: the mixed mesophytic, western mesophytic, oak-hickory, and oak-chestnut forests. This large region extends over all or part of 35 states (Figure 1). I obtained a list of the bird species within this region by comparing distribution maps of bird species (Dunn 1987) to the map of the Central Hardwoods. Bird species whose winter or breeding season distributions overlapped with the outline of the Central Hardwoods region were included; migrant and transient birds were not.

Approximately 232 bird species winter or breed within the Central Hardwoods region (Appendix); all scientific names follow the American Ornithologists' Union (1998). Sixty-nine (30%) of these species occur year-round, 44 (19%) occur in the winter, and 119 (51%) occur in the breeding season only.

Four bird species that were found in the Central Hardwoods historically, Passenger Pigeon (*Ectopistes migratorius*), Carolina Parakeet (*Conuropsis carolinensis*), Ivory-billed Woodpecker (*Campephilus principalis*), and Bachman's Warbler (*Vermivora bachmanii*), have become extinct. The Passenger Pigeon and Bachman's Warbler may have been affected by changes in fire regimes in the Central Hardwoods region, although it seems likely that outright habitat loss was more important in their decline than habitat degradation through fire exclusion. For example burning in forests by Native Americans kept forest structure open and

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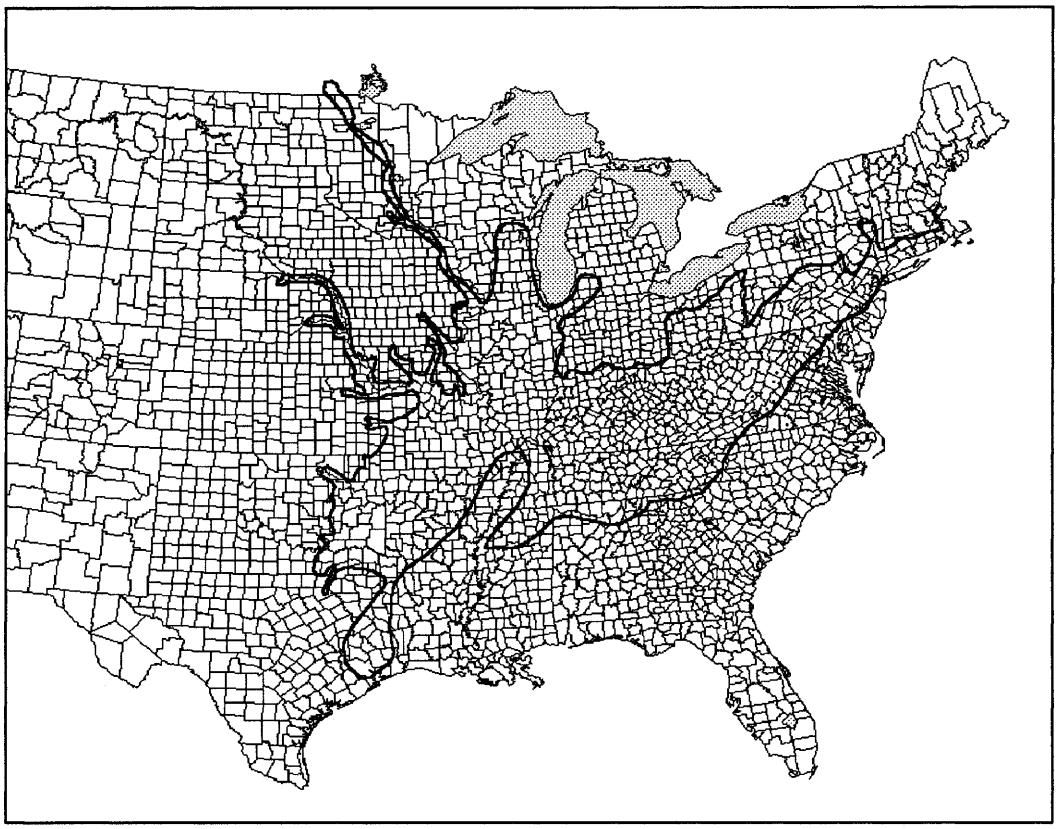

Figure 1.—Central Hardwoods region from Braun (1950).

parklike, which may have favored mast producing species and facilitated foraging by Passenger Pigeons on the ground. Bucher (1992) has hypothesized that destruction of forest breeding habitat and the lack of social facilitation in foraging were the major factors that contributed to the extinction of the species. Bachman's Warbler may have narrowly specialized on canebrakes (*Arundinaria* spp.) in bottomland hardwoods for breeding habitat (Remsen 1986). Fire played a critical role in maintenance of these large stands of cane (Hughes 1966).

Several bird species have been nearly extirpated from the Central Hardwoods landscape. The distribution within the region of Greater Prairie Chicken, Red-cockaded Woodpecker, Bewick's Wren, and Brown-headed Nuthatch have all receded within the last 200 years. The Greater Prairie Chicken formerly occurred in Ohio, Kentucky, Arkansas, and Missouri, and the eastern seaboard from Massachusetts and Virginia, but disappeared from hunting pressure and habitat destruction (Schroeder and Robb 1993). Lumsden (1966) suggested that the Greater Prairie Chicken may have colonized the eastern U.S. in response to grassland openings created when Native Americans burned woodlands.

Causes for the decline of the Bewick's Wren in the Central Hardwoods is far from clear. The most common explanation is that the Bewick's Wren expanded eastward in the early 19th century in response to agricultural expansion, but was then out-competed by the House Wren as it expanded its range (Kennedy and White 1997). Although the Bewick's Wren was not found in the region prior to 1821, C. Hunter (pers. comm.) has suggested that it might have been present in the oak-savanna mosaic of the Central Hardwoods. Loss of this habitat to agriculture and modification of the fire regime may have degraded the best habitat for the Bewick's Wren.

Pine Woodland Specialists in the Central Hardwoods Region

Some of the rarest and most threatened bird species of the Central Hardwoods landscape are associated with pine woodlands along the southern edge of the region. The Red-cockaded Woodpecker, a federally endangered species since 1970, is highly associated with open pinelands in the southeastern United States (Jackson 1994). Historically, the distribution of the woodpecker within the Central Hardwoods was primarily the Ouachita Highlands of Arkansas, Missouri, and Oklahoma, and the Cumberland Plateau of Kentucky and Tennessee (fig. 1). This species was typically associated with stands of shortleaf pine *(Pinus echinata*) on dry slopes and ridges. Interestingly, the distribution of Red-cockaded

Woodpecker clusters in the Daniel Boone National Forest has striking overlap with the distribution of Native American archeological sites (L. Perry, pers. comm.), which suggests that Native American use of fire may have been important in maintaining habitat for the woodpecker.

The Red-cockaded Woodpecker was apparently extirpated from Missouri by 1946 (Eddleman and Clawson 1987) and from Tennessee by 1994 (Nicholson 1997). Only one individual native to Kentucky remains, although 16 individuals have been translocated to Kentucky from larger populations to support the recovery effort there (L. Perry, pers. comm.). In each of these states the loss or decline of the red-cockaded woodpecker seemed to follow a similar pattern: elimination of old-growth shortleaf pine and drastic reduction of the fire frequency put extreme pressure on populations that were naturally small and fragmented by topography.

The largest remaining population of Red-cockaded Woodpeckers in the Central Hardwoods region is found in the 5701-ha McCurtain County Wilderness Area in southeastern Oklahoma, which is dominated by old-growth shortleaf pine-hardwood forest on steep ridges. Historical accounts characterize the vegetation of the Ouachita Mountains of Oklahoma "...as widely spaced trees with low basal area and stem density, open grassy understories, sparse midstories, and indicate that fire shaped forest conditions (e.g., pine-bluestem communities)" (Masters and others 1995). Substantial evidence indicates that Native Americans (the Caddo Indians before 1751 and the Choctaw in the mid-nineteenth century) used fire frequently in the area. Fire was also used frequently by early European settlers as indicated by analysis of fire scars, up until the era of modern fire suppression in 1957 (Masters and others 1995). Mean fire interval of the Wilderness Area during the presettlement period was between 3.5 and 5.6 years; this extended to over 500 years in the era of modern fire suppression.

Fire suppression and attendant extensive growth of hardwoods within the McCurtain County Wilderness Area is believed to have been partially responsible for the decline of the Red-cockaded Woodpecker (Kelly 1991; Masters and others 1995; Masters and others 1995). Wood (1977) located 29 groups (89-92 individuals) from 1974-77; Kelly (1991) found 15 active clusters (31 individuals); and Masters and others (1995) reported 9 active clusters (22 individuals): an average loss of 1.4 clusters per year. The Oklahoma Department of Wildlife Conservation is actively working to restore woodpecker habitat through hardwood control and reintroduction of fire.

Efforts to restore Red-cockaded Woodpecker habitat include removal of hardwoods that have grown in response to pine harvest and fire suppression and reintroduction of fire. In the Central Hardwoods region Red-cockaded Woodpecker habitat restoration has resulted in predictable effects on other species in the avian community. (Wilson and others 1995) reported increases in numbers of 10 pine-grassland bird species (Eastern Wood-Pewee, Northern Bobwhite, Red-headed Woodpecker, Prairie Warbler, Indigo Bunting, Bachman's Sparrow) in response to management for Red-cockaded Woodpeckers in Arkansas. (Hines 1999) found similar response of the avian community in Kentucky. In both studies some "interior" species (Black-and-white Warbler, Ovenbird) were found more frequently in control plots than in treatments.

Avian Communities of Savannas, Barrens, and Glades in the Central Hardwoods Region

Savannas, barrens, and glades were important components of the Central Hardwoods landscape before European settlement and even before human colonization. Pine barrens in New Jersey and New York (Gibson and others 1999), serpentine barrens in Pennsylvania (Tyndall and Hull 1999), rock outcrop communities (Quarterman and others 1993), cedar glades (Baskin and Baskin 1999), and the Big Barrens region of Kentucky and Tennessee (Baskin and others 1999) are some of the vegetation types that provided open, grassland/shrubland/savanna habitats for birds in the Central Hardwoods region. Some of these plant communities were extensive--the Big Barrens was approximately 2 million acres at the time of European settlement–but many were relatively small and isolated (Quarterman and others 1993) historical and prehistorical evidence suggests that grasslands in the region have long provided important habitat for many species of birds (Askins 1999).

Many of these communities share common features that inhibit tree growth: harsh edaphic conditions (i.e., shallow soils over bedrock that dry quickly) and the frequent occurrence of fire (Anderson and others 1999). Use of fire by Native Americans played an essential role in retarding succession and maintaining these communities with few or no shrubs or trees (Bonnicksen and others 1999; Askins 1999).

Populations of birds, as measured by the North American Breeding Bird Survey (BBS), that inhabit grassland, shrubland, and savanna communities are showing some of the most dramatic declines of any functional group of bird species in the eastern United States (Peterjohn and Sauer 1999). To better focus on bird population trends in the Central Hardwoods region, I selected the 10 physiographic regions within the Central Hardwoods region that are used by the BBS for trend estimates (table 1). I counted the number of physiographic regions in which each species showed statistically significant positive and negative trends over the period 1965 to 1995 (DeGraaf and Rappole 1995; Appendix). For example the Field Sparrow has had significant negative trends over a 30-year period in 9 of the 10 BBS physiographic regions; the American Robin has significantly increased in 7 of 10 regions (Appendix).

Relatively few studies have been published of the avian communities of the savannas, barrens, and glades of the Central Hardwoods region. One study of a cedar glade (Schultz 1930; Quarterman et. al 1993) and a Breeding Bird Census in a serpentine grassland in Pennsylvania (Greenewalt and others 1961) indicate that many of the birds

Table 1.—Comparison of physiographic regions used by Braun (1950) and the Breeding Bird Survey (Robbins et al. 1986).

Braun (1950)	Breeding Bird Survey
1. Mixed Mesophytic Forest	
a. Cumberland Mtns.	21. Cumberland Plateau
b. Alleghany Mtns.	22. Ohio Hills
c. Cumberland and Allelghany Plateaus	
2. Western Mesophytic Forest	
a. Bluegrass	14. Highland Rim
b. Nashville basin	15. Lexington Plain
c. Illinoian glaciation	
d. Mississippian Plateau	
e. Mississippi Embayment	
3. Oak-hickory Forest	
Southern Division	19. Ozark-Ouachita Plateau
a. Interior Highlands	31. Till Plains
b. Forest-Prairie Transition	
Northern Division	
c. Mississippi Valley	
d. Prairie Peninsula	
4. Oak-Chestnut Forest	
a. Southern Apalachians	10. Northern Piedmont
b. Northern Blue Ridge	12. Southern New England
c. Ridge and Valley	13. Ridge and Valley
d. Piedmont	23. Blue Ridge Mountains
e. Glaciated	

of these vegetation communities are showing significant regional declines (table 2).

Some of the best remaining examples of grasslands in the Central Hardwoods region have some form of conservation protection. Management objectives of these preserves frequently include maintenance of small, relatively isolated populations of rare plants, invertebrates, and birds. Burning in grassland preserves such as these requires special attention (Engstrom 1997). Consider the following general suggestions for managing grasslands. (1) Mix up management applications (e.g., season of fire) from year-to-year to provide variation in disturbance. No single management prescription will be best for all species. (2) Consider vegetation litter recovery and accumulation when establishing fire frequency. This is important for some bird species, such as Henslow's Sparrow, which prefers relatively thick grasses for nesting. (3) Consider the size of the management area in relation to the needs of the species of interest. Subdividing large tracts into smaller units and applying different management practices on different units would provide habitats in a variety of stages of recovery from disturbance.

Birds of Oak Savannas

Fire is critical for determining the structure and composition of vegetation of sand savannas (Will-Wolf and Stearns 1999), deep soil savannas (Anderson and Bowles 1999), and open oak woodlands (Fralish and others 1999) in the Central Hardwoods region. In the absence of fire, shade-tolerant tree species such as sugar maple (*Acer saccharum*), gradually replace oaks (Abrams 1992) close the canopy, and create more mesic conditions. Changes in tree species composition and forest structure strongly affect the avian community. Recently, (Brawn 1998) and (Artman and Downhower 2000) have experimentally studied the effects of fire on bird communities in oak woodlands in Illinois and Ohio respectively.

As in the cases of restoration of shortleaf pine woodlands the use of fire to manage oak woodlands and savannas favors some bird species over others (table 3). Note that many of the bird species that increase significantly after application are those that are declining within the region.

Conclusions

Many of the structurally open habitats in the Central Hardwoods region probably originated because edaphic

Table 2.—Bird species found in two grassland communities in the Central Hardwoods region. Underlined species are showing significant declines in at least three physiographic regions used by the Breeding Bird Survey (See Appendix).

Cedar glade in central Tennessee (Schultz 1930)	Serpentine Barrens in Pennsylvania (Greenewalt et al. 1961)
Northern Cardinal	Rufous-sided Towhee
Indigo Bunting	Field Sparrow
Field Sparrow	Gray Catbird
Chipping Sparrow	Brown Thrasher
Rufous-sided Towhee	
White-eyed Vireo	
Red-eyed Vireo	
Carolina Chickadee	
Common Yellowthroat	
Carolina Wren	
Blue Jay	
Yellow-breasted Chat	
American Crow	
Tufted Titmouse	
Wood Thrush	
Summer Tanager	
Blue-gray Gnatcatcher	
Northern Mockingbird	
Northern Flicker	
Brown Thrasher	
Gray Catbird	
Northern Bobwhite	
Mourning Dove	
Yellow-billed Cuckoo	
Downy Woodpecker	
Eastern Bluebird	
Orchard Oriole	

Table 3—Bird species that showed significant responses to use of prescribed fire in oak woodlands.

	Brawn (1998)	Artman and Downhower (this conference)
Northern Bobwhite	Positive	
Mourning Dove	Positive	
Red-headed Woodpecker	Positive	
Great Crested Flycatcher	Positive	
Eastern Wood-Pewee		Positive
American Robin		Positive
Wood Thrush	Negative	
Veery	Negative	
Brown Thrasher	Positive	
Ovenbird	Negative	Negative
Hooded Warbler		Negative
Worm-eating Warbler		Negative
Scarlet Tanager	Negative	
Summer Tanager	Positive	
Eastern Towhee	Positive	
Indigo Bunting	Positive	Positive
Baltimore Oriole	Positive	

conditions permitted few trees to develop and then were kept open by extensive use of fire by Native Americans. Bird species that prefer open habitat structure have either largely disappeared (Greater Prairie Chicken, Bachman's Sparrow, Red-cockaded Woodpecker) or shifted to agricultural habitats. Many of the species that were common in grasslands prior to European settlement and subsequently shifted to agricultural habitats are undergoing widespread population declines as farmland has been converted to forests or human environments. Great reduction in the number of grasslands, balds, and barrens has increased the importance of managing the remaining grasslands with care to avoid endangering small isolated populations of invertebrates and some bird species. Prescribed fire is an effective tool and sometimes the only practical tool for achieving management goals. Managers can take practical steps to minimize loss of individuals through the use of prescribed fire. Any change of fire frequency—either increasing or decreasing—over a long time period will favor some plant species over others, which will strongly affect the habitat structure and associated bird species. In the Central Hardwoods region widespread declines of bird species that are associated with open habitats indicates that fire should be used widely to maintain openings.

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Appendix

Bird species of the Central hardwoods landscape. Status: B=breeding, W=winter, and Y=year-round. Species that have shown statistically significant changes from 1965-1995 from Breeding Bird Survey results. (See text for list of BBS physiographic regions.)

			N physiographic regions showing significant trends	
Common Name	Scientific Name	Status	Positive	Negative
Pied-billed Grebe	*Podilymbus podiceps*	Y		
Eared Grebe	*Podiceps nigricollis*	W		
American White Pelican	*Pelecanus erythrorhynchos*	B		
Double-crested Cormorant	*Phalacrocorax auritus*	B		
Anhinga	*Anhinga anhinga*	B		
American Bittern	*Botaurus lentiginosus*	B		
Least Bittern	*Ixobrychus casmerodius*	B		
Great Blue Heron	*Ardea herodias*	B	7	0
Great Egret	*Casmerodius albus*	B		
Snowy Egret	*Egretta thula*	B		
Little Blue Heron	*Egretta caerulea*	B		
Tricolored Heron	*Egretta tricolor*	B		
Cattle Egret	*Bubulcus ibis*	B		
Green Heron	*Butorides striatus*	B	0	2
Black-crowned Night-Heron	*Nycticorax nycticorax*	B		
Yellow-crowned Night-Heron	*Nycticorax violaceus*	B		
Canada Goose	*Branta canadensis*	Y		
Wood Duck	*Aix sponsa*	B	4	0
Green-Winged Teal	*Anas crecca*	W		
American Black Duck	*Anas rubripes*	Y		
Mallard	*Anas platyrhynchos*	Y	2	0
Northern Pintail	*Anas acuta*	Y		
Blue-winged Teal	*Anas discors*	B		
Northern Shoveler	*Anas clypeata*	B		
Gadwall	*Anas strepera*	W		
American Wigeon	*Anas americana*	B		
Canvasback	*Aythya valisineria*	W		
Redhead	*Aythya americana*	W		
Ring-necked Duck	*Aythya collaris*	W		
Lesser Scaup	*Aythya affinis*	W		
Common Goldeneye	*Bucephala clangula*	W		
Bufflehead	*Bucephala albeola*	W		
Hooded merganser	*Lophodytes cucullatus*	B		
Common Merganser	*Mergus merganser*	W		
Ruddy Duck	*Oxyura jamaicensis*	W		
Black Vulture	*Coragyps atratus*	B	1	0
Turkey Vulture	*Cathartes aura*	Y	1	0
Osprey	*Pandion haliaetus*	B		
Mississippi Kite	*Ictinia mississippiensis*	B		
Bald Eagle	*Haliaeetus leucocephalus*	W		
Northern Harrier	*Circus cyaneus*	Y		
Sharp-shinned Hawk	*Accipiter striatus*	Y	1	0
Cooper's Hawk	*Accipiter cooperii*	Y	1	0
Northern Goshawk	*Accipiter gentilis*	W		
Red-shouldered Hawk	*Buteo lineatus*	Y	3	0
Broad-winged Hawk	*Buteo platypterus*	B	0	1
Red-tailed Hawk	*Buteo jamaicensis*	Y	7	0
Rough-legged Hawk	*Buteo lagopus*	W		
Golden Eagle	*Aquila chrysaetos*	W		

Continued

Appendix continued

Common Name	Scientific Name	Status	N physiographic regions showing significant trends	
			Positive	Negative
American Kestrel	*Falco sparverius*	Y	1	1
Merlin	*Falco columbarius*	W		
Gray Partridge	*Perdix perdix*	Y		
Ring-necked Pheasant	*Phasianus colchicus*	Y		
Ruffed Grouse	*Bonasa umbellus*	Y		
Sharp-tailed Grouse	*Tympanuchus phasianellus*	Y		
Greater Prairie Chicken	*Tympanuchus cupido*	Y		
Wild Turkey	*Meleagris gallopavo*	Y		
Northern Bobwhite	*Colinus virginianus*	Y		
King Rail	*Rallus elegans*	B		
Virginia Rail	*Rallus limicola*	B		
Sora	*Porzana carolina*	B		
Purple Gallinule	*Porphyrula martinica*	B		
Common Moorhen	*Gallinula chloropus*	B		
American Coot	*Fulica americana*	Y		
Piping Plover	*Charadrius melodus*	B		
Killdeer	*Charadrius vociferus*	Y	4	1
Spotted Sandpiper	*Actitis macularia*	B		
Upland Sandpiper	*Bartramia longicauda*	B		
Common Snipe	*Gallinago gallinago*	W		
American Woodcock	*Scolopax minor*	Y		
Wilson's Phalarope	*Phalaropus tricolor*	B		
Ring-billed Gull	*Larus delawarensis*	W		
Herring Gull	*Larus argentatus*	W		
Common Tern	*Sterna hirundo*	B		
Forster's Tern	*Sterna forsteri*	B		
Least Tern	*Sterna antillarum*	B		
lack Tern	*Chlidonias niger*	B		
Black Skimmer	*Rynchops niger*	B		
Rock Dove	*Columba livia*	Y		
Mourning Dove	*Zenaida macroura*	Y	4	0
Black-billed Cuckoo	*Coccyzus erythropthalmus*	B	0	1
Yellow-billed Cuckoo	*Coccyzus americanus*	B	0	6
Common Barn-Owl	*Tyto alba*	Y		
Eastern Screech-Owl	*Otus asio*	Y		
Great Horned Owl	*Bubo virginianus*	Y		
Barred Owl	*Strix varia*	Y		
Long-eared Owl	*Asio otus*	Y		
Short-eared Owl	*Asio flammeus*	Y		
Northern Saw-whet Owl	*Aegolius acadicus*	Y		
Common Nighthawk	*Chordeiles minor*	Y	0	2
Chuck-will's-widow	*Caprimulgus carolinensis*	B		
Whip-poor-will	*Caprimulgus vociferus*	B	0	2
Chimney Swift	*Chaetura pelagica*	B	1	3
Ruby-throated Hummingbird	*Archilochus colubris*	B	0	1
Belted Kingfisher	*Ceryle alcyon*	Y	1	3
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Y		
Red-bellied Woodpecker	*Melanerpes carolinus*	Y		
Yellow-bellied Sapsucker	*Sphyrapicus varius*	W		
Downy Woodpecker	*Picoides pubescens*	Y		
Hairy Woodpecker	*Picoides villosus*	Y		
Red-cockaded Woodpecker	*Picoides borealis*	Y		

Continued

Appendix continued

Common Name	Scientific Name	Status	N physiographic regions showing significant trends	
			Positive	Negative
Northern Flicker	*Colaptes auratus*	Y		
Pileated Woodpecker	*Dryocopus pileatus*	Y		
Olive-sided Flycatcher	*Contopus borealis*	B		
Eastern Wood-Pewee	*Contopus virens*	B	0	5
Acadian Flycatcher	*Empidonax virescens*	B	0	2
Alder Flycatcher	*Empidonax alnorum*	B		
Willow Flycatcher	*Empidonax traillii*	B		
Least Flycatcher	*Empidonax minimus*	B	0	1
Eastern Phoebe	*Sayornis phoebe*	B	3	0
Great Crested Flycatcher	*Myiarchus crinitus*	B	0	5
Eastern Kingbird	*Tyrannus tyrannus*	B	0	2
Scissor-tailed Flycatcher	*Tyrannus forficatus*	B		
Horned Lark	*Eremophila alpestris*	Y	0	4
Purple Martin	*Progne subis*	B	1	2
Tree Swallow	*Tachycineta bicolor*	B	1	0
Northern Rough-winged	Swallow*Stelgidopteryx serripennis*	B	2	1
Bank Swallow	*Riparia riparia*	B		
Cliff Swallow	*Hirundo pyrrhonota*	B	1	0
Barn Swallow	*Hirundo rustica*	B	1	2
Blue Jay	*Cyanocitta cristata*	Y		
American Crow	*Corvus brachyrhynchos*	Y		
Fish Crow	*Corvus ossifragus*	B		
Common Raven	*Corvus corax*	Y		
Black-capped Chickadee	*Parus atricapillus*	Y		
Carolina Chickadee	*Parus carolinensis*	Y		
Tufted Titmouse	*Parus bicolor*	Y		
Red-breasted Nuthatch	*Sitta canadensis*	W		
White-breasted Nuthatch	*Sitta carolinensis*	Y		
Brown-headed Nuthatch	*Sitta pusilla*	Y		
Brown Creeper	*Certhie americana*	W		
Carolina Wren	*Thryothorus ludovicianus*	Y		
Bewick's Wren	*Thryomanes bewickii*	B	0	1
House Wren	*Troglodytes aedon*	B	4	2
Winter Wren	*Troglodytes troglodytes*	W		
Marsh Wren	*Cistothorus palustris*	B		
Golden-crowned Kinglet	*Regulus satrapa*	W		
Ruby-crowned Kinglet	*Regulus calendula*	W		
Blue-gray Gnatcatcher	*Polioptila caerulea*	B	1	0
Eastern Bluebird	*Sialia sialis*	Y	4	1
Veery	*Catharus fuscescens*	B		
Swainson's Thrush	*Catharus ustulatus*	B		
Hermit Thrush	*Catharus guttatus*	W		
Wood Thrush	*Hylocichla mustelina*	B	1	4
American Robin	*Turdus migratorius*	Y	7	0
Gray Catbird	*Dumetella carolinensis*	B	2	4
Northern Mockingbird	*Mimus polyglottos*	Y		
Brown Thrasher	*Toxostoma rufum*	B		
Cedar Waxwing	*Bombycilla cedrorum*	Y	6	0
Northern Shrike	*Lanius excubitor*	W		
Loggerhead Shrike	*Lanius ludovicianus*	Y	0	3
European Starling	*Sturnus vulgaris*	Y		
White-eyed Vireo	*Vireo griseus*	B	1	3

Continued

Appendix continued

Common Name	Scientific Name	Status	N physiographic regions showing significant trends	
			Positive	Negative
Solitary Vireo	*Vireo solitarius*	B		
Bell's Vireo	*Vireo bellii*	B	0	1
Yellow-throated Vireo	*Vireo flavifrons*	B	0	1
Warbling Vireo	*Vireo gilvus*	B	1	1
Red-eyed Vireo	*Vireo olivaceus*	B	1	1
Blue-winged Warbler	*Vermivora pinus*	B	0	2
Golden-winged Warbler	*Vermivora chrysoptera*	B	0	1
Nashville Warbler	*Vermivora ruficapilla*	B		
Northern Parula	*Parula americana*	B	1	0
Yellow Warbler	*Dendroica petechia*	B	2	0
Chestnut-sided Warbler	*Dendroica pensylvanica*	B		
Magnolia Warbler	*Dendroica magnolia*	B		
Black-throated Blue Warbler	*Dendroica caerulescens*	B		
Yellow-rumped Warbler	*Dendroica coronata*	W	1	0
Black-throated Green Warbler	*Dendroica virens*	B	1	0
Blackburnian Warbler	*Dendroica fusca*	B		
Yellow-throated Warbler	*Dendroica dominica*	B	2	1
Pine Warbler	*Dendroica pinus*	B	2	0
Prairie Warbler	*Dendroica discolor*	B	0	6
Cerulean Warbler	*Dendroica cerulea*	B	0	3
Black-and-white Warbler	*Mniotilta varia*	B	0	4
American Redstart	*Setophaga ruticilla*	B	0	4
Prothonotary Warbler	*Protonotaria citrea*	B	0	1
Worm-eating Warbler	*Helmitheros vermivorus*	B		
Swainson's Warbler	*Limnothlypis swainsonii*	B		
Ovenbird	*Seiurus aurocapillus*	B		
Louisiana Waterthrush	*Seiurus motacilla*	B		
Common Yellowthroat	*Geothlypis trichas*	B	0	2
Hooded Warbler	*Wilsonia citrina*	B		
Kentucky Warbler	*Oporornis formosus*	B	0	1
Canada Warbler	*Wilsonia canadensis*	B		
Yellow-breasted Chat	*Icteria virens*	B	0	7
Summer Tanager	*Piranga rubra*	B	0	2
Scarlet Tanager	*Piranga olivacea*	B	3	1
Northern Cardinal	*Cardinalis cardinalis*	Y		
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	B	2	1
Blue Grosbeak	*Guiraca caerulea*	B		
Indigo Bunting	*Passerina cyanea*	B	0	7
Painted Bunting	*Passerina ciris*	B		
Dickcissel	*Spiza americana*	B	0	2
Rufous-sided Towhee	*Pipilo erythrophthalmus*	Y	0	9
Bachman's Sparrow	*Aimophila aestivalis*	B		
American Tree Sparrow	*Spizella arborea*	W		
Chipping Sparrow	*Spizella passerina*	B	2	2
Field Sparrow	*Spizella pusilla*	Y	0	10
Vesper Sparrow	*Pooecetes gramineus*	B	0	3
Lark Sparrow	*Chondestes grammacus*	B	0	1
Savannah Sparrow	*Passerculus sandwichensis*	B		
Grasshopper Sparrow	*Ammodramus savannarum*	B	0	6
Henslow's Sparrow	*Ammodramus henslowii*	B		
Le Conte's Sparrow	*Ammodramus leconteii*	W		
Fox Sparrow	*Passerella iliaca*	W		

Continued

Appendix continued

Common Name	Scientific Name	Status	N physiographic regions showing significant trends	
			Positive	Negative
Song Sparrow	*Melospiza melodia*	Y		
Lincoln's Sparrow	*Melospiza lincolnii*	W	1	0
Swamp Sparrow	*Melospiza georgiana*	Y		
White-throated Sparrow	*Zonotrichia albicollis*	W		
White-crowned Sparrow	*Zonotrichia leucophrys*	W		
Dark-eyed Junco	*Junco hyemalis*	W		
Lapland Longspur	*Calcarius lapponicus*	W		
Snow Bunting	*Plectrophenax nivalis*	W		
Bobolink	*Dolichonyx oryzivorus*	B	1	1
Red-winged Blackbird	*Agelaius phoeniceus*	Y	0	6
Eastern Meadowlark	*Sturnella magna*	Y	0	9
Western Meadowlark	*Sturnella neglecta*	B		
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	B		
Rusty Blackbird	*Euphagus carolinus*	W		
Brewer's Blackbird	*Euphagus cyanocephalus*	B		
Common Grackle	*Quiscalus quiscula*	Y		
Brown-headed Cowbird	*Molothrus ater*	Y	0	3
Orchard Oriole	*Icterus spurius*	B	1	3
Northern Oriole	*Icterus galbula*	B	1	3
Purple Finch	*Carpodacus purpureus*	W		
House Finch	*Carpodacus mexicanus*	Y		
Pine Siskin	*Carduelis pinus*	W		
American Goldfinch	*Carduelis tristis*	Y	0	1
Evening Grosbeak	*Coccothraustes vespertinus*	W		
House Sparrow	*Passer domesticus*	Y		
Eurasian Tree Sparrow	*Passer montanus*	Y		