

Floodplain Forest

Mid-Atlantic Coastal Plain

The Coastal Plain floodplain forest habitat includes levee forest, cypress-gum swamps, bottomland hardwoods, and alluvial floodplains with small poorly defined fluvial features (such as Small Stream Swamps), as well as semipermanent impoundments (beaver ponds and mill ponds), sand and mud bars, and oxbow lakes. Floodplain forest may be associated with blackwater rivers (originating in the Coastal Plain) or brownwater rivers (originating the Piedmont or Mountains but flowing into the Coastal Plain). The floodplain forest systems of the Coastal Plain in the southeast are now only small fragments and sections of the original millions of acres present before European settlement and have been lost or altered by development, drainage, agriculture and logging (Weller and Stegman 1977). Several of the species of wildlife that once called large floodplain systems home are gone or greatly reduced in numbers.

Sand and Mud Bar communities are found throughout the Coastal Plain and are usually in and adjacent to streams and rivers and these areas are mostly too wet, young or severely flooded to support a forest canopy (Schafale and Weakley 1990). The dynamic nature of these sand and mud bars also prevents establishment of vegetation. These communities are small and vary widely within and among sites with the size and gradient of river, frequency of duration of flooding, degree of consolidation of substrate, amount of regular fluvial deposition and location within the Coastal Plain (Schafale and Weakley 1990). They are common sites for migrating shorebirds or wading birds to briefly stopover and rest or forage.

Coastal Plain Semipermanent impoundments are distinguished from the surrounding floodplain communities by having permanent or semipermanent standing water (beaver ponds, and similar manmade impoundments) and are found throughout the Coastal Plain (Schafale and Weakley 1990). Oxbow Lakes are abandoned river channel meanders with permanent nonflowing water found throughout the Coastal Plain along major rivers (Schafale and Weakley 1990).

Levee Forest communities in blackwater systems occur on natural levee deposits along channels of large rivers. Dominant trees include wetland hardwoods such as laurel oak, overcup oak, willow oak, river birch, sweetgum, red maple and American elm. Loblolly pine may be common, especially in disturbed sites. These areas are seasonally to intermittently flooded, and typical of blackwater river systems, there is a highly variable flow regime with floods of short duration and periods of very low flow (Schafale and Weakley 1990). The shrub layer ranges from sparse to dense and the herb layer is usually well developed. These areas are greatly affected by the forces of the river and are the rarest of the blackwater floodplain natural communities (Schafale and Weakley 1990).

Bottomland Hardwoods in blackwater systems occur on high parts of the floodplain away from the channel and are dominated by laurel oak, water oak, willow oak, overcup oak, red maple, sweetgum, loblolly pine, and occasionally Atlantic white cedar (Schafale and Weakley 1990). Shrub layers can be very dense and switch cane can be common. Vines can be dense, but usually not as dense as on levees, and the herb layer is usually sparse. Flooding occurs in these sites occasionally but they are seldom disturbed by flowing water like levees. Blackwater rivers

carry little inorganic sediment so flooding does not provide a substantial nutrient input as it does in brownwater systems (Schafale and Weakley 1990). These areas may carry fires (due to dense lower layers of vegetation) when dry and the occurrence of fire would affect the plant community composition and structure.

Brownwater Levee Forests, in contrast to blackwater levee habitats, tend to have periods of sustained high flow and the water is high in pH, nutrients and mineral sediment (Schafale and Weakley 1990). Forests are dominated by bottomland hardwood species such as sycamore, sugarberry, green ash, river birch, boxelder, water hickory and sweetgum, with moderately dense shrub layers, abundant vines and a dense herb layer (Schafale and Weakley 1990).

Bottomland hardwoods in brownwater systems are found throughout the coastal plain and typical trees include swamp chestnut oak, cherrybark oak, laurel oak, water oak, willow oak, Shumard’s oak, sweetgum, green ash, shagbark hickory, bitternut hickory, water hickory and American elm (Schafale and Weakley 1990). These systems are seasonally to intermittently flooded and the water table may be high for long periods even when the site is not flooded (Schafale and Weakley 1990).

Blackwater Cypress-Gum Swamps contain just a few tree species, tolerant of nearly permanent flooding: bald cypress, pond cypress, and swamp black gum. These communities get little input of nutrients due to the poor inorganic sediment load carried by blackwater rivers and the infertile acidic soils and wetness produce slow growth in the trees (Schafale and Weakley 1990). The difference between cypress and gum dominance is probably related to logging history, but environmental factors such as flooding frequency and depth, water chemistry, soil type and latitude also contribute (Schafale and Weakley 1990). Since cypress-gum swamps flood for long periods of time their vegetational diversity is usually low but they may serve as important habitat for some aquatic animals and plants. Hollow cypress and swamp black gum are particularly important for bats, chimney swifts and other cavity dwelling species. In addition, several colonial waterbird species rely on swamp forests for nesting habitat.

Pond cypress and swamp black gum are unusual in brownwater Cypress-Gum Swamp systems, replaced by a mix of water tupelo and bald cypress as dominant tree species. Carolina water ash and red maple are typical in the understory of blackwater Coastal Plain cypress-gum swamps with Carolina water ash the predominant understory species in brownwater subtypes (Schafale and Weakley 1990). Floodplain forests are usually a mix of trees of different types growing close together that may be associated with different microenvironments that are close enough to interact with trees in different microenvironments. If a floodplain contains levees and ridges large enough to support distinctive communities, larger than the zone of edge effect between them, then the low areas between them may be considered Cypress-Gum Swamps (Schafale and Weakley 1990). Table 1 provides a list of priority species associated with this habitat for which there is conservation concern.

Table 1. Priority species associated with coastal plain floodplain forest.

Group	Scientific name	Common name	State status* (Federal status)
Birds	<i>Anhinga anhinga</i>	Anhinga	SR
	<i>Chaetura pelagica</i>	Chimney Swift	

Table 1. Priority species associated with coastal plain floodplain forest.

Group	Scientific name	Common name	State status* (Federal status)
	<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	
	<i>Contopus virens</i>	Eastern Wood-pewee	
	<i>Dendroica cerulea</i>	Cerulean Warbler	SR
	<i>Dendroica virens waynei</i>	Wayne's Black-throated Green Warbler	
	<i>Elanoides forficatus</i>	Swallow-tailed Kite	
	<i>Haliaeetus leucocephalus</i>	Bald Eagle	T (T)
	<i>Helmitheros vermivorus</i>	Worm-eating Warbler	
	<i>Hylocichla mustelina</i>	Wood Thrush	
	<i>Ictinia mississippiensis</i>	Mississippi Kite	SR
	<i>Limnothlypis swainsonii</i>	Swainson's Warbler	
	<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	
	<i>Nyctanassa violacea</i>	Yellow-crowned Night-heron	
	<i>Oporornis formosus</i>	Kentucky Warbler	
	<i>Picoides villosus</i>	Hairy Woodpecker	
	<i>Scolopax minor</i>	American Woodcock	
	<i>Wilsonia citrina</i>	Hooded Warbler	
Mammals	<i>Condylura cristata</i>	Star-nosed Mole	SC
	<i>Corynorhinus rafinesquii</i>	Rafinesque's Big-eared Bat	T
	<i>Lasiurus intermedius</i>	Northern Yellow Bat	SR
	<i>Lasiurus seminolus</i>	Seminole Bat	
	<i>Myotis austroriparius</i>	Southeastern Bat	SC
	<i>Neotoma floridana</i>	Eastern Woodrat	T
	<i>Peromyscus gossypinus</i>	Cotton Mouse	
	<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew	
	<i>Sylvilagus palustris</i>	Marsh Rabbit	
Amphibians	<i>Ambystoma mabeei</i>	Mabee's Salamander	SR
	<i>Ambystoma maculatum</i>	Spotted Salamander	
	<i>Ambystoma opacum</i>	Marbled Salamander	
	<i>Desmognathus auriculatus</i>	Southern Dusky Salamander	
	<i>Eurycea guttolineata</i>	Three-lined Salamander	
	<i>Eurycea quadridigitata</i>	Dwarf Salamander	SC
	<i>Eurycea sp 1</i>	Sandhills Salamander	
	<i>Hemidactylum scutatum</i>	Four-toed Salamander	SC
	<i>Plethodon glutinosus sensu stricto</i>	Northern Slimy Salamander	
	<i>Scaphiopus holbrookii</i>	Eastern Spadefoot	
Reptiles	<i>Clemmys guttata</i>	Spotted Turtle	
	<i>Crotalus horridus</i>	Timber (Canebrake) Rattlesnake	SC
	<i>Elaphe guttata</i>	Corn Snake	

Table 1. Priority species associated with coastal plain floodplain forest.

Group	Scientific name	Common name	State status* (Federal status)
	<i>Eumeces laticeps</i>	Broad-headed Skink	
	<i>Lampropeltis getula getula</i>	Eastern Kingsnake	
	<i>Terrapene carolina</i>	Eastern Box Turtle	
	<i>Thamnophis sauritus sauritus</i>	Common Ribbonsnake	
*Abbreviations			
E	Endangered		
SC	Special Concern		
SR	Significantly Rare		

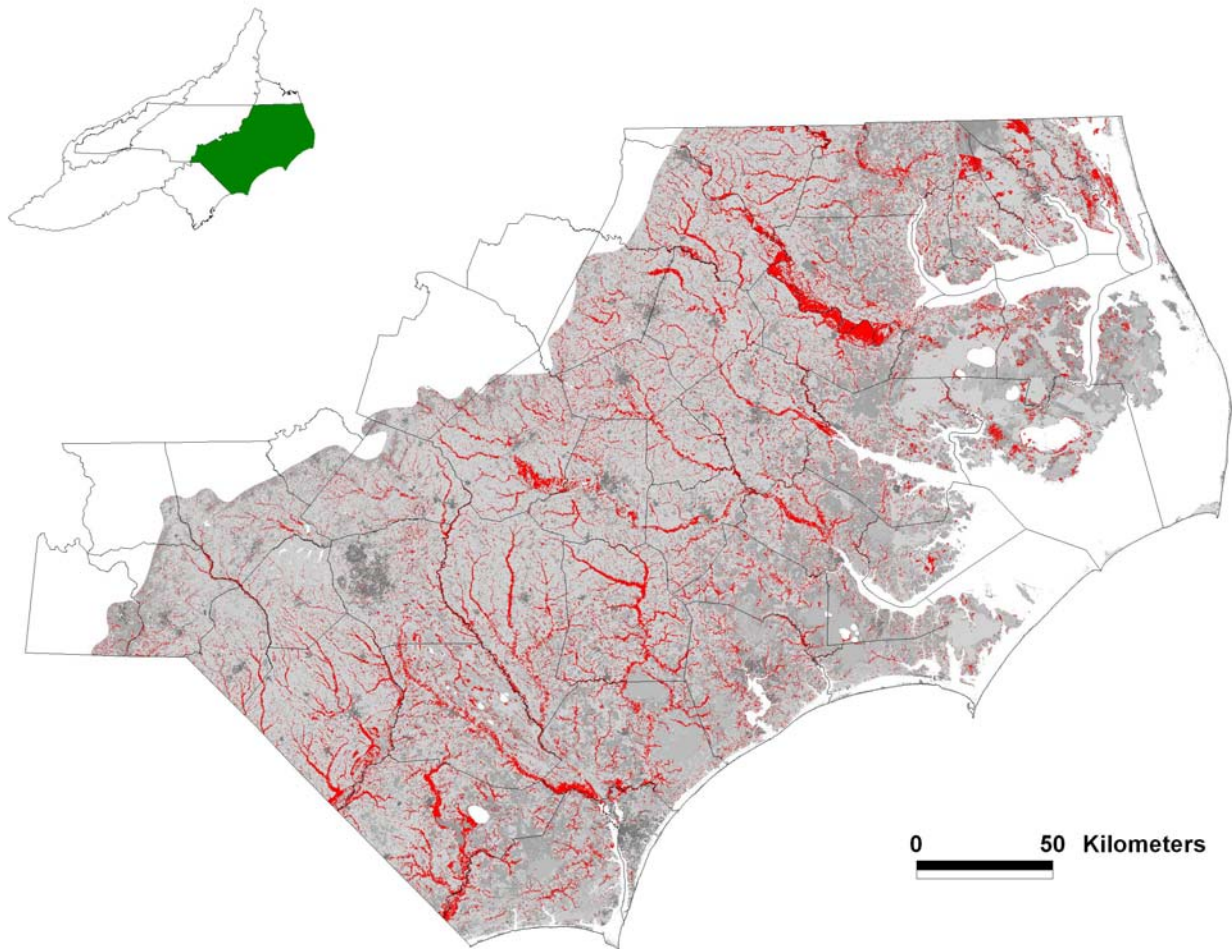
Location And Condition Of Habitat

Floodplain forests of various conditions and sizes can be found throughout the Coastal Plain region. The condition of coastal plain floodplain forests of all types have been greatly reduced in recent years throughout North Carolina and the entire southeast (Weller and Stegman 1977, Schafale and Weakley 1990) by a variety of anthropogenic factors. Map 1 depicts locations of floodplain forest habitats in the Mid-Atlantic Coastal Plain ecoregion.

Factors that impact these systems include flooding regime patterns that have been changed by dams and other development, habitat fragmentation, changes in water chemistry and organic matter loads, increased nitrogen from agricultural and development-related runoff, exotic species and high-grading of stands and logging that reduces wide buffers. All of these factors individually or interactively produce abrupt or gradual changes in floodplain plant and wildlife communities. In particular, the sediment load in many brownwater rivers is now a major problem in the Coastal Plain, and even many blackwater systems now have high sediment loads (Schafale and Weakley 1990).

Floodplain forest along the Roanoke River may be the finest example remaining in the state, yet even there, flow regime has been greatly impacted by dams. Other large floodplain forests are associated with the Cape Fear River, Neuse River, Tar/Pamlico River, and Chowan River. Non-point source and point source pollution from a variety of human introduced activities has greatly increased in many drainages due to growing human population. Untreated stormwater runoff from large cities and towns is a major problem that impacts both aquatic life and terrestrial wildlife associated with floodplain forests.

Map 1. Floodplain forest habitats in the Mid-Atlantic Coastal Plain ecoregion of North Carolina (in red).



Data source: NC GAP, 1992

Problems Affecting Species And Habitats

Alteration of hydrology due to dam creation and the draining of wetlands are one of the primary problems affecting this habitat type. Long-duration flooding has had impacts on all ground nesting bird species. Loss of old growth characteristics (canopy gaps, vine tangles, hollow trees, dead and downed woody material) and fragmentation of stands is a major concern. A lack of standing dead or older trees has impacted the availability of quality bat and chimney swift roosting and breeding sites and nesting productivity for species such as wood duck and hooded merganser. Lack of downed woody debris has impacted a variety of amphibians and reptiles.

Fragmentation of stands has contributed to the loss of intact large riparian corridors and the width of many riparian corridors has been greatly reduced. Breeding area-sensitive bottomland-hardwood birds have likely been impacted by the loss of intact woodland systems. Large patches of floodplain habitat are lacking in much of the Coastal Plain. Swallow-tailed kites

are one such species that is area sensitive and although are not presently known to breed within the state, do breed just across the South Carolina border. High-grading of stands has changed plant species diversity and stand vegetative structure. Forestry activities (e.g., logging) have reduced colonial waterbird and eagle nesting areas. Increases in amounts of non-native plants (e.g., Privet, Japanese grass, Japanese honeysuckle) and the overall loss of large canebreaks are partly due to the lack of infrequent fire and also certain logging practices. Understory vegetative diversity has declined in many areas due to modified flooding regimes and increases in invasive non-native plant species. Sewerlines have been constructed along many floodplain corridors, especially in the upper Coastal Plain.

Drainage of wetlands has exacerbated the problems in and adjacent to floodplain forest habitats. This habitat loss impacts all floodplain species, including furbearers, breeding amphibians, overwintering birds, and migrant species that use these areas as stopover sites. Water quality is also an issue in certain major river drainages that negatively affects many invertebrates, fish, amphibians and reptiles.

Species And Habitat Conservation Actions and Priorities For Implementation

Land acquisition and easements should be pursued through cooperation with land trusts with an effort to increase the width of riparian buffers and create larger patches of connected habitat. Priority should be given to brownwater bottomlands, as these are the most species-rich and are more susceptible to clearcutting and other timber harvest than are cypress-gum swamps (i.e., wetter sites). Wherever possible, maintenance or restoration of floodplain forest connectivity should be pursued; floodplain forest are important distribution and dispersal corridors for many species (Bailey *et al.* 2004).

The South Atlantic Coastal Plain Partners In Flight Bird Conservation Plan calls for eight patches of forested wetlands of at least 10,000 acres in size throughout the South Atlantic Coastal Plain (Hunter *et al.* 2000). Identified funding sources for fee simple or easement purchases are the Clean Water Management Trust Fund, the Natural Heritage Trust Fund, the Coastal Wetlands Grant program and the North American Wetland Conservation Act program. An attempt should be made to protect waterbird nesting colonies.

Efforts need to be made to retain old growth floodplain forest (e.g., for chimney swifts, bats, and herpetofauna). Partnerships to begin cane restoration projects and research should be initiated with the Natural Resources Conservation Service. Floodplain buffers of 300-600 feet should be realized in as many areas as possible. This would benefit floodplain forest species such as northern parula, yellow-throated warbler, prothonotary warbler, wood thrush, Swainson's warbler, worm-eating warbler, and acadian flycatcher, as well as amphibians, canebrake rattlesnakes and forest bats.

The Forest Landbird Legacy Program (a cooperative effort between the Commission, the US Fish and Wildlife Service, and the Natural Resources Conservation Service) should be further expanded to influence habitat for birds and other wildlife in mature floodplain forest through canopy gap management and other options. The cooperative efforts with colonial waterbird (wading bird) working groups should continue and future management recommendations from the North American Waterbird Management Plan should be followed (Kushlan *et al.* 2002).

Priority Research, Survey, And Monitoring

Surveys are needed to document the distribution, relative abundance and status of many wildlife species associated with floodplain forest habitats. Priorities for conducting surveys need to focus on species believed to be declining, at risk or mainly dependent on floodplain forest communities. Secondary priority for surveys should be for species for which current distribution information is already available or for species that are considered common.

Monitoring systems need to be expanded and/or targeted to be able to assess current population status and trend information for all wildlife species associated with floodplain forest habitats. Many North Carolina floodplain forest bird species require specialized monitoring attention, since neither BBS nor standard point counts does not adequately sample irregularly distributed or clumped species like cerulean and Swainson's warbler. Long-term monitoring for amphibians and reptiles needs to be developed or enhanced (Taylor and Jones 2002) and there is a decided lack of long-term monitoring information on most bat species (Ellis *et al.* 2002).

Research studies targeting birds need to be long-term and large-scale, replicated studies that have controlled experimental approaches and focus on population demographics and the response of species to habitat manipulations where appropriate as outlined by the National Partners in Flight Research working group (Donovan *et al.* 2002). Similar research priorities are needed for other floodplain forest taxa including bats, small mammals, amphibians and reptiles.

- **Surveys**

- Design specific surveys to determine status and distribution of birds not adequately picked up by the Breeding Bird Survey in floodplain forests (e.g., cerulean warbler, Swainson's warbler, Kentucky warbler, worm-eating warbler, hooded warbler, prothonotary warbler).
- Determine the status and distribution of Wayne's black-throated green warbler.
- Determine the status and distribution of swallow-tailed kite, Mississippi kite, yellow-crowned night-heron and anhinga (as well as other colonial nesting waterbirds).
- Determine the breeding and roosting status and distribution of chimney swift in natural conditions along major floodplains with appropriate habitat conditions (e.g. older, hollow trees).
- Determine the status and distribution of priority bat species (e.g., Rafinesque's big-eared bat, northern yellow bat, Seminole bat and southeastern bat).
- Conduct small mammal surveys, especially for the eastern woodrat with a focus on circumneutral soils (other small mammal survey needs include the cotton mouse and southern pygmy shrew).
- Determine the status and distribution of the numerous salamanders associated with floodplain forests (Taylor and Jones 2002).
- Determine the status and distribution of canebrake rattlesnakes, as well as other snakes using floodplain forest habitats (Taylor and Jones 2002).
- Document bald eagle nesting sites.

- **Monitoring -**

- Continue long-term monitoring of active bald eagle territories, successful breeding pairs, and fledged eagles.
- Conduct long-term monitoring for floodplain forest birds (breeding, migration, and winter periods) in forest patches of varying size (Robbins *et al.* 1989 and Doherty, Jr. and Grubb, Jr. 2000).
- Establish MAPS and migration banding stations, as well as specialized long-term monitoring for hard to sample species such as cerulean and Swainson's warbler (Graves 2001).
- Establish long-term monitoring for all bat species.
- Establish long-term monitoring for herpetofauna using floodplain forest habitat (especially breeding salamanders and canebrake rattlesnakes).

- **Research**

Genetics

- Research the genetic makeup of the coastal population of the black-throated green warbler.
- Research the genetic relationships among floodplain salamanders.

Management practices

- Examine the response of bird, amphibian, small mammal and plant communities to canopy gap management (Kilgo *et al.* 1999, Grialou *et al.* 2000, Twedt *et al.* 2001 and Moorman *et al.* 2002).
- Examine the impacts of long-term flooding regimes on ground-nesting birds (e.g., Swainson's warbler) (Swift *et al.* 1984); similar studies are also needed for salamanders.
- Determine the conservation and restoration efforts needed for canebrake rattlesnakes in floodplain forests (Brantley and Platt 2001).

Predator effects

- Conduct bird productivity research (especially neotropical migrants) with a focus on nest searching studies to determine the predator community and bird nesting success in patches of different size and with various landscape context (Rodewald and Yahner 2001).

Population demographics

- Obtain information on the demographics and habitat-use of floodplain neotropical migrant landbirds during breeding and migration periods (Donovan *et al.* 2002).
- Examine demographics and habitat-use of bats in floodplain forests; there is also a need to identify, monitor, and maintain (or recruit) key bat habitats and microhabitats in floodplain forests (Ellis *et al.* 2002).
- Examine the demographics and habitat-use of small mammals in floodplain forests (Yates *et al.* 1997).

Habitat use

- Conduct studies (similar to the long-term studies ongoing in South Carolina) to document habitat-use and nesting success of Swainson's warbler in managed and unmanaged systems (Graves 2002 and Somershoe *et al.* 2003).
- Study the effects of riverine buffer width characteristics on bird species diversity, richness, survival, nest success and productivity (Perkins *et al.* 2003) (similar studies also needed for small mammals, bats, amphibians and reptiles to determine long-term productivity in buffers of various widths).
- Examine resource abundance (e.g., insects and fruits) in canopy gaps and use by breeding and migrant birds (Blake and Hoppes 1986).
- Study the territory and nest-site selection of cerulean warblers along the Roanoke River (Jones and Robertson 2001).
- Examine the demographics, habitat-use patterns, and impacts of feral hogs on ground nesting birds, salamanders and small mammals (Warren and Ford 1997).
- Examine the effects of habitat patch size on small mammal populations (Yates *et al.* 1997).
- Determine the habitat-use patterns of salamanders and reptiles in floodplain forests.
- Document habitat-use patterns of canebrake rattlesnakes in floodplain forests (using telemetry).
- Study the impacts of beaver and beaver ponds on species composition (both flora and fauna) to determine negative or positive impacts of beaver or beaver control measures.
- Study nutria impacts on both floral and faunal communities and individual species.

Supporting References

Bailey, M. A., J. N. Holmes, and K. A. Buhlmann. 2004. Habitat management guidelines for amphibians and reptiles of the southeastern United States (DRAFT). Partners in Amphibian and Reptile Conservation.

Blake, J.G. and W.G. Hoppes. 1986. Influence of resource abundance on use of tree-fall gaps by birds in an isolated woodlot. *The Auk* 103: 328-340.

Brantley, C.G. and S.G. Platt. 2001. Canebrake conservation in the southeastern United States. *Wildlife Society Bulletin* 29(4): 1175-1181.

Doherty, Jr. P.F. and T.C. Grubb, Jr. 2000. Habitat and landscape correlates of presence, density and species richness of birds wintering in forest fragments in Ohio. *Wilson Bulletin* 112(3): 388-394.

Donovan, T.M., C.J. Beardmore, D.N. Bonter, J.D. Brawn, R.J. Cooper, J.A. Fitzgerald, R. Ford, S.A. Gauthreaux, T. L. George, W.C. Hunter, T.E. Martin, J. Price, K.V. Rosenberg, P.D. Vickery

- and T.B. Wigley. 2002. Priority research needs for the conservation of neotropical migrant landbirds. *J. Field Ornithol.* 73(4): 329-339.
- Ellis, A.M., L.L. Patton and S.B. Castleberry. 2002. Bat activity in upland and riparian habitats in the Georgia Piedmont. *Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies* 56: 210-218.
- Graves, G.R. 2001. Factors governing the distribution of Swainson's warblers along a hydrological gradient in Great Dismal Swamp. *The Auk* 118(3): 650-664.
- Graves, G.R. 2002. Habitat characteristics in the core breeding range of the Swainson's warbler. *Wilson Bulletin* 114(2): 210-220.
- Grialou, J.A., S.D. West and R.Neal Wilkins. 2000. The effects of forest clearcut harvesting and thinning on terrestrial salamanders. *Journal of Wildlife Management* 64(1):105-113.
- Hunter, W. C., L. Peoples, and J. Collazo. 2001. Partners in Flight bird conservation plan for the South Atlantic Coastal Plain. American Bird Conservancy.
- Johns, M.E. 2004. North Carolina Bird Species Assessment. N.C. Partners in Flight.
- Jones, J. and R.J. Robertson. 2001. Territory and nest-site selection of cerulean warblers in eastern Ontario. *The Auk* 118(3): 727-735.
- Kilgo, J.C., K.V. Miller and W.P. Smith. 1999. Effects of group-selection timber harvest in bottomland hardwoods on fall migrant birds. *Journal of Field Ornithology* 70(3): 404-413.
- Kushlan, J. A., M. J. Steinkamp, K. C. Parsons, J. Capp, M. A. Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. 2002. Waterbird Conservation for the Americas: the North American waterbird conservation plan, Version 1. Waterbird Conservation for the Americas, Washington, DC.
- Moorman, C.E., D.C. Gynn, Jr. and J.C. Kilgo. 2002. Hooded warbler nesting success adjacent to group-selection and clearcut edges in a southeastern bottomland forest. *The Condor* 104: 366-377.
- Pashley, D.N., C.J. Beardmore, J.A. Fitzgerald, R.P. Ford, W.C. Hunter, M.S. Morrison, K.V. Rosenberg. 2000. Partners in Flight: Conservation of the Land Birds of the United States. American Bird Conservancy, The Plains, VA.
- Perkins, M.W., R.J. Johnson and E.E. Blankenship. 2003. Response of riparian avifauna to percentage and pattern of woody cover in an agricultural landscape. *Wildlife Society Bulletin* 31(3): 642-660.
- Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Inigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panajabi,

- D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners in Flight North American landbird conservation plan. Cornell Lab of Ornithology. Ithaca, NY.
- Robbins, C.S., D.K. Dawson and B.A. Dowell. 1989. Habitat area requirements of breeding forest birds of the Middle Atlantic states. *Wildlife Monographs*. 103: 1-34.
- Rodewald, A.M. and R.H. Yahner. 2001. Avian nesting success in forested landscapes: influence of landscape composition, stand and nest-patch microhabitat, and biotic interactions. *The Auk* 118(4): 1018-1028.
- Rosenberg, K.V., R.W. Rohrbaugh, Jr., S.E. Barker. J.D. Lowe, R.S. Hames and A.A. Dhondt. 1999. A land manager's guide to improving habitat for scarlet tanagers and other forest-interior birds. The Cornell Lab of Ornithology.
- Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. N.C. Department of Environment and Natural Resources, Natural Heritage Program, Raleigh, NC.
- Somershoe, S.G., S.P. Hudman and C.R. Chandler. 2003. Habitat use by Swainson's warblers in a managed bottomland forest. *Wilson Bulletin* 115(2): 148-154.
- Swift, B.L., J.S. Larson and R.M. DeGraaf. 1984. Relationship of breeding bird density and diversity to habitat variables in forested wetlands. *Wilson Bulletin* 96(1): 48-59.
- Taylor, J.D. and J.C. Jones. 2002. Quantifying amphibian richness in Southeastern forests. *Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies* 56: 301-311.
- Twedt, D.J., R.R. Wilson, J.L. Henne-Kerr and R.B. Hamilton. 2001. Nest Survival of forest birds in the Mississippi alluvial valley. *Journal of Wildlife Management* 65(3): 450-460.
- Warren, R.J. and C.F. Ford. 1997. Diets, nutrition and reproduction of feral hogs on Cumberland Island, Georgia. *Proc. Annu. Conf. Southeast. Fish and Wildl. Agencies* 51:285-296.
- Weller, M.W. and J.L. Stegman. 1977. Evaluating and maintaining habitats for fish and wildlife. *Trans. Of the 42nd North American Wildlife and Natural Resources Conf.* Wildlife Management Institute, Washington, D.C. pp.31-41.
- Yates, M.D., S.C. Loeb and D.C. Guynn, Jr. 1997. The effect of habitat patch size on small mammal populations. *Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies* 51:501-510.