Floodplain Forest

Piedmont Ecoregion

Piedmont floodplain forests generally do not contain significant recognizable elevation differences easily seen in the larger coastal floodplain systems. In these smaller floodplains, the relief and size of the fluvial landforms (levees, sloughs and ridges), which differentiate the communities in large floodplains, become smaller and harder to find (Schafale and Weakley 1990). In larger and more expansive examples of these floodplains, the forest canopy contains a good mixture of bottomland and mesophytic (moderately moisture tolerant) plant species, such as green ash, red maple, swamp chestnut oak, willow oak, and American elm. In areas where floodplain landforms are apparent, levees may contain sycamore, river birch and box elder. Floodplain areas that have been farmed or clearcut recently are usually dominated by tulip poplar or sweetgum.

Piedmont floodplain communities include Piedmont Levee Forest, Piedmont Swamp Forest, Piedmont Bottomland Forest, Floodplain Pool, Piedmont Semipermanent Impoundment and Piedmont Alluvial Forest (Schafale and Weakley 1990). Piedmont Alluvial Forest is quite common as a habitat type although the vegetative buffers surrounding them can be quite small or fragmented. Some of the best remaining examples of Piedmont Bottomland Forest and associated large floodplain communities are at New Hope Creek Bottomland in Durham County, Pee Dee National Wildlife Refuge in Anson and Richmond Counties, and along the Dan River. The widest floodplains are located within Triassic Basins, which contain more easily erodable sedimentary rock than are found elsewhere (metamorphic rock).

Piedmont Alluvial Forests are distinguished from larger floodplain communities by the absence or poor development of the depositional fluvial landforms, which determine vegetation (Schafale and Weakley 1990). Levees, sloughs and ridges may be visible in alluvial forest communities but are usually small. Variation in these sites is likely related to frequency and recentness of large-scale flood events.

Historically, many floodplains were maintained in switch cane (*Arundinaria gigantea*) and herbaceous plants through fire and other periodic disturbance. Small remnants of “canebrake” communities still exist throughout the Piedmont, but management strategies to maintain this feature are almost non-existent. Migratory landbirds that use switch cane areas for breeding include hooded warbler, Kentucky warbler and Swainson’s warbler.

Floodplain pools that occur in small depressions and are flooded for a portion of the year generally have few or no trees and are especially important sites for breeding amphibians such as spotted salamander, marbled salamander, four-toed salamander and many frogs. Piedmont floodplains are also important as movement corridors for mammals, reptiles, and amphibians. Birds use riparian corridors at all times of the year and these areas are especially important to neotropical migrants during the migration periods. Indeed, floodplain forests generally have the highest nesting bird concentrations in the state and they are arguably the most important habitats for birds. In general, our knowledge about how wildlife use altered or fragmented habitat is lacking especially for animals other than birds or bats (Ellis *et al*. 2002) and we need to develop more accurate and usable protocols for sampling many species using floodplains

such as amphibians to better understand status, distribution and life histories (Taylor and Jones 2002). Table 1 provides a list of priority species associated with this habitat for which there are conservation concerns.

Table 1. Priority species associated with piedmont floodplain forest.

Group	Scientific name	Common name	State status* Federal status)
Birds	*Caprimulgus vociferus*	Whip-poor-will	
	Coccyzus americanus	Yellow-billed Cuckoo	
	Colaptes auratus	Northern Flicker	
	Contopus virens	Eastern Wood-pewee	
	Haliaeetus leucocephalus	Bald Eagle	T (T)
	Helmitheros vermivorous	Worm-eating Warbler	
	Hylocichla mustelina	Wood Thrush	
	Limnothlypis swainsonii	Swainson's Warbler	
	Melanerpes erythrocephalus	Red-headed Woodpecker	
	Nyctanassa violacea	Yellow-crowned Night-heron	
	Oporornis formosus	Kentucky Warbler	
	Picoides villosus	Hairy Woodpecker	
	Scolopax minor	American Woodcock	
	Wilsonia citrina	Hooded Warbler	
Mammals	*Corynorhinus rafinesquii*	Rafinesque's Big-eared Bat	T
	Lasiurus seminolus	Seminole Bat	
	Myotis austroriparius	Southeastern Bat	SC
Amphibians	*Ambystoma maculatum*	Spotted Salamander	
	Ambystoma opacum	Marbled Salamander	
	Ambystoma talpoideum	Mole Salamander	SC
	Eurycea guttolineata	Three-lined Salamander	
	Hemidactylium scutatum	Four-toed Salamander	SC
	Hyla versicolor	Northern Gray Treefrog	SR
	Plethodon glutinosus sensustricto	Northern Slimy Salamander	
Reptiles	*Clemmys guttata*	Spotted Turtle	
	Clemmys muhlenbergii	Bog Turtle	T (T)
	Crotalus horridus	Timber Rattlesnake	SC
	Elaphe guttata	Corn Snake	
	Eumeces laticeps	Broad-headed Skink	
	Heterodon platirhinos	Eastern Hog-nosed Snake	
	Lampropeltis getula getula	Eastern Kingsnake	

Table 1. Priority species associated with piedmont floodplain forest.

Group	Scientific name	Common name	State status* Federal status)
	Terrapene carolina	Eastern Box Turtle	
	Thamnophis sauritus sauritus	Common Ribbonsnake	

*Abbreviations:
T Threatened
SC Special Concern
SR Significantly Rare

Location And Condition Of Habitat

Floodplain forests of some type are found beside most rivers and streams in the Piedmont. They are of varying widths, depending upon the topography of land adjacent to the river, and the transition between floodplain and upland forest is often gradual. In 2002, 150,900 acres in the Piedmont were classified as oak-gum-cypress and 97,000 acres as elm-ash-cottonwood for a total of 247,900 acres of bottomland-related trees, or a little over 2% of the land area in the Piedmont (Brown and Sheffield 2003). Map 1 depicts locations of floodplain forest communities in the Piedmont ecoregion.

Human-influenced alterations have affected much of the Piedmont's riverine and floodplain habitats. Logging, clearing land for agriculture, development, recreational use, and reservoir construction all cause direct loss and alteration of floodplain forests. In the past half century, an estimated 52% of bottomland forests in the south have been cleared for agriculture or development (Smith *et al*. 2001). Land clearing activities conducted adjacent to, and up and down-stream of floodplain forests can cause indirect impacts to the floodplains, particularly related to hydrology. Areas adjacent to floodplains are often prime targets for general development and subdivisions, and buffer size is often inadequate to provide any protection from a variety of anthropomorphic disturbances over time. For instance, flooding events may occur with greater frequency in some areas due to increased upstream impervious surfaces and clearing of vegetation near buffers.

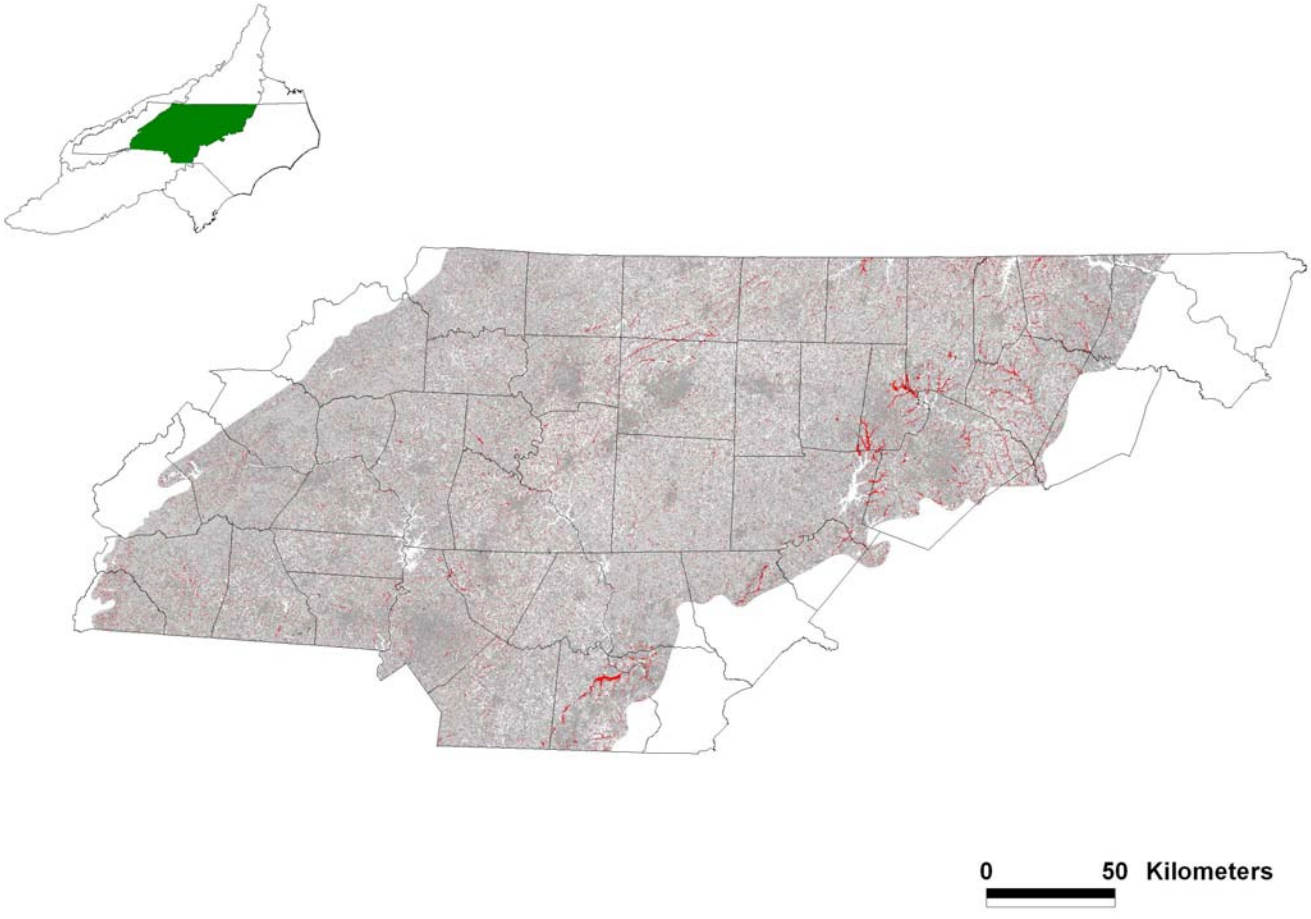
Managed river flows from dams have altered the natural flow regime, and in particular have impacted the timing and intensity of overbank flow into the floodplain, altering both water and sediment deposition. The input of nutrients from flood events makes levee sites along streams and rivers very fertile, and overbank flows help to recharge vernal pools in the wetland. Changes in flow regimes may eventually lead to changes in the floodplain plant and animal communities (Schafale and Weakley 1990).

Sediment pollution is a major concern in most stream and river systems in the Piedmont. The condition of some Piedmont floodplain forests is greatly degraded by these impacts. The Pee Dee and Dan River basins contain some of the larger tracts of intact floodplain forest left in the Piedmont and offer some of the best opportunities for large-scale habitat conservation. Beaver activity and the creation of beaver ponds in floodplain forest can have substantial impacts on trapping sediment and associated pollutants.

Exotic plant species such as Japanese honeysuckle, Japanese grass and Chinese privet are frequent invaders in small floodplain systems, especially if these areas have been logged in the past. The reduction in overall plant diversity is often extensive due to these invasive non-native plants and may cause problems for native fauna, though the extent of wildlife impacts is largely unknown.

Floodplain sites are often prime candidates for farmlands, and few bottomlands of any large size remain. Intact Bottomland Forests, especially without exotic species invasion, are among the rarest of natural communities in North Carolina (Schafale and Weakley 1990). Floodplain Pools are widespread in the Piedmont but are generally small in size. Pools that dry out less frequently (or seldom dry out) can develop permanent aquatic communities (with fish) that are often unsuitable for breeding amphibians. Sediment pollution is now a major problem for many floodplain pools in the Piedmont.

Map 1. Floodplain forest habitat in the Piedmont ecoregion of North Carolina (in red).



Data source: NC GAP, 1992

Problems Affecting Species And Habitats

Problems affecting species and habitats include fragmentation and direct habitat loss, altered hydrology, and lack of old growth dynamics. A brief discussion of these issues, as well as others that affect floodplain forest communities, follows.

- *Direct habitat loss* - Riparian forests have become scarce in the Piedmont because many of these areas are now used for food and fiber production. Additionally, many riparian areas were lost to create reservoirs, and some have been cleared for development. Many are damaged by construction of sewerlines, which are built almost exclusively in floodplains.
- *Altered hydrology* - The most significant source of habitat alteration is altered hydrology. Altered hydrology changes plant communities and also affects the availability of ephemeral wetlands for breeding amphibians. Building ditches and canals in floodplains dramatically alters hydrology and is often done to prepare a floodplain for agriculture, forestry, or development. Even in abandoned sites, ditches will continue to alter the hydrology for many decades. Bank stabilization efforts can alter riverine dynamics that create oxbow lakes and some ephemeral wetland habitats important to amphibians. Controlled flows downstream of dams and the construction of levees can reduce overbank flood events which are important for recharging ephemeral wetlands and spreading nutrients in the floodplain. However, excessive flooding can also be problematic. Increased severe flooding can be caused by reduction of vegetated floodplains and increases in impervious surfaces in the uplands. Dams can alter the timing and duration of flood events. Flooding for long periods of time during the breeding season can harm plant and animal reproduction and severe floods also threaten human safety and property.
- *Habitat fragmentation* - As floodplain forests are lost or altered, the remaining tracts of forest become smaller and more isolated. New highways and other corridors are often constructed across floodplains, fragmenting the floodplain forest. Floodplains are used as travel corridors by many species and fragmentation may alter dispersal and migration patterns. Reptiles and amphibians may be particularly vulnerable to reduced movement when the matrix surrounding the forest becomes unsuitable. The reduced size of remaining forest patches may impact area sensitive birds (Kilgo et al. 1998) and small mammals (Yates et al. 1997). Clearing of adjacent uplands can increase edge effects and limit the effective size of floodplain forest habitat.
- *Lack of old growth dynamic* - Old growth floodplain forests contain large diameter trees, snags, dead wood, and canopy gaps that support dense undergrowth. Some younger riparian forests and those that lack periodic habitat disturbance can have a reduced number of snags. Snags play a very important role in providing nesting, foraging, and roosting areas for many cavity nesting birds, bats, arboreal mammals, reptiles and amphibians. Lack of snags and den trees is often a limiting factor for several species of wildlife, especially secondary cavity users (McComb et al. 1986). Younger riparian forests can also lack dead wood on the ground, which is important for some songbirds (e.g., Kentucky warbler), many reptiles, amphibians, and some small mammals. Habitat disturbance can be important for creating canopy gaps which create small pockets of dense, low growth (valuable for nesting for Swainson's warbler, hooded warbler, Kentucky warbler and wood thrush), provide cover for American woodcock, and are

valuable foraging areas for many juvenile birds. Stream snagging (clearing woody debris within stream channels) after storms can reduce habitat structure, particularly for reptiles and amphibians among terrestrial creatures (*aquatic organisms are covered under the river basin sections in this Strategy*). Snagging can also alter river hydrology and morphology. "High grade" logging operations removes the larger trees that provide important habitat structure for wildlife, while the low-quality trees that are left can often hamper the regeneration of more wildlife-favorable trees.

- *Water quality* - Poor water quality due to nutrient inputs, reduced dissolved oxygen levels, sedimentation, and chemical contamination (among others) can have a strong impact on amphibians, turtles, and other animals associated with floodplain forests that forage or breed in aquatic areas, in addition to the direct impacts on fully aquatic species. Sediment pollution is a major problem in the Piedmont of North Carolina. (S*ee river basin sections for further discussion of water quality issues within specific basins*).
- *Exotic plants* - Japanese grass (*Microstegium vimineum*) can suppress the growth of other plants, alter habitat structure, and has little wildlife value. Other common invasive plants that impact floodplain community structure include Chinese Privet and Japanese honeysuckle, though these plants have some limited wildlife value. In general, the density of exotic, invasive plants in small to medium sized floodplain forests in the Piedmont is significant though the resulting impact on wildlife populations is largely unknown.
- *Loss of canebrake communities* - Historical data indicate that extensive stands of switch cane (*Arundinaria gigantea*) have been drastically reduced throughout the Piedmont. Cane communities are maintained through fire or other periodic disturbance. While fires would likely not burn very hot or well through many floodplains due to the moist soils, floodplains with extensive canebrakes historically burned periodically, which helped to maintain and expand these canebrakes. Canebrakes benefit Swainson's warbler, Kentucky warbler, hooded warbler, wood thrush, American woodcock, and timber rattlesnake, among others. Fire suppression and development adjacent to floodplains has contributed to a loss of large canebrakes, which have been replaced primarily by other woody vegetation.
- *Commercial collecting of turtles* - The extent of commercial collecting of bog turtle and spotted turtle for the pet trade, and its impact on local populations is unknown, but potentially a problem.

Species And Habitat Conservation Actions and Priorities For Implementation

Conservation of floodplains is complicated by the fact that many conservation actions also require protection of associated uplands and upstream riparian systems. However, floodplains are the highest priority habitat for conservation in the Piedmont because of their importance to birds (Cooper and Demarest 1999), bats, and herpetofauna. Intact floodplains are equally important for protecting aquatics habitats.

Habitat management and restoration actions

- Restoration projects are needed to create oxbow lakes, shallow wetlands, snags, and canopy gaps in appropriate locations. Smith et al. (2001) indicate that small openings

(<0.26ha) comprising <22% of the total area of old-growth bottomland forest may help enhance bird species diversity. Incentive programs for landowners (like the Forest Landbird Legacy Program) could encourage reforestation or structural improvement of floodplain forests.

- In managed rivers, restore stream flows that promote controlled overbank flows and hydrological connectivity between the river and the floodplain.
- Opportunities to restore cane break communities should be sought, through controlled burning or other management.
- Large trees should be maintained around reservoirs for potential eagle nests, and forest cover should be maintained in the tailrace below dams for eagle foraging.
- Population control of feral hogs may be necessary in some areas in the near future.
- Greenways maintained for public recreation should be created and managed to reduce the width of pedestrian paths so that the overhead tree canopy is not broken, and native plant communities are not degraded (Novotny 2003, Hull 2003).

Policy-based actions

- Land use planning and zoning laws are needed to limit development, land clearing, and hydrology alterations within floodplains (e.g., route highways and other corridors that cross floodplains as closely as possible to existing corridors to avoid fragmenting an extensive corridor of forest; try to avoid routing sewerlines through high quality floodplain).
- Promote stormwater management regulations and efforts to control point source pollution.

Protection Actions

- Land acquisition and/or conservation easements are key to maintaining or restoring connectivity between forest stands. Land protection efforts should be targeted to enhance the size and connectivity of existing protected areas.
- Establishment and conservation of large riparian buffers and land in the adjacent uplands could benefit many neotropical migrants, as well as other taxa. Riparian buffers should be at least 100m wide to benefit breeding area-sensitive forest birds (Keller et al. 1993, Hodges and Krementz 1996). For private lands, Cooper and Demarest (1999) recommend buffers of 30m per side on order 1-2 streams, 100m per side on order $\geq$3 streams, and 500m per side on all rivers.
- Minimize land clearing and disturbance around eagle nests and heron rookeries.

Priority Research, Survey, And Monitoring

Priorities for conducting surveys need to focus on species believed to be declining, at risk or mainly dependent on floodplain communities. Bat surveys and amphibian surveys are considered high priorities for this habitat. Secondary priority for surveys should be for species for which current distribution information is already available, or for species that are generalists in terms of habitat usage. Few of the existing monitoring efforts adequately cover floodplains (e.g. the Breeding Bird Survey does not adequately sample floodplains).

- **Surveys**
  - Determine the breeding distribution and status of floodplain associated bird species (e.g., Swainson's warbler and Louisiana waterthrush).
  - Conduct nocturnal surveys to determine the population status and distribution of Chuck-wills-widow and Whip-poor-will.
  - Inventory heron and egret rookeries.
  - Determine the distribution and population status of bats in Piedmont floodplain forests. Few systemic surveys have been conducted throughout the Piedmont region; most of these surveys have been conducted or coordinated by the NC Museum of Natural Sciences. In addition to Rafinesque's big-eared bat, Seminole bat, and southeastern bat, it is possible that other priority bats may be found in the Piedmont. Northern yellow bats may occur in the eastern Piedmont, and northern long-eared bats may occur in the western Piedmont. Hoary bats have been detected in acoustical surveys along the Pee Dee river.
  - Determine the distribution and population status of terrestrial small mammals, like golden mouse and shrews, in Piedmont floodplain forests.
  - Determine the status and distribution of mole salamander, four-toed salamander, gray treefrog, and timber rattlesnake (and conduct surveys to determine the distribution and status of many common reptiles and amphibians).
  - Identify both breeding sites and travel corridors for bog turtle in the northwestern Piedmont.
- **Monitoring**
  - Establish selective monitoring systems for bird species that are difficult to detect by conventional survey protocols (e.g., Swainson's warbler, Kentucky warbler and other floodplain bird species). (A monitoring program for birds in floodplain forests on Caswell Game Land, Caswell County, was initiated by the Commission in 2004).
  - Establish more MAPS and migration-period bird banding stations.
  - Conduct long-term monitoring of heron and egret rookeries.
  - Continue monitoring of bald eagle nesting territories.
  - Initiate long-term bat population monitoring.
  - Initiate long-term reptile and amphibian monitoring in floodplain pools in particular.
- **Research**

  Predator effects
  - Conduct studies about nesting success, productivity and survival of floodplain birds in buffers of different widths; this could provide some insight into population declines and help to guide management recommendations for buffer width.

  Habitat use

- Identify those reptile and amphibian species that are most vulnerable to direct mortality and isolation from roads. Strategies to mitigate the impacts of roads should be devised and tested.
- Determine the extent of the use of floodplains as travel corridors for bog turtle in the western Piedmont; determine any management actions that are needed to facilitate use by bog turtles.
- Determine the extent and timing of use of riparian corridors by birds during the migration period.

Management practices

- Evaluate the distribution, impacts on native wildlife, and feasibility of control of feral hogs, which are very common at inner coastal sites along major rivers adjacent to the Piedmont (e.g., Howell Woods in Johnston County), and are found sporadically throughout the Piedmont.
- Examine ways to effectively restore canebrake communities, and determine the response of birds, mammals, amphibians and reptiles to the reestablishment of switch cane stands.
- Study the effects of various river flow regimes on ephemeral pool habitat in floodplains, to help develop management recommendations for dam releases. This research will be particularly critical to help guide management recommendations in the Federal Energy Regulatory Commission relicensing process for dams along the Yadkin, Pee Dee, and Catawba rivers.

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.

Brown, M.J. and R.M. Sheffield. 2003. Forest statistics for the Piedmont of North Carolina, 2002. U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, NC. Resource Bulletin SRS-86.

Cooper, R. J., and D. Demarest. 1999. Partners in Flight bird conservation plan for the Southern Piedmont. Partners in Flight.

Ellis, A.M., L.L. Patton and S.B. Castleberry. 2002. Bat activity in upland and riparian habitats in the Georgia Piedmont. Proc. Conf. Southeast. Assoc. Fish and Wildl. Agencies 56:210-218.

Hodges, M.F. and D.G. Krementz. 1996. Neotropical migratory breeding bird communities in riparian forests of different widths along the Altamaha River, Georgia. Wilson Bulletin 108(3): 496-506.

Hull, Jamie R. 2003. Can urban greenways provide high quality avian habitat? Masters Thesis, N.C. State University, Raleigh, NC.

Johns, M.E. 2004. North Carolina Bird Species Assessment. N.C. Partners in Flight.

Keller, Cherry M. E., Chandler S. Robbins, and Jeff S. Hatfield. 1993. Avian communities in riparian forests of different widths in Maryland and Delaware. Wetlands 13(2):137-144.

Kilgo,J.C., R.A. Sargent, B.R. Chapman, and K.V. Miller. 1998. Effect of stand width and adjacent habitat on breedig bird communities in bottomland hardwoods. Journal of Wildlife Management 62(1): 72-83.

McComb, W.C., S.A. Bonney, R.M. Sheffield and N.D. Cost. 1986. Den tree characteristics and abundance in Florida and Sotu Carolina. Journal of Wildlife Management 50(4):584-591.

Novotny, Kristen E. 2003. Mammalian nest predator response to greenway width, habitat structure, and landscape context. Masters Thesis, N.C. State University, Raleigh, NC.

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.

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.

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.

Smith, W.P., H.E. Hunt, and W.K. Townley. 2001. A comparison of breeding bird communities and habitat features between old-growth and second-growth bottomland hardwood forest. U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, NC. Gen. Tech. Rep. SRS 42.

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.

Yates, M.D., S.C. Loeb and D.C. Guynn. 1997. The effect of habitat patch size on small mammal populations. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 51:501-510.