

## **THE UPPER TAR RIVER BASIN: SWIFT CREEK AND FISHING CREEK SUBBASINS**

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The Tar-Pamlico River Basin stretches 180 miles from its headwaters in the north central Piedmont portion of North Carolina to the Atlantic Ocean (N.C. Division of Environmental Management, 1994). The basin, encompassing 5440 square miles, is the fourth largest river basin in North Carolina and is one of only four of the 17 major river basins in North Carolina whose boundaries are located entirely within the state (N.C. Division of Environmental Management, *ibid.*). There are 2,355 miles of freshwater streams in the basin (N.C. Division of Environmental Management, *ibid.*), with the most biologically diverse occurring in the Swift Creek Subbasin and Fishing Creek Subbasin (N.C. Natural Heritage Program, 1997).

The Swift Creek Subbasin in particular has been identified as possibly the most significant lotic creek ecosystem remaining along the Atlantic Seaboard (Alderman, et al., 1993). Swift Creek is a major tributary of the Tar River, flowing southeast from Henderson in Vance County, then through Warren, Franklin, Nash, and Edgecombe counties to its confluence with the Tar River above Tarboro in Edgecombe County. Fishing Creek, its sister tributary to the northeast, flows from the northwestern edge of Warren County, through Halifax County to its confluence with the Tar River in the vicinity of Tarboro in Edgecombe County. Numerous tributaries supply the Fishing Creek and Swift Creek subbasin; Little Fishing Creek and Shocco Creek are species-rich tributaries of Fishing Creek, while Sandy Creek is the notable headwater of Swift Creek.

These two subbasins together support ten rare mussel species, three rare fish species, one rare amphibian species, and two rare bird species (N.C. Natural Heritage Program, *ibid.*). The Federally Endangered Tar spiny mussel (*Elliptio steinstansana*) occurs in both subbasins, while the dwarf wedgemussel (*Alasmidonta heterodon*), also Federally Endangered, occurs in the Fishing Creek subbasin. For conservation purposes, the Fishing Creek subbasin is the most important subbasin in North Carolina for the dwarf wedgemussel (Alderman, 1997). The Tar spiny mussel is endemic to North Carolina.

The other eight mussel species are found in both subbasins; of these species, six are listed as State Threatened: the triangle floater (*Alasmidonta undulata*), yellow lance (*Elliptio lanceolata*), Roanoke slabshell (*Elliptio roanokensis*), Atlantic pigtoe (*Fusconaia masoni*), yellow lampmussel (*Lampsilis cariosa*), and squawfoot (*Strophitus undulatus*). Two other rare mussel species, eastern lampmussel (*Lampsilis radiata*), a species of Special Concern, and notched rainbow (*Villosa constricta*) also occur within both subbasins. The two subbasins together support some of the most extensive and best populations of these species. Swift Creek has the best yellow lance and Atlantic pigtoe populations throughout their distribution (Alderman, 1997).

Freshwater mussels are filter-feeding organisms, filtering plankton from the water column. In head water lotic areas, they also remove large quantities of fine detritus from the water. Because of their method of feeding, they are extremely sensitive to alterations in the hydrology of stream channels or changes in water quality due to sedimentation or

introduction of toxic substances (Alderman, et al., 1993). They are also highly vulnerable to increased stream insolation due to removal of forest cover adjacent to streams, invasion of exotic species such as the zebra mussel (*Dreissena polymorpha*), and reductions in underlying habitat diversity (Hall, personal communication, 1992). Seventy-two percent of North America's assemblage of 300 freshwater mussels are extinct or on their way to extinction (Williams, 1992). Of the 60 freshwater mussel species occurring in North Carolina, slightly over half are listed as Endangered, Threatened, or species of Special Concern by the N.C. Wildlife Resources Commission.

Three rare fish and one rare amphibian also are known to occur within the Swift Creek and Fishing Creek Subbasins. A population of the least brook lamprey (*Lampetra aepyptera*), a species of Special Concern, occurs in the Fishing Creek Subbasin. The Neuse River waterdog (*Necturus lewisi*), an amphibian species of Special Concern, the Roanoke bass (*Ambloplites cavifrons*), and Carolina madtom (*Noturus furiosus*) occur in both subbasins. The Carolina madtom and Neuse River waterdog are endemic to North Carolina, known from only the Neuse and Tar river drainages.

The number of rare species alone does not provide the full picture of the species diversity present in the Swift Creek and Fishing Creek Subbasins. Although the Swift Creek Subbasin covers less than 300 square miles of the Piedmont and Coastal Plain of North Carolina, it provides habitat for more than 7% of the fish species found on the North American continent north of Mexico and provides habitat for nearly 29% of the fish species present in the Atlantic drainages in North Carolina (Alderman, 1997). Although such an analysis of fish species diversity in the Fishing Creek Subbasin has not been initiated, similar results are anticipated based on the water quality and diversity of aquatic habitat available.

Nearly 800 freshwater fish species occur in North America north of Mexico (Page and Burr, 1991). Of these, more than 225 species occur in North Carolina, and nearly 100 of these are found in the Tar-Pamlico drainage basin (Menhinick, 1991). Because of declining water quality and sedimentation, many aquatic species including fish are now isolated in small areas of streams, creeks, and rivers; their confined distribution makes them highly vulnerable to extirpation (Alderman, 1997.) Nearly a quarter of North Carolina's freshwater fish species are currently listed as Endangered, Threatened, or as species of Special Concern by the N.C. Wildlife Resources Commission.

Approximately 220 species of amphibians occur in North America north of Mexico (Collins, 1990). According to the North Carolina Natural Heritage Program, about 75 of these occur in North Carolina, and about 10% of these are, like the Neuse River waterdog which occurs in these subbasins, completely aquatic. Of the amphibians occurring in the state, seventeen are listed as Endangered, Threatened, or of Special Concern by the N.C. Wildlife Resources Commission. While many amphibians are not completely aquatic, they utilize riparian zones as breeding habitat and are highly vulnerable to soil disturbance and loss of soil humidity caused by removal of the tree canopy.

Birds are the most diverse class of vertebrates inhabiting North Carolina. Over 440 species have been recorded within the state or its offshore waters. In a breeding bird survey of the Swift Creek watershed, two rare bird species were identified (Alderman, et

al., *ibid.*). The loggerhead shrike (*Lanius ludovicianus*) and the black vulture (*Coragyps atratus*), both of which are bird species of Special Concern in North Carolina, are known to occur in the Swift Creek subbasin. The uncommon red-headed woodpecker (*Melanerpes erythrocephalus*) also has been observed here. A decline in bird populations is often indicative of deteriorating habitat quality; for instance, neotropical migrants sensitive to fragmentation of forest interior habitat have been in decline since the late 1940s (Wilcove, 1985; Whitcomb, R.F., et al., 1981). The breeding bird survey of Swift Creek revealed the presence of the following forest interior breeding bird species: scarlet tanager (*Piranga olivacea*), hooded warbler (*Wilsonia citrina*), Kentucky warbler (*Opornis formosus*), Louisiana waterthrush (*Seiurus motacilla*), ovenbird (*Seiurus aurocapillus*), prothonotary warbler (*Protonotaria citrea*), American redstart (*Setophaga ruticilla*), black-and-white warbler (*Mniotilta varia*), yellow-throated warbler (*Dendroica dominica*), red-eyed vireo (*Vireo olivaceus*), yellow-throated vireo (*Vireo flavifrons*), wood thrush (*Hylocichla mustelina*), blue-gray gnatcatcher (*Polioptila caerulea*), white-breasted nuthatch (*Sitta carolinensis*), Acadian flycatcher (*Empidonax vireescens*), pileated woodpecker (*Dryocopus pileatus*), ruby-throated hummingbird (*Archilochus colubris*), barred owl (*Strix varia*), red-shouldered hawk (*Buteo lineatus*), and wood duck (*Aix sponsa*).

All of these species benefit from maintaining undisturbed forest interior habitat. Some of these species not only require undisturbed forested habitat, but riparian areas within forests. The prothonotary warbler, Louisiana waterthrush, barred owl, wood duck, and several others must have the presence of water in their nesting habitat.

The vegetation-based natural communities of the floodplains and adjacent uplands have not been thoroughly investigated in most of these subbasins. They can be expected to match closely the descriptions of community types in Schafale and Weakley (1990). The larger creeks and rivers are almost certainly bordered by Coastal Plain Levee Forest (Brownwater Subtype), with Coastal Plain Bottomland Hardwoods and Cypress--Gum Swamp filling most of the floodplains. Smaller Coastal Plain tributaries would be expected to support Coastal Plain Small Stream Swamp communities. The upper headwaters in the Piedmont would be bordered by Piedmont/Low Mountain Alluvial Forests. On adjacent bluffs, Mesic Mixed Hardwood Forests would occur on lower slopes and north-facing slopes. Small amounts of Dry-Mesic Oak--Hickory Forest and possible Dry Oak--Hickory Forest may remain on drier bluffs and bluff tops. The longleaf pine forests and oak-hickory forests that prevailed on the flatter uplands are largely to completely gone from this region, and these areas are now occupied by fields, pine plantations, and successional pine-hardwood forests.

### **RIPARIAN BUFFER MANAGEMENT FOR WILDLIFE HABITAT**

The preservation of broad wooded riparian buffers adjacent to streams is essential to prevent stream insolation, capture sediment or toxic materials before they enter the stream channel, and supply adequate but not excessive large woody debris to the stream channel. Establishing a no-harvest zone directly adjacent to the channel provides the greatest degree of protection to the zone most likely to contribute excessive large woody debris and sediment, since these are most likely to travel over short distances. Keeping the canopy trees in place in the no-harvest zone prevents a greater-than-natural loss of

canopy trees through windthrow (Alderman, 1997), thereby reducing the chance that excessive woody debris will enter the channel. The no-harvest zone also promotes development and perpetuation of an extensive root mat, providing maximal stability of soils in the vicinity of the stream (Alderman, *ibid.*). Additionally, a no-harvest zone provides natural shading of the stream during the part of the day when the sun is relatively high in the sky, protecting the stream from insolation.

If the portion of the buffer which is selectively harvested is carefully managed, the riparian buffer can provide additional protection from sedimentation. Sediment export into stream channels can be minimized by leaving broader riparian buffers on each side of streams (Swift, 1986). These riparian buffers can be preserved in their natural state or selectively harvested. In this study, riparian buffers of approximately 200 feet in width captured almost all sediment runoff in a broad sampling of slope conditions.

The broader selectively harvested buffers can also help prevent insolation when the sun is not as high in the sky. It has been estimated that at least half of the selectively harvested portion should be retained to prevent stream insolation (Burns, 1992). The selectively harvested portion of the buffer also protects canopy trees within the no-harvest zone from windthrow (Alderman, 1997). If the area beyond the no-harvest zone was clearcut instead, large woody debris in the cleared area could be carried into stream channels in large "rafts", or interwoven mats, following storm events. A selectively harvested zone beyond the no-harvest zone prevents accumulation and transport of excessive woody debris (Alderman, *ibid.*).

Taking these factors into account, a selectively harvested buffer of 200 feet with a no-harvest zone 50 feet in width or greater seems likely to prevent sediment export into stream channels, reduce stream insolation, and provide adequate but not excessive large woody debris to the stream channel, thereby providing high quality habitat for aquatic species.

How should the selectively harvested portion of the buffer be managed to conserve high quality aquatic habitat features while simultaneously providing suitable habitat for wildlife using riparian corridors? While many wildlife species utilizing riparian corridors can tolerate and in some cases benefit from a mosaic of different habitat types, this mosaic is probably already being provided in the broader upland landscape. So, in deciding what selective harvest criteria to apply, we used the criteria which promote suitable habitat for sensitive species which prefer undisturbed forest interior. One of the best examples in the literature of a cluster of species sensitive to forest management is that of neotropical migrants. According to a study (Keller, et al., 1993) utilizing point-count surveys of neotropical migrants in 117 riparian forest corridors in Maryland and Delaware, corridor widths of 100 meters (50 meters, or 165 feet, each side) will provide habitat for over half of the neotropical migrant species surveyed. Where it is possible in management strategy to have larger buffers in certain locations along a stream, it would be beneficial as breeding habitat for a greater range of neotropical migrants and would be appreciated.

Criteria for for management of the selectively harvested portion of the riparian buffer were derived from "Habitat Management Guidelines for Forest Interior Breeding Birds of Coastal Maryland" (Bushman and Therres, 1988) and are as follows:

- a. maintain natural species composition of the buffer;
- b. use single tree selection to remove trees, retaining 70% canopy closure;
- c. conduct tree harvest during the non-breeding season when possible;
- d. avoid construction of new roads or right-of-way corridors within the buffer;
- e. keep existing road widths to a minimum (ideally, 25 feet wide or less) to reduce fragmentation;
- f. retain snags, especially those which do not protrude above the canopy and those which occur in clusters;
- g. avoid soil disturbance to the fullest extent possible; and
- h. avoid use of herbicides, pesticides, or fertilizers.

In addition to providing some habitat for neotropical migrants, the retention of 70% of the canopy will also help to prevent stream insolation, to supply adequate but not excessive large woody debris to the channel, and to protect habitat for aquatic macroinvertebrates, fish, and amphibians. Maintaining the natural composition of the riparian buffer will contribute to the food resources of numerous other wildlife species using riparian corridors, such as mink, wild turkey, and black bear.

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