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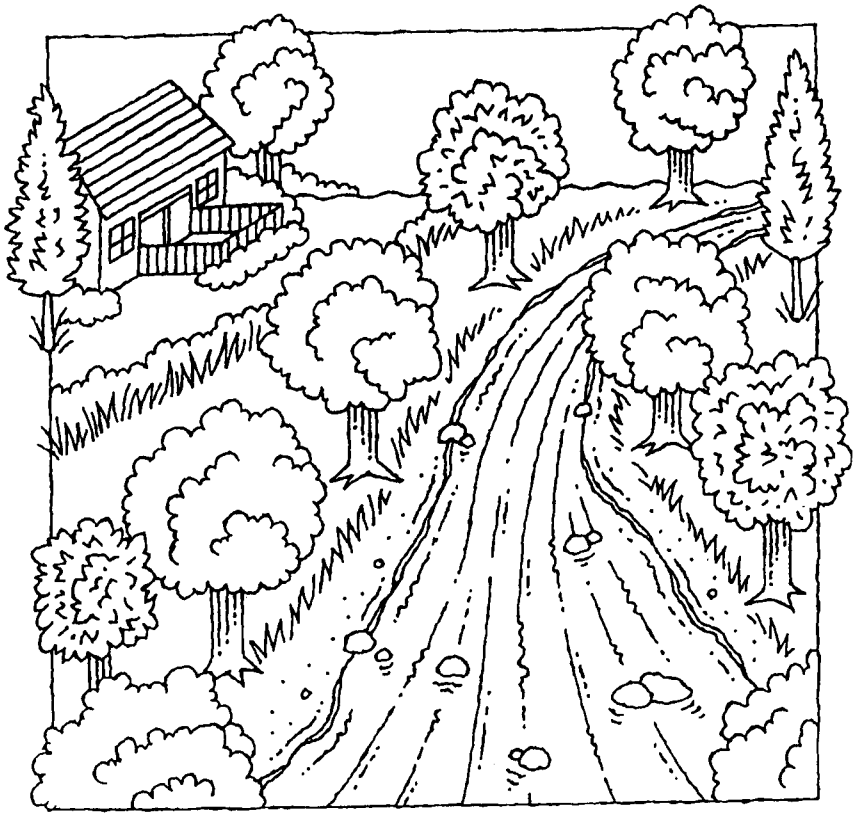
Maintaining and Restoring Urban Riparian Buffers

A guide for landowners and local governments in Wake County



INTRODUCTION
What this publication is about

This publication has been prepared to explain the benefits of riparian buffers and the possible threats to buffers from hurricane damage cleanup and renovation, and to provide guidance for local governments and private landowners in Wake County in responding to hurricane damage to buffers in urban areas of the county.

What is an urban riparian buffer?

An urban riparian buffer is an area of trees and vegetation along a river, year-round or wet-weather stream, pond, or lake in a city, town, suburb or urban fringe area. According to U.S. Geological Survey, there are about 1,215 stream miles in Wake County,* and a recent university study indicates that forested buffers at least 50 feet wide remain along about 87 percent of those miles.** Assuming that 50-foot buffers exist along both sides of 87 percent of the stream miles in Wake County, it seems likely that Wake County has some 12,800 acres of riparian stream buffers. While it is impossible to calculate how much of the county's riparian buffer could be called "urban," it is obvious that as cities, towns and suburbs spread, more and more miles of riparian buffer will become incorporated into residential, commercial or industrial development.

Who owns riparian buffers?

When streams in Wake County flow across land that is owned by the county or municipalities—such as in city or county parks—then buffers around them are considered public property. The county or municipalities decide what activities can occur in these buffers and are responsible for maintaining them. Several municipalities in Wake County require developers to set aside and donate land—often land along streams— for greenway systems. These greenway systems are also considered public property, and activities in them are controlled by local governments. However, unless a developer or an individual landowner has donated land along streams for a public greenway system, when streams flow across private lands, riparian buffers belong to the owners of the land.

At this point, there are few restrictions on what private landowners can do in riparian buffers on their land. Some landowners in Wake County may

* The source for this information is the 1:100,000 EPA river reach file 3 stream network clipped to Wake County. This analysis would not necessarily agree with an analysis done at a finer scale.

**This analysis was done using stream segments from the Tiger Files.

Water Oak	(*Quercus nigra)*
White Oak	(*Quercus alba)*
White Ash	(*Fraxinus americana)*

Shrubs and non-woody vegetation

Common Name	Latin Name
Crossvine	(*Bignonia capreolata)*
Bottlebrush grass	(*Elymus hystrix)*
Bluestem Goldenrod	(*Solidago ceasis)*
Broad Loose-flower Sedge	(*laytonia virginica)*
Common Spicebush	(*Lindera bezoin)*
Silky Dogwood	(*Cornus amomum*)
Euyonomus	(*Euyonomus americana)*
False Nettle	(*Boehmeria cylindrica)*
Heartleaf Aster	(*Aster divaricatus)*
Jack-in-the-Pulpit	(*Arisaema triphyllum)*
Mountain Doghobble	(*Leucothe recurva)*
Painted Buckeye	(*Aescules sylvatica)*
Rattlesnake Fern	(*Botrychium virginianum)*
Strawberry Bush	(*Euyonomus Americana)*
Witchgrass	(*Panicum spp.)*
Violet	(*Violet spp.*)
Virginia Creeper	(*Parthenocissus quinquefolia)*
Virginia Wildrye	(*Elymus virginicus)*
Muscadine Grape	(*Vitus rotundifolia)*
Smilax	(*Smilax spp.)*

have donated conservation easements in riparian buffers to local governments or conservation organizations. These easements include agreements on what activities can take place in the buffers. In water supply watersheds (the drainage areas of Jordan Lake, Falls Lake, Smith Creek, Swift Creek, and the Cape Fear protected area) riparian buffers of certain widths are required to be left in tact, and in some places, floodplain or wetlands restrictions may prohibit certain types of development. The N.C. Environmental Management Commission has proposed a rule that would require riparian buffers of at least 50 feet in width to be left intact in all new development in the Neuse River Basin (which includes most of Wake County), but this rule has not yet been adopted, and if it is, it will not apply to existing development.

Therefore, hundreds—perhaps thousands—of urban homeowners and landowners have complete responsibility for hundreds of miles of intact urban riparian buffer in Wake County.

Why be concerned about urban riparian buffers?

Stream buffers filter pollutants out of runoff from roads, parking lots and other paved areas, and they provide shade to moderate soil and stream temperatures. Riparian buffers therefore help protect water quality and habitat for fish and other aquatic life. They also provide habitat for wildlife such as birds, small mammals, reptiles and amphibians.

It is important to emphasize that to perform these important functions, buffers must contain trees and other woody vegetation. Only trees, bushes and shrubs with extensive, deep root systems can provide the kind of nutrient uptake and pollutant removal that effectively "buffers" streams from urban land uses. However, grassed strips do help slow down runoff and cause some sediment to drop out of runoff, and the ideal situation is to have a forested buffer directly adjacent to the stream with a grassed strip on the upland side of the buffer.

Over-aggressive development that removes trees and natural vegetation right down to the stream edge destroys the water quality and wildlife benefits that urban riparian buffers provide. That's why the N.C. Environmental Management Commission has proposed a rule that would require riparian buffers of at least 50 feet in width to be left intact along both sides of streams in new developments within the drainage area of the troubled Neuse River.

However, there is now a new threat to the many miles of intact riparian buffers in established, stable residential areas of Wake County—the potential for additional damage and a change in the use of riparian buffers as landowners clean up damage from Hurricane Fran.

The benefits of urban riparian buffers

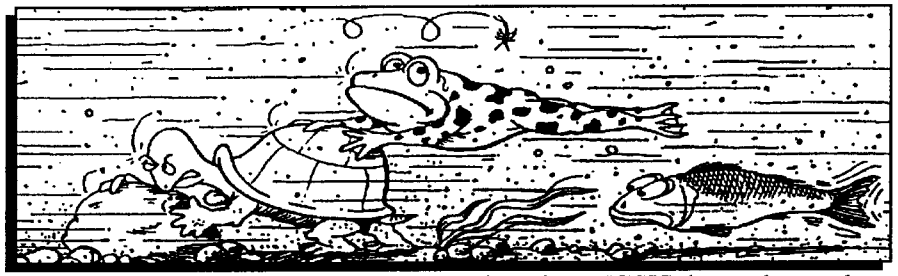
Scores of studies, including many performed in North Carolina, have documented the environmental benefits of riparian buffers.

They stabilize streambanks and limit channel erosion.

Streambank erosion occurs when water flows against the toe (base) of an unprotected slope. Trees and other native woody vegetation have deep root systems that hold streambank soil in place. The top plant growth deflects stream flow away from the bank and dissipates the energy of the stream. In addition, woody debris in streams form riffles and small pools that fish and other aquatic creatures like.

They intercept polluted sediment and assimilate nutrients in urban runoff.

In urban areas, sediment that washes off streets and other paved areas is likely to have adsorbed (attracted) heavy metals and hydrocarbon pollutants. If large quantities of urban sediment is washed into streams, water quality and aquatic habitat can suffer, and small stream channels can be clogged.



Studies at North Carolina State University (NCSU) have shown that forested stream buffers trap sediment in runoff because the rough forest floor slows down runoff and gives sediment a chance to drop out.

Runoff from urban areas also typically carries significant amounts of nutrients—phosphorous and nitrogen from lawn application of fertilizer and from pet and other animal waste. When nutrient-laden water soaks into the floor of riparian buffers, the roots of trees and shrubs assimilate nutrients. NCSU studies have shown that forested riparian buffers can remove large percentages of nutrients. Studies show that forested buffers can reduce nitrogen by as much as 68 percent, and that a forested buffer in combination with an upland grassed buffer can remove more than 90 percent of total nitrogen from runoff.

NATIVE SPECIES SUITED FOR RIPARIAN HABITAT IN WAKE COUNTY

The list that follows was taken primarily from Shafale and Weakley's (1990) description of plant communities found in Piedmont/Low Mountain Alluvial Forests. These communities are found along small streams with small floodplains and are usually more like upland communities than wetland communities. This is by no means an exhaustive list of all species found in riparian habitats of Wake County. However, it does contain many common species suitable to these habitats. The species listed below may or may not be appropriate for your stream buffer depending on specific soil type. Contact your local Soil and Water Conservation District, county forest ranger, or your local Cooperative Extension Service office for detailed advice on species selection.

Trees

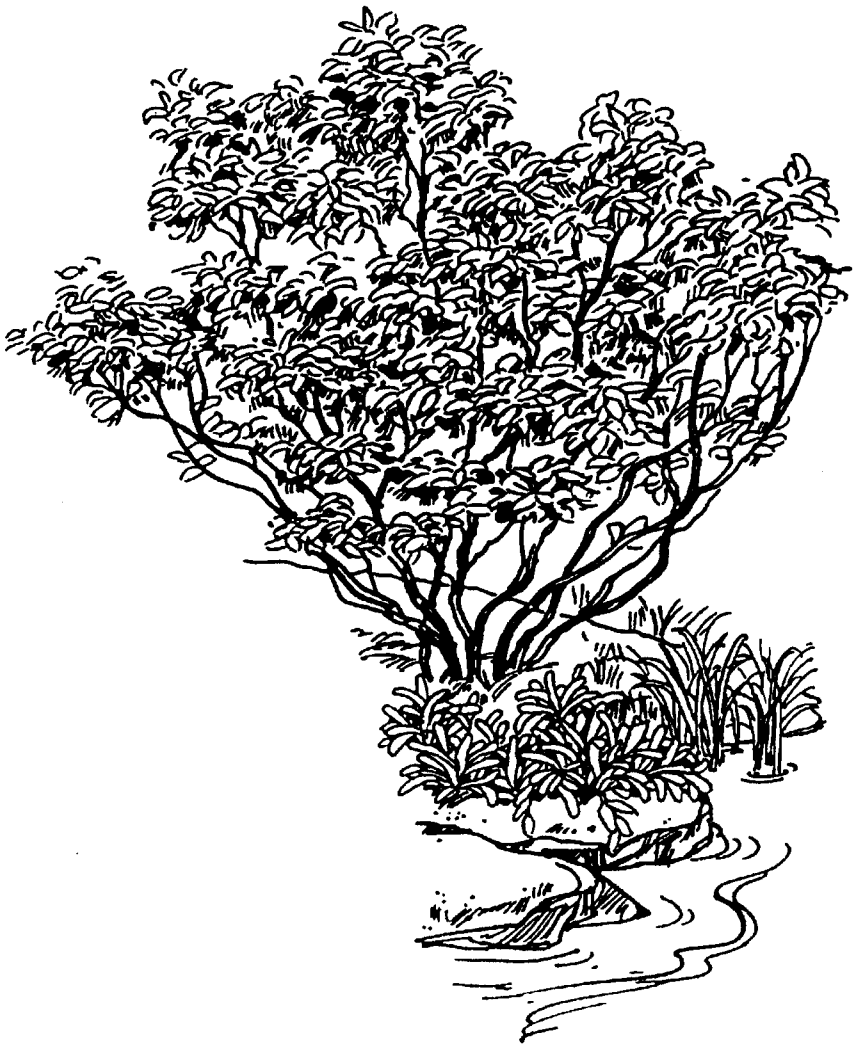
Common name	**Latin name**
American Beech	*(Fagus grandifolia)*
American Holly	*(Ilex opaca)*
Bitternut Hickory	*(Carya cordiformis)*
Black Cherry	*(Prunus serotina)*
Black Gum	*(Nyssa slvatica)*
Black Walnut	*(Juglans nigra)*
Cherrybark Oak	*(Quercus pagoda)*
Common Paw Paw	*(Asimina triloba)*
Flowering Dogwood	*(Cornus florida)*
Green Ash	*(Fraxinus pennsylvanica)*
Ironwood	*(Carpinus caroliniana)*
Loblolly Pine	*(Pinus taeda* L.)
Mockernut Hickory	*(Carya tomentosa)*
Pignut Hickory	*(Carya glabra)*
River Birch	*(Betula nigra)*
Redbud	*(Cercis canadensis)*
Red Maple	*(Acer rubrum)*
Red Oak	*(Quercus rubra)*
Sugarberry	*(Celtis laevigata)*
Sweet Gum	*(Liquidambar styraciflua)*
Shumard Oak	*(Quercus shumardii)*
Sycamore	*(Plantanus occidentalis)*
Tulip Poplar	*(Liriodendron tulipfera*)

continued

U.S. Environmental Protection Agency, Chesapeake Bay Program. 1995. *Water Quality Functions of Riparian Forest Buffer Systems in the Chesapeake Bay Watershed.* U.S. Environmental Protection Agency Technology Transfer Report EPA 903-R-95-004. Annapolis, MD.

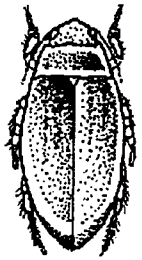
Welsh, David J. 1992. *Riparian Forest Buffers: Function and Design for Protection and Enhancement of Water Resources.* USDA Forest Service, Northeastern Area, Radnor, PA.

Wharton, Rachel. 1996. "Buffer Zones Protect Water Quality . . . Naturally," *Waterwise* Vol 4, No 3. (newsletter of the N.C. Sea Grant College Program, NCSU, Raleigh).



They moderate the temperature of the stream ecosystem.

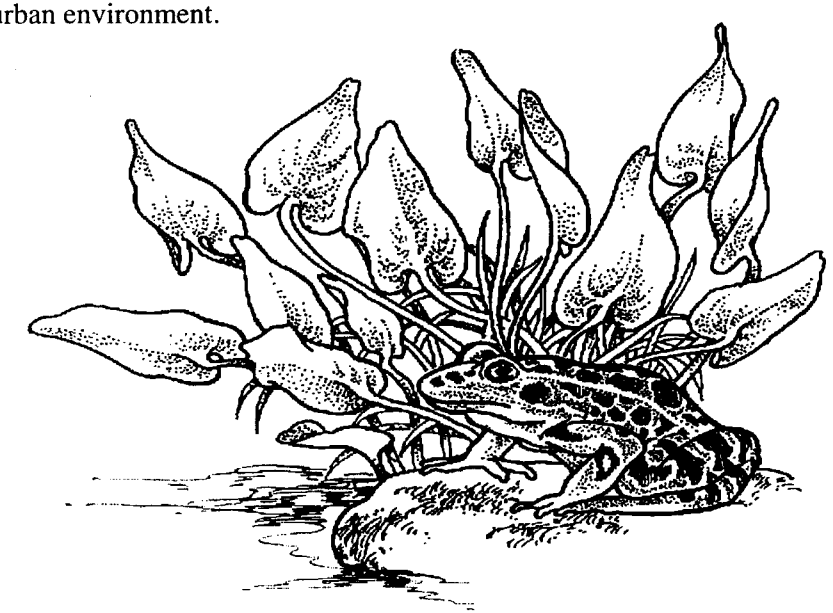
Trees and shrubs shade stream waters and soil and even lower the temperature of the air around the stream. Studies have shown that shading can lower the light and temperature of urban stream environments enough to promote the survival and growth of aquatic insects and help maintain oxygen concentrations in water. Both of these functions help provide better habitat for fish, frogs, salamanders, and various reptiles. In addition riparian vegetation serves as a food source for important members of the aquatic food chain.



water beetle

They provide wildlife habitat.

Because they have fertile soils, a diversity of vegetation, and a plentiful supply of water, riparian buffers can provide important breeding, foraging and resting areas for a number of bird and animal species. Depending upon their size and density, buffers may provide homes for common native birds— such as robins, mockingbirds, and sparrows, or they may harbor forest interior birds or even offer resting places for migratory songbirds. They often provide habitat for small furry mammals such as squirrels, moles, mice, rabbits, and if they are large and continuous enough may provide homes for even larger species such as deer. The larger the buffer, the more diverse the species it will support. One of the goals of greenway programs in Wake County is to preserve enough land along streams to provide homes and movement corridors for a diversity of wildlife within our urban environment.

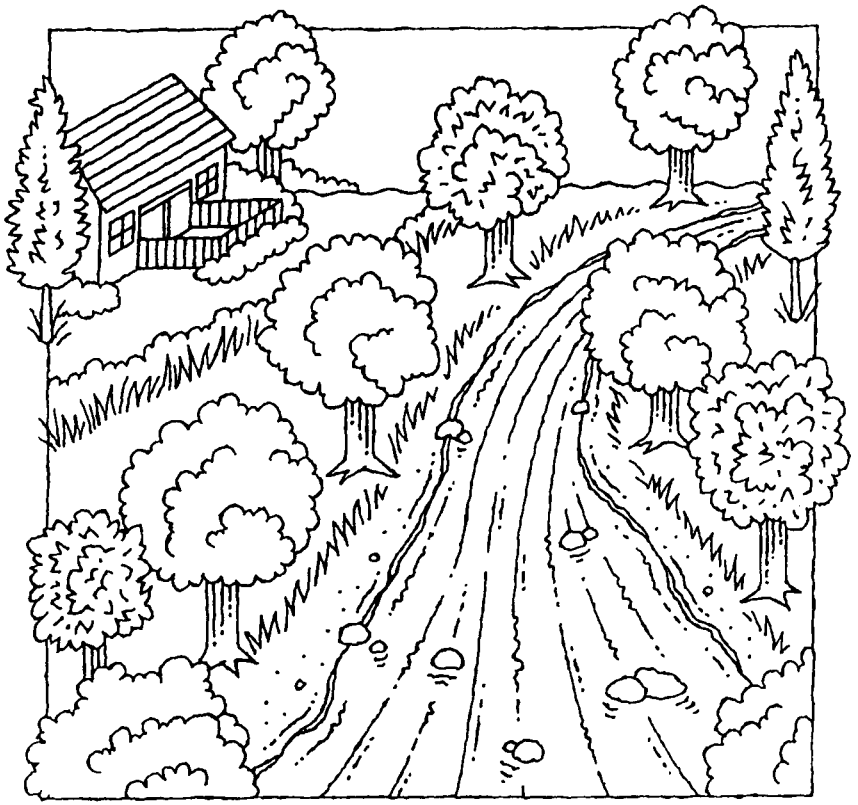


The ideal urban riparian buffer

In its proposed water quality management plan for the Neuse River Basin, the N.C. Division of Water Quality describes an ideal riparian buffer system for water quality. It consists of a 20-foot zone of undisturbed forest adjacent to the stream, a 20-foot zone of managed forest upland from zone one, and a 10-foot grassed area used for dispersing runoff flow upland from zone 2. Ideally, these 50-foot buffers would exist along both sides of the stream. Where existing forest land is developed for residential or other purposes, such a buffer system can conceivably be incorporated.

However, there are few existing urban areas in Wake County where undisturbed forest exists. Given that, what is the best riparian buffer for water quality for which urban homeowners and landowners can aim?

- **Buffer width:** If you can't give up 20 feet (in width) along the stream for a natural forested area, provide the widest forested area you can



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Assistance to urban landowners/homeowners for preserving riparian buffers

- **The N.C. Conservation Tax Credit Program.** Administered by the N.C. Department of Environment, Health and Natural Resources, this program is designed to assist landowners in protecting the environmental benefits of sensitive habitat, including riparian buffers. Substantial tax relief is allowed against individual and corporate donations of real property for conservation purposes. The tax credit amounts to 25 percent of market value of the donated property up to $25,000. Your tax return must be accompanied by certification by the N.C. DEHNR that the property is appropriate for conservation purposes. For information contact:

  N.C. Conservation Tax Credit Program
  c/o Office of Policy Development
  Department of Environment, Health and Natural Resources
  P.O. Box 27687
  Raleigh, NC 27611

- **Conservation Easements.** A conservation easement is a written agreement between a landowner and a qualified conservation organization or a local or state government. In the agreement, the landowner agrees to a series of restrictions designed to keep a specified area of land in its natural condition. If the easement is perpetual and meets one or more specific conservation purposes, it can qualify as a charitable contribution for federal income tax purposes. Under certain arrangements, the donor may also claim the value of the easement as a deduction for gift and estate tax purposes. In North Carolina, income tax credit equal to 25 percent of the market value of property (up to $25,000) is also available for conservation easements. North Carolina also requires county tax assessors to consider the reduction in property value caused by the granting of a conservation easement. For more detailed information on conservation easements and other conservation strategies contact

  The Conservation Trust for North Carolina
  P.O. Box 33333
  Raleigh, NC 27636
  (919) 828-4199

immediately adjacent to the stream. Remember, buffer width is important not only for pollutant filtering but also for streambank stabilization and stream shading. Experts suggest that to stabilize streambanks, buffers of trees and shrubs should be at least as wide as the stream but not less than 15 feet.

- **Vegetation:** If your forested area is not as wide as it needs to be, try to compensate by providing denser vegetation. Experts say that to achieve maximum potential pollutant removal, vegetation at least six inches high should cover 80 percent or more of the buffer area so that bare ground cannot be seen. Native species of trees, bushes and shrubs should be used since they are more likely to thrive in the local soil and climate conditions (see list of species in the appendix). However, when planting additional vegetation, take care not to damage the root systems of existing trees and plants.

- **Transition area:** Between the riparian buffer and any structures or areas of activity (such as patios, gardens, recreation areas, pet pens), provide a transition area of grass that can act to spread out the flow of runoff evenly across the buffer. Use little or no fertilizer or chemicals on the grass.

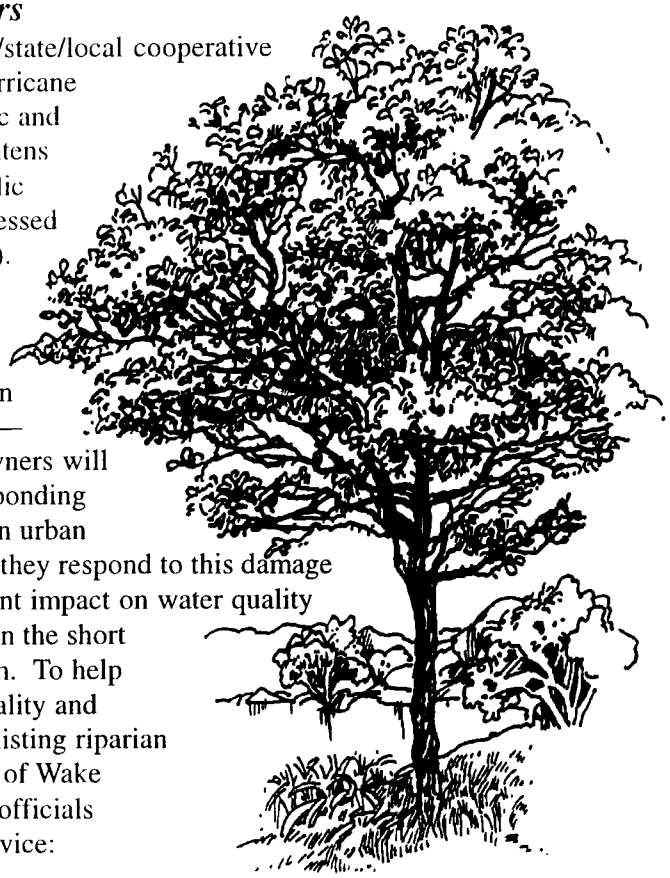
- **Maintenance:** Mow grass infrequently or eliminate mowing within the buffer. Keep grass at least 6 inches high. Inspect the grass area and the buffer several times a year for evidence of channelized runoff or erosion, and repair these areas to make sure runoff continues to be distributed across the buffer rather than cutting a channel to the stream (Call the Wake Soil and Water Conservation District for technical assistance in repairing eroded or channelized areas). Do not dump compost, lawn waste, pet waste or other refuse in the buffer area. Remove sediment deposits manually (excessive sediment reduces buffer capacity).

- **Activities in buffer:** Restrict human activity in your riparian buffer as strictly as you can to prevent vegetation from being trampled and damaged. Trees should be removed only if they present a hazard and then with great care. Removed trees should be replaced with native species suitable to the location.

Restoring riparian buffers damaged by Hurricane Fran

Riparian buffers in established neighborhoods and in parks and greenways in Wake County were hard hit by Hurricane Fran. To homeowners, these buffers may appear to be "devastated" or "destroyed." However, officials with the N.C. Division of Forest Resources, the Natural Resources Conservation Service, and the Wake Soil and Water Conservation District urge homeowners and local governments not to write off these important riparian buffers. They are natural ecosystems, and given time and the right kind of help, they can repair themselves and continue to provide the important environmental functions they did before Hurricane Fran.

Advice for responding to hurricane damage in riparian buffers



Through federal/state/local cooperative emergency efforts, hurricane damage on both public and private land that threatens public safety and public facilities will be addressed (see discussion below). However, for the most part, local governments—acting alone or in cooperation with nonprofit groups—and individual landowners will be responsible for responding to hurricane damage in urban riparian buffers. How they respond to this damage could have a significant impact on water quality in local streams both in the short term and the long term. To help preserve the water quality and wildlife benefits of existing riparian buffers in urban areas of Wake County, conservation officials offer the following advice:

- **N.C. Clean Water Management Trust Fund.** In 1996 the N.C. General Assembly created the Clean Water Management Trust Fund to help finance projects that specifically address water pollution problems and focus on upgrading surface waters. The fund may be used to build a network of riparian buffers and greenways for environmental, educational, and recreational benefits. The fund is to receive 6.5 percent of any unreserved credit balance remaining in the General Fund at the end of each fiscal year. It is expected that the fund will have about $30 million a year to be distributed to state agencies, local governments, and nonprofit groups. Specific rules and procedures for making grants from the Trust Fund are currently under development. For information about the Clean Water Management Trust Fund contact:

  Bill Flournoy
  N.C. Department of Environment, Health,
  and Natural Resources
  P.O. Box 27687
  Raleigh, NC 27611-7687
  919/715-4191

Assistance to individuals in restoring riparian buffers

The U.S. Department of Agriculture administers many programs that provide financial incentives for owners of agricultural and forest lands to conserve resources and protect water quality. The 1996 Farm Bill put into place a new agricultural conservation program called the Environmental Quality Incentives Program (EQIP) that may provide assistance to farmers and ranchers who face serious threats to soil, water, and related natural resources on their land. This program is administered by the Farm Services Agency and the Natural Resources Conservation Service in conjunction with local Soil and Water Conservation Districts. Agricultural landowners should contact their local conservation district for information about EQIP. In Wake County contact

Wake Soil and Water Conservation District
4001-D Carya Dr.
Raleigh, NC 27610
919/250-1050

Low-cost tree seedlings suitable for riparian area restoration are available from the N.C. Division of Forest Resources. For further information or to request a seedling catalog contact your county forest ranger. In Wake County: 919/848-0688 or 1-888-NC TREES.

- **The N. C. Division of Forest Resources.** The Urban and Community Forestry Grant Program administered by the N.C. Division of Forest Resources provides grants to local governments, educational institutions, nonprofit neighborhood associations, civic groups and community tree volunteer groups for projects that create and support long-term, sustained urban and community forestry programs. Urban forest planning, tree ordinance development, hazard tree identification, tree inventories, training, education, and demonstration projects are examples of qualifying projects. For information contact

  Barry New
  N.C. DEHNR - Division of Forest Resources
  PO Box 29581
  Raleigh NC 27626-0581
  (919) 733-2162 Ext 249

- **N.C. Park and Recreation Trust Fund.** The Recreation Resources Service at North Carolina State University is administering the local government part of the N. C. Park and Recreation Trust Fund. This fund provides 50/50 matching grants to incorporated cities or counties for acquisition, development or renovation of public indoor or outdoor recreation areas and facilities. While this is not a "Fran recovery" program, it is conceivable that some restoration work related to greenway recreation facilities could be incorporated into a renovation project. For information contact

  Recreation Resources Service
  Box 8004, N.C. State University
  Raleigh, NC 27695-8004
  (919) 515-7118

- **The Clean Water Act Section 319 Program.** Administered by the N.C. Department of Environment, Health and Natural Resources, this federal program provides funding for projects, including stream restoration, that help control nonpoint source pollution. Guidelines for the use of these funds may change from year to year, and the program is subject to annual appropriations. For information on current funding contact:

  Linda Hargrove
  N.C. DEHNR - Division of Water Quality
  P.O. Box 27687
  Raleigh, NC 27611
  919/733-5083 Ext 352

- Don't dump fallen trees, stumps, or tree limbs into streams. This debris can collect, obstruct stream flow, and cause flooding and channel damage. If you know of areas where fallen trees or collected debris causing flooding of homes and roadways, call the Wake Soil and Water Conservation District (919/ 250-1050), or, the City of Raleigh (919/ 890-3836), if within the city limits.

- Where streambanks have been extremely destabilized by the uprooting of trees and it appears further erosion could threaten homes, other buildings, or roadways, contact the Wake Soil and Water Conservation District (WSWCD) or your municipal engineering department. WSWCD may be able to provide assistance in repairing the damage. Municipalities will sometimes share the cost of streambank stabilization projects with homeowners. Stabilization with deep-rooted native vegetation and other "bioengineering" techniques is preferable to "hard" solutions, such as the use of riprap. Homeowners should seek professional assistance in determining the cause of erosion problems and in identifying possible alternatives and the need for permits. WSWCD or your municipality's engineering department will be able to offer you advice for stabilizing streambanks.

- Resist the temptation to convert forested areas to grass. If you have lost many trees, the micro-climate of your buffer may have changed to be more hospitable to grass, but fight off the urge to extend your lawn to the stream edge. Remember that your stream needs the shade and buffering ability of trees. Replace lost trees with native riparian trees such as poplar, sycamore, or oak (See species list in the appendix).

- Avoid bringing heavy equipment such as skidders and loaders into riparian buffers. Heavy tree removal equipment can compact soil, damage surviving vegetation, and create ruts that will channel runoff directly into streams and promote gully erosion. If you can, remove fallen trees that present a safety hazard by chain-sawing them into pieces that you can move with a wheelbarrow. If fallen trees present no hazard, you can simply saw them and stack the wood in place, if that's acceptable to you. Also consider chipping as much woody debris as possible and using it as mulch in your yard and garden or to replace forest litter swept away by flood waters.

- If you must use heavy equipment to remove trees from riparian buffers, then use Forestry Best Management Practices recommended for streamside management zones. This means stationing skidders outside the

buffer and removing trees by cable, taking care to avoid creating channels perpendicular to the stream and to disturb as little vegetation as possible. Once trees have been removed, reseed or replant disturbed ground cover. (For publications or advice on Forestry Best Management Practices contact the N.C. Division of Forest Resources at 919/733-2162, or your local forest ranger at 919/212-7363.)

- In severely damaged areas, replant a variety of native riparian trees, shrubs and ground cover (for species that do well in Wake county, see list in appendix). At least 80 percent of the buffer floor should be covered by vegetation. Where leaf litter (partially decomposed leaves, bark and other organic debris) has been scoured off the buffer by flooding, provide some temporary mulch by raking leaves from other parts of your yard and spreading them under trees or by chipping woody debris and using the wood chips as mulch.

- Where damage to the riparian buffer has not been severe, chain-saw fallen trees, stack up the wood, and leave the area to repair itself.

Federal emergency programs that will help local governments with some riparian area cleanup

The first priority of local governments in addressing storm damage along streams is to ensure public safety. Fallen trees and debris that threaten to create flooding situations must be removed, and trees that are still standing but could fall into public areas must be taken down. There are two federal programs that are helping local governments address public safety concerns related to forested stream buffers in Wake County (and other counties hit by Hurricane Fran).

- The federal Natural Resources Conservation Service (NRCS) together with the Wake Soil and Water Conservation District (WSWCD), the City of Raleigh, and the State of North Carolina, is administering the Federal Emergency Watershed Protection Program (EWP). This program is designed specifically to alleviate conditions along streams that could lead to flooding that would threaten substantial numbers of people and property or roads. Immediately after Hurricane Fran hit, representatives of NRCS and its partners began walking streams in Wake County looking for problem areas that would quality for EWP cleanup. Where they have found such problems, they have contracted with private companies to have trees cut away from streams and, in some cases, debris hauled from the site. Activities under this program are expected to continue throughout 1997 and it is expected that about $2 million will be spent to respond to problems in Wake County. It is important to note that this program was not designed to provide general tree removal to homeowners. Debris removal is limited to the area in and immediately adjacent to the stream channel (within 5-10 feet).

- The Federal Emergency Management Agency (FEMA) will provide for removal of trees on public or private land that present a hazard to public areas.

Through these two cooperative programs, local governments should be able to address public safety threats on public and private land throughout Wake County. In addition, there are a number of sources of assistance that local governments and nonprofit groups can use to restore urban riparian buffers on public lands.

Assistance available to local governments and nonprofit groups for restoring urban riparian buffers on public lands

- **FEMA.** Local governments or nonprofit groups that had an official tree program in place before Hurricane Fran may receive assistance in removing and replacing trees that had been planted and/or maintained as part of the program. Most trees in public parks and natural areas are not eligible for FEMA assistance, unless it can be shown that they present a public hazard .

- **N.C. Division of Water Resources**. Local governments can apply for Water Resources Development Project grants that will pay 66-2/3 percent of the cost of stream restoration projects, which may include streambank stabilization, stream cleanup and tree planting. For information contact

Jeff Bruton, Stream Restoration Program
N.C. DEHNR - Division of Water Resources
P.O. Box 27687, Raleigh, NC 27611
919/733-4064