Conservation Action Plan for the Upper Little Tennessee River Basin

October 2008

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PART I: INTRODUCTION

Conservation Action Planning: What is it?

Conservation action planning is a collaborative, science-informed approach used to identify the biodiversity that needs to be conserved in an area, to decide where and how to conserve it, and to measure effectiveness. This approach was developed by The Nature Conservancy who has shared it with numerous organizations around the world. The basic concepts of this conservation approach follow an adaptive management framework of setting goals and priorities, developing strategies, taking action, and measuring results. It follows the same planning cycle used by World Wildlife Fund and other members of the Conservation Measures Partnership (http://www.conservationmeasures.org/CMP/) (Box 1). Thus, when TNC approached WWF about participating in a series of workshops focused on watersheds in the Southeast US, it made sense to adopt the conservation action planning methodology.

Box 1. Diagram of Conservation Action Planning.

At its core, this approach is a framework to help practitioners focus their conservation strategies on clearly defined elements of biodiversity, or conservation targets, fully articulate threats to these targets, and measure their success in a manner that will enable them to adapt and learn over time. The process accomplishes this by prompting a conservation team to work through a series of diagnostic steps that culminate in the development of clearly defined objectives and strategic actions. Together these represent a testable hypothesis of conservation success that forms the basis of an "adaptive" approach to conservation management.

Conservation action planning encourages teams of practitioners to capture their best understanding of the conservation situation, build a set of actions based on that understanding, implement the actions, measure the outcomes of their actions, learn from these outcomes, and refine actions over time.

Project Scope

The Little Tennessee River has its headwaters in Rabun County, Georgia, and flows north/northwest into Tennessee through Macon, Swain, and Graham Counties in North Carolina. The total area of the Little Tennessee River Basin in Georgia, North Carolina, and Tennessee is 2,225 square miles. The Little Tennessee River is impounded at Fontana Dam in Graham County, North Carolina, which creates over 10,000 acres of surface waters. The Tuckasegee River, with its headwaters in Jackson County, North

Carolina, flows northwest into Swain County where it joins the Little Tennessee River at Fontana Reservoir. The Nantahala River is another major tributary to the Little Tennessee River. With its headwaters in southwestern Macon County, it flows northward into Swain County and also joins the Little Tennessee River at Fontana Reservoir. The Cullasaja River drains southeastern Macon County, which includes the town of Highlands, and flows into the Little Tennessee River at Franklin above Lake Emory Dam. The Cheoah River, with its headwaters in Graham County, is another major tributary to the Little Tennessee River; it joins at Calderwood Reservoir, just downstream from Cheoah Dam. The Little Tennessee River is more or less continuously impounded from Fontana and Cheoah Reservoirs, across the state line into Tennessee through Chilhowee and Tellico Reservoirs before joining the Tennessee River at Lenoir City, Tennessee.

The Upper Little Tennessee River Basin Conservation Action Plan (CAP) includes the headwaters in Rabun County, Georgia, the unimpounded mainstem Little Tennessee River and tributaries, the Tuckasegee River and tributaries, the Nantahala River and tributaries, and the Cheoah River and tributaries (Figure 1). The total project area is approximately 1,850 square miles, with 1,800 square miles in North Carolina and 51 square miles in Georgia. The Cheoah River watershed is disconnected from the upper portion of the watershed due to the presence of Fontana Reservoir. Originally the project scope for this CAP was to be the entire Little Tennessee River Basin. However, the large geographic scope, the trans-boundary issues, and the existence of a strong long-standing partnership (the Little Tennessee Nonpoint Source Team and its constituent organizations in the upper portion of the watershed, see Appendix V) led to the decision to focus on the Upper Little Tennessee River Basin, including the small portion of the watershed in Georgia and all of the watershed contained within North Carolina.

Municipalities within the CAP area include Dillard, Georgia, and within North Carolina: Highlands, Franklin, Forest Hills, Webster, Dillsboro, Sylva, Cherokee, Bryson City, Robbinsville, and Santeetlah. The percentage of each county within the CAP area contained within the Little Tennessee River Basin in North Carolina is as follows: Clay (10%), Jackson (88%), Macon (94%), Swain (100%), Graham (100%), and Cherokee (2%). Public lands within the basin consist of: Great Smoky Mountains National Park, Nantahala National Forest, the Blue Ridge Parkway, Needmore Game Lands, and a few state-owned conservation easements, totaling over 715 square miles. The Cherokee Indian Reservation, or Qualla Boundary, is part of the project area in Swain and Jackson Counties. It covers an area of 69 square miles. There are a few additional Cherokee landholdings in Graham County.

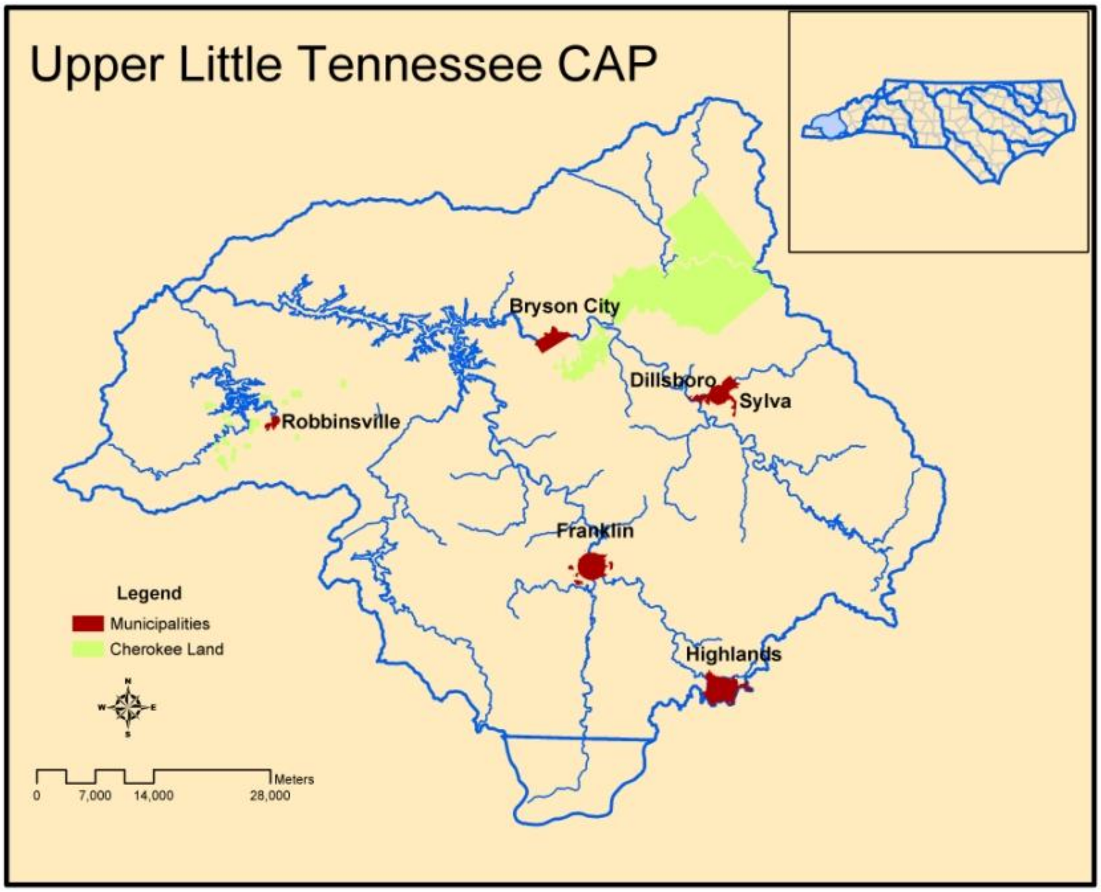


Figure 1. Project area for the ULTN CAP.

Project Purpose and Timeline

The main purpose of this project was to gain consensus on conservation strategies that a) would be most effective for conserving the aquatic life of the Upper Little Tennessee River Basin and b) would benefit from the collective input of members of the Little Tennessee Nonpoint Source Team (LTNPST). Several excellent plans already exist for the region and this work drew heavily upon them. These are the North Carolina Division of Water Quality's (NC DWQ) basinwide plan; the North Carolina Ecosystem Enhancement Program's (EEP) watershed restoration plan; Land Trust for the Little Tennessee's (LTLT) conservation plan; the Little Tennessee Watershed Association's (LTWA) State of the Streams report; and the North Carolina Wildlife Resources Commission's (NC WRC) statewide Wildlife Action Plan. The Upper Little Tennessee River Basin CAP is intended to supplement and be used in conjunction with these existing plans. The CAP was developed by a group of stakeholders working within the Little Tennessee River Basin. Targets, threats, and conservation strategies were determined at various workshops throughout 2007 (see Figure 2 and Appendix I for timeline and list of attendees at each workshop) and feedback was requested from the larger stakeholder group. The CAP attempts to look holistically at the basin and determine strategies to best conserve the biological diversity of the basin.

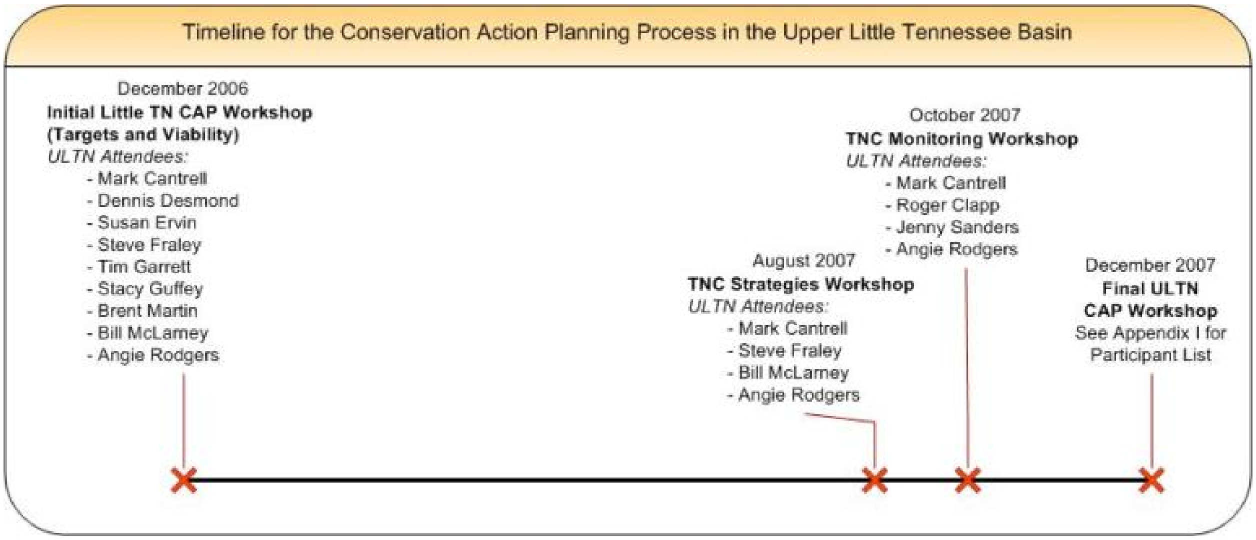


Figure 2. Timeline for the ULTN CAP, including workshop dates and attendees. Refer to Appendix I for the full list of attendees at the December 2007 workshop and their affiliations.

Biological and Cultural Importance of the Upper Little Tennessee River Basin

The Upper Little Tennessee River Basin supports the richest aquatic species assemblage remaining in the Blue Ridge Mountains. Many of these species are found only in the unimpounded Little Tennessee and Tuckasegee Rivers upstream of Fontana Reservoir. The centerpiece is a short 24-mile reach of the Little Tennessee River between Franklin (or Porters Bend) Dam and Fontana Reservoir that still supports what is believed to be the full species assemblage that was once found throughout the upper Little Tennessee River and its major tributaries. This is one of a very few small, isolated river reaches that collectively supports what remains of the exceptional aquatic biodiversity of the Southeastern United States. There are 41 aquatic or wetland species within the Upper Little Tennessee River Basin that are presently considered rare at some level and three of these are federally listed: Appalachian elktoe (*Alasmidonta raveneliana*) and littlewing pearlymussel (*Pegias fabula*) are federally endangered mussels; spotfin chub (*Erimonax monachus*) is a federally threatened fish. There are over 60 species of fish and about 10 species of freshwater mussels in this basin. There are 13 designated Aquatic Significant Natural Heritage Areas, as determined by the NC Natural Heritage Program, in the project area. They are: Little Tennessee River (below Franklin), Tuckasegee River, Cartoogechaye Creek, Cullasaja River/Ellijay Creek, Little Tennessee River (above Franklin), Oconaluftee River, Whiteoak Creek, Alarka Creek, Raven Fork, Upper Nantahala River (headwaters), Cheoah River, Santeetlah Creek, and Snowbird Creek. These areas, designated based on the presence of rare aquatic species and high water quality standards, represent the best of the state's natural diversity. The North Carolina Wildlife Action Plan identified three priority areas within the Little Tennessee River Basin: the Little Tennessee River watershed, the Tuckasegee River watershed, and the Cheoah River watershed between Lake Santeetlah and the Little Tennessee River. The U.S. Fish and Wildlife Service designated critical habitat for spotfin chub in the mainstem Little Tennessee River from the North Carolina/Georgia border down to Fontana Reservoir. Additionally, critical habitat for Appalachian elktoe is located in the mainstem Little Tennessee River from Franklin to

Fontana Reservoir, the Tuckasegee River from approximately Cullowhee down to Bryson City, and in the Cheoah River between Santeetlah Lake and the confluence with the Little Tennessee River (Figure 3).

Nearly all of the Great Smoky Mountains National Park in North Carolina is located within the Little Tennessee River Basin (the remainder of the North Carolina portion is in Haywood County in the French Broad River Basin). This national park boasts the largest amphibian assemblage in all of North America. It is also the most visited national park in the United States.

The Upper Little Tennessee River Basin has a diverse history from its first known settlers, called the Upper Valley People, to the Cherokee Middle Towns settlement, to the Spanish explorers of the 16th century, to the numerous settlers of varied origins following the Revolutionary War. Early hunter/gatherer groups are known from western North Carolina at least 5,000 years ago and perhaps earlier. The Upper Valley People were a primitive group of people living along the Little Tennessee River, the Hiwassee River, and other rivers in western North Carolina. Characteristics of this group include pressing fiber cords into their pottery, living in circular houses, and burying their dead in a flexed position. Following the Upper Valley People, came the Middle Valley People who did not have cord pressings in their pottery, were mound builders, and buried their dead in a partially flexed position. They lived along rivers where they appear to have relied on mussels for sustenance, indicating they may have migrated from a coastal area such as the Gulf of Mexico. The Hiwassee People followed the Middle Valley People and they built rectangular houses that were part of villages protected by stockades. The Hiwassee People were mound builders, on which they constructed their public buildings. No burials have been found by this group, so they are thought to have cremated their dead. The Dallas People arrived after the Hiwassee People, although the two groups apparently lived in their separate villages for some time. Eventually, the Hiwassee People were either driven out or absorbed by the Dallas People. The Cherokee were the tribe to follow the Dallas People (Blackmun 1977).

The Cherokee were once part of the mighty Iroquois Nation. The two groups split when the Iroquois spread north of the Great Lakes and into central New York and the Cherokee spread to the area between the Great Lakes and the Ohio River. The Cherokee eventually battled with the Delawares and the Iroquois for territory. When they were defeated they slowly retreated to the Ohio River, then down the Kanawha River into West Virginia. They ventured into western North Carolina possibly by way of the Holston and Tennessee Rivers and eventually established boundaries that consisted of about four thousand square miles which included all of western North Carolina and parts of Kentucky, West Virginia, South Carolina, eastern Tennessee, and Alabama. There were three distinct areas that developed amongst the Cherokees: the Lower Towns consisted of settlements in eastern Georgia and South Carolina; the Over Hills Towns consisted of settlements in western Georgia and along the Little Tennessee and Tellico Rivers; and the Middle Towns consisted of villages along the headwaters of the Little Tennessee River, Tuckasegee River, and the Hiwassee and Valley Rivers (Blackmun 1977).

The 1500s brought Spanish explorers into western North Carolina, followed by the English. Trade with the Indians was a motive for movement into western North Carolina by various settlers and there was a struggle between the Indians and colonists for over 250 years related to trade and territory. During the mid to late 1700s colonists from various countries (including Germany, Scotland, Ireland, and Wales) settled in the region -- many of these people had been previously settled in central or eastern North Carolina. Following the Revolutionary War, the state government of North Carolina provided land grants to war veterans that aided in pushing settlements further west in the state. Although there were settlers in western North Carolina from all areas of Europe and Africa, Scots-Irish settlers made up at least one third of all emigrants (Scottish Tartans Museum).

The clans from the Highlands of Scotland migrated to America and settled mostly in North Carolina in the latter part of the 18th century. Their migration was driven by three interrelated factors. One was the changing agricultural practices and the rising price of land rents; the second factor was the deterioration of the clan system, which likely removed social ties and other restraints that might have prevented migration; and thirdly, there was a growth in population that led to poverty and the need to seek better conditions. The largest Highlands settlement in North America was established in North Carolina (Meyer 1963).

The 18th century brought about a tumultuous period between the European settlers and the Cherokee. There were numerous years of warfare which resulted in death, loss of Indian Territory, and general unrest. In 1827 the Cherokee adopted a written constitution in order to declare themselves a sovereign nation and therefore give them rights to their land. However, this constitution was not recognized and enforced by the state or federal government. The Indian Removal Act of 1830 was pushed through Congress by President Andrew Jackson as a way to negotiate removal treaties with Indians living east of the Mississippi River. In exchange for their eastern lands, they would be given lands west of the Mississippi. The majority of the southeastern nations refused to leave; therefore, they were eventually forced west. In 1838, approximately 16,000 Cherokee remained in their territory and the federal government sent in troops to force their removal out west. This movement to present day Oklahoma is known as the "Trail of Tears" and resulted in approximately 4,000 deaths along the way due to hunger, disease, and harsh weather conditions (Horton et al. 1979).

Some Cherokees, known as the Oconaluftee Indians, had not been part of the changing Cherokee culture in the early 19th century that had resulted in a Cherokee republic. These Oconaluftee Cherokees had withdrawn from the Cherokee Nation in 1819 and became citizens of the state of North Carolina. Therefore, the treaty which exchanged Cherokee eastern territory for land out west did not affect the Oconaluftee. This group, along with Indians that hid in the Snowbird Mountains under the leadership of Tsali, was the basis of the Eastern Band of Cherokee.

The Eastern Band of Cherokee Nation resides on the Qualla Boundary in Swain and Jackson Counties. There are a few Cherokee landholdings in Graham County, as well. The Cherokee have lived in harmony with nature and have utilized the many resources available within the Little Tennessee River Basin. Fish weirs were a common method of trapping fish. These weirs consisted of rocks in a V-shape, with the narrow end pointing downstream. Fish were funneled by the weir into a woven or log trap where they could be easily collected. Additionally, tools such as spears, fish hooks made from bone, and net weights were used to aid in fish harvest. Remnants of fish weirs can be seen on several rivers, including the Tuckasegee River in Jackson County. Fish were used for food, medicinal purposes, and were also the subject of mythology. There are numerous plant and animal species considered sacred by the Cherokee (Cantrell 2005).

Challenges and Opportunities

Challenges:

Western North Carolina, in the not-so-distant past, was a land of wilderness and mountains, off-limits to much development and modernization. However, an updated road system now provides access to even the most remote localities and western North Carolina has become a hot-spot for retirement and second-home development. The populations of Macon and Jackson Counties are expected to increase by over 30 percent between 2000 and 2020 (NCDWQ 2007). Out-of-state land ownership has increased dramatically; in 2004, 43 percent of Macon County's parcels were owned by non-residents of North Carolina (Stacy Guffey 2007, pers. comm.). Because of the increase in demand for mountain property, prices have also increased over the past several years. This has provided a boost to many counties struggling for revenue, but has also put a strain on utilities and other county services and also on long-time property owners due to increasing tax values. Many property owners of large parcels have been forced to sell because taxes were too burdensome. In addition, rising land values have made land purchases for conservation purposes increasingly difficult because of the cost.

Due to rising land values, more land is being sold in the mountains of North Carolina, resulting in increased development. Areas that were once forests or farms are now being graded and sited for multiple dwelling units. The amount of impervious surface across the watershed is also increasing and consequently affecting the hydrology and water quality.

Water quality within the Little Tennessee River Basin in North Carolina is relatively good. There are a total of 2,565 stream miles in the basin, and 40 miles (plus 170 acres of Fontana Reservoir) are considered impaired, as designated by the North Carolina Division of Water Quality (NCDWQ 2007). The impaired waters include portions of: Cullasaja River (Ravenel Lake), Savannah Creek, Scott Creek, Tuckasegee River, Tuckasegee River arm of Fontana Reservoir, Little Tennessee River, Whiteoak Creek, and the Cheoah River (Figure 3). It is important to note that some of the impaired reaches are also designated as critical habitat, through the Endangered Species Act, for federally listed species such as spotfin chub (mainstem Little Tennessee River above Franklin) and Appalachian elktoe (mainstem Tuckasegee River near Sylva). Stressors causing impairment vary, but include: habitat degradation, toxic chemicals, fecal coliform bacteria, turbidity, and sediment associated with sources such as impoundments, agriculture, impervious surfaces, construction, and wastewater treatment plants. Nonpoint source pollution is the largest threat to water quality and aquatic habitat within the basin. Sedimentation and other impacts associated with development, particularly along stream corridors, are on the rise. Many of the waterbodies within this basin, particularly those within large river valleys, lack sufficient riparian vegetation. In many cases, this is due to roads being built adjacent to the waterbody or to the presence of farming or development along river corridors (NCDWQ 2007).

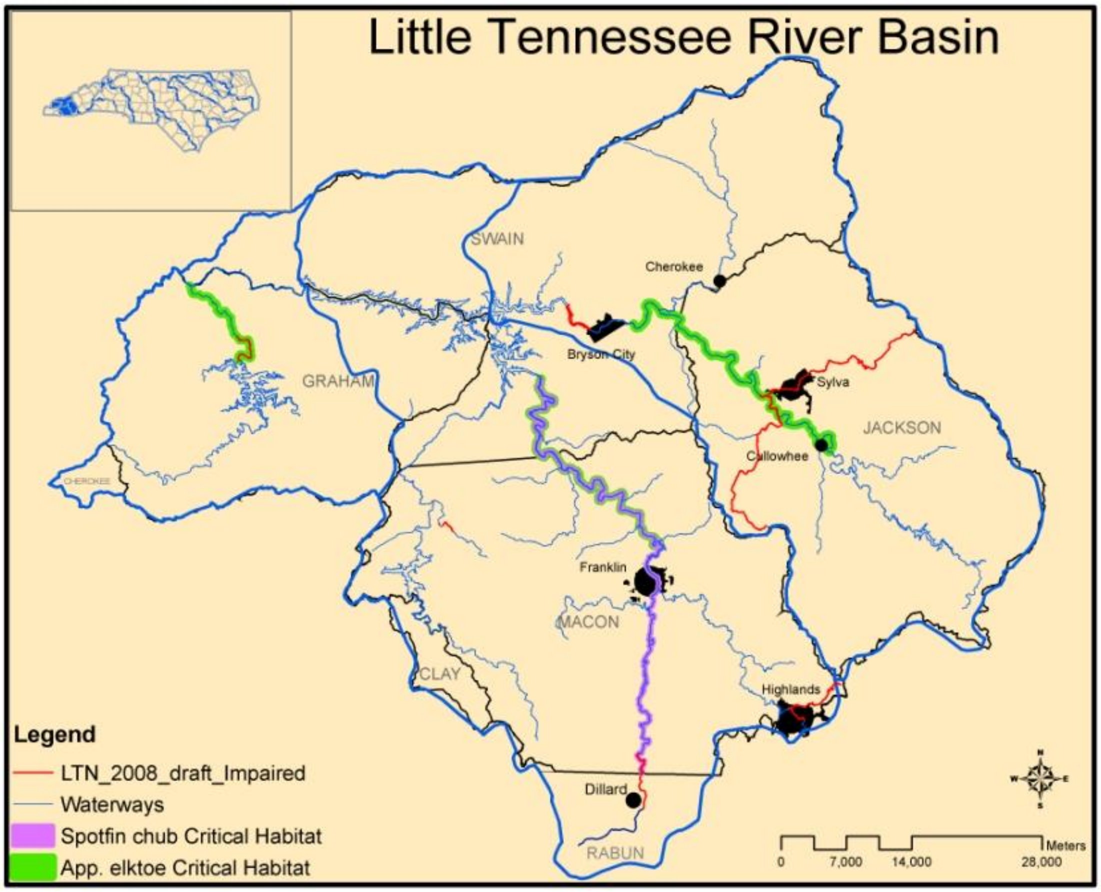


Figure 3. Impaired waters and critical habitat designations for the Little Tennessee River Basin.

Water quantity is also becoming an issue in the basin. The town of Franklin, for example, is realizing that Cartoogechaye Creek will be incapable of providing sufficient water supply in the future, given the anticipated population increase within Macon County. The town of Franklin is beginning to explore options for other drinking water sources. Additionally, the old Fruit of the Loom plant in Rabun County, Georgia, has been purchased by Rabun County and the county is making plans to upgrade that facility for potential municipal wastewater treatment. This could result in an interbasin transfer, which regardless of the direction of the transfer (i.e. from or to the Little Tennessee River), could have a negative impact on water quantity and quality in North Carolina.

Because of sluggish economic growth and development in the past, the recent boom in development in western North Carolina has left many counties and municipalities unprepared to deal with such drastic change. In some places, local governments have placed moratoria on development until they can enact ordinances to protect the local character and natural resources of the area. These have been met with both praise and criticism from local constituents. Planning for growth has not been much of a need in western North Carolina in the past, but it is an issue that appears to be on the minds of many leaders and citizens throughout the region. In June 2007, a growth management workshop was held in Franklin, North Carolina, and attendees were asked to fill out a survey ranking their greatest concerns and challenges. Of the 32 respondents, 20 identified themselves as affiliated with local governments. The top two concerns were slope and ridge-top development and protection of streams and rivers from erosion and sedimentation (Ben Brown, pers. comm.).

Opportunities:

There appears to be a growing recognition within western North Carolina of the need for community-level planning and the importance of place-based economics. Multiple efforts around the region are exemplifying this increased awareness and recognition of the need for change. Here we present several examples of these efforts:

- Jackson County elected a set of county commissioners within the past year who have begun addressing growth and development issues within the county. The Jackson County commissioners enacted a moratorium on subdivision development that lasted five months in order to gain better control on how and where development was occurring within the county. During the moratorium, they passed a Subdivision Ordinance and a Mountain and Hillside Development Ordinance.
- In February 2008, Macon County adopted a Flood Ordinance, following an eight-month moratorium in the fall 2007 on recreation vehicle (RV) park construction within the floodplain. The revised ordinance details development restrictions specific to RVs and the construction of RV parks within the floodplain. Additionally, information from the new FEMA (Federal Emergency Management Agency) maps, rules mandated through FEMA, and rules developed by the commissioners were incorporated into the Macon County ordinance, which included the following provisions: no net addition of fill in the floodplain; establishment of non-encroachment areas (areas containing high velocity waters during a flood) where no permanent structures may be built; and no storage of hazardous materials in non-encroachment areas. Macon County commissioners have received several exception requests, but thus far, have upheld the ordinance and denied these requests.
- In 2007, several members of the North Carolina House of Representatives introduced House Bill 1756, the Safe Artificial Slope Construction Act, which would require local governments to enact ordinances that promote safe development on steep mountain slopes to protect human safety and property. It also would provide for disclosure of properties located in landslide hazard areas as identified by the North Carolina Geological Survey. The bill is currently on hold and has been referred to the Committee on Environment and Natural Resources.
- The Land of Sky Regional Council of Governments, which covers four western North Carolina counties, established a Mountain Ridge and Steep Slope Protection Advisory Committee, composed of a diverse group of participants, to study relevant issues and develop strategies to promote safer and more responsible development. Committee recommendations for steep slope development take into consideration economics, public health and safety, water quality, wildlife issues, and preferred development processes. These recommendations can be used by local governments as guidance in developing ordinances for their jurisdictions.

- The Southwestern Commission Council of Governments, which covers the seven westernmost counties, is embarking on a project in conjunction with the Community Foundation of Western North Carolina called the Mountain Landscapes Initiative. The result of the pilot project will be a Tool Box containing information on best practices for our mountains and watersheds that can be used by property owners, contractors, and developers. Additionally, it will provide resources to local governments regarding effective long-range planning for their communities.

Perhaps one of the greatest opportunities within the Upper Little Tennessee River Basin is having a well-established group of partners that have been working together in some capacity for many years. These partners consist of non-profit organizations such as watershed associations and land trusts, state and federal government agencies, and academia. The Little Tennessee Nonpoint Source Team (LTNPST) partnership has been meeting regularly for over 12 years to discuss the protection of resources within the Upper Little Tennessee River Basin. Recently, this group has embraced the concepts behind the Conservation Action Plan and has become interested in exploring opportunities to collaborate on large-scale projects within the basin, based on strategies identified within the CAP.

PART II: CONSERVATION ACTION PLAN FOR THE UPPER LITTLE TENNESSEE RIVER BASIN

A conservation action plan is produced by following a series of steps outlined by The Nature Conservancy. Initially, focal **conservation targets** are chosen for the area in which the plan is being produced. Conservation targets can be species, species assemblages, communities, or ecological systems that are representative of the project area's biodiversity. The status, or **viability**, of a conservation target must be assessed to determine its resistance to a changing environment and its resiliency, or ability to recover under impending stresses. Assessing viability provides an opportunity to examine the current status of the conservation target, in addition to denoting a desired future condition of the target. The next step involves ranking **threats**, or those conditions that may limit the viability of a target. Threats are ranked based on the following three categories: severity, or the level of damage it may cause; scope, or the geographic range of potential damage; and irreversibility, a measure of the degree to which the threat could be reversed. Based on the viability analysis and threat rankings, **conservation strategies** can be developed to help conserve or restore targets. These strategies outline necessary steps to achieve the desired outcome for the target of interest. In order to determine the success of a particular strategy, **monitoring** must be incorporated into the strategy design. **Strategy effectiveness monitoring** measures how a strategy is accomplishing the intended objective by monitoring a series of outlined steps. **Status monitoring** is used to assess current trends and provides data that can be used to confirm overall health of a target or indicate potential problems. It can be a particularly useful tool in providing baseline data.

The conservation action plan and its component pieces (targets, viability analysis, threats, and conservation strategies) were identified and ranked during facilitated discussions of local and regional experts at several workshops throughout 2007 (see Figure 2 and Appendix I for timeline and list of attendees at each workshop). The results of these facilitated discussions were then shared with members of the larger stakeholder group and updated based on their feedback.

Box 2.
Focal Conservation Targets – A limited suite of species, communities, and ecological systems that are chosen to represent and encompass the full array of biodiversity found in a project area. They are the basis for setting goals, carrying out conservation actions, and measuring conservation effectiveness. In theory, conservation of the focal targets will ensure the conservation of all native biodiversity within functional landscapes.

Nested Targets - Species, ecological communities, or ecological system targets that are represented by the focal conservation targets. Nested targets are finer scale elements that are represented by and would be conserved by protecting the focal conservation targets.

Conservation Targets

The first step in the CAP process is to identify focal conservation targets for the project area. Focal conservation targets and their associated nested targets are a limited suite of species, ecological communities, and ecological systems that are chosen to represent and encompass the biodiversity found within the project area (see Box 2). If these targets are successfully conserved, then the assumption is that other biodiversity within the region should also be conserved. Within the Upper Little Tennessee River Basin, the group selected six conservation targets to represent the full range of aquatic biodiversity (Table 1). The nested targets chosen are species or communities that serve as finer scale representative examples of the overall conservation targets.

Table 1. Focal Conservation targets and associated nested targets for the Upper Little Tennessee River Basin.

Target	Definition	Nested Targets
Small, low-gradient headwater streams	Headwater basins, < 4 square miles, low gradient	Smoky dace, Little Tennessee crayfish, Tuckasegee crayfish, spotfin chub, wild and reproducing brook trout.
Small, high-gradient headwater streams	Headwater basins, < 4 square miles, high gradient	Tuckasegee crayfish, wild and reproducing brook trout.
Large Creeks	4-40 square miles	Hellbender, rock bass, river otter, gilt darter, and spotfin chub. Example systems of this type include Scott Creek, Savannah Creek, Cowee Creek, Burningtown Creek, and Betty's Creek.
Small and medium rivers	> 40 square miles	Sicklefin redhorse, spotfin chub, smallmouth bass, olive darter, stonecat, freshwater mussel assemblages, Appalachian elktoe, littlewing pearlymussel, biota of the Needmore Tract, hellbender, ducks, river otters. Example systems of this type include the Tuckasegee River, Oconaluftee River, the Little Tennessee River (up to about Darnell Creek), Cullasaja River up to about the falls and Cartoogechaye Creek up to Wayah Creek.
Riparian habitats	Habitat adjacent to all waterbodies within the basin	Montane alluvial forests, river canebrakes, floodplains, ducks, hemlock, Virginia spiraea. Riparian habitats in this region are a major neotropical and other bird migration corridor through the Blue Ridge
Wetland communities	Wetland types within the basin identified by Schafale and Weakely (1990)	Southern Appalachian Bogs Southern Subtype, Swamp Forest Bog Complex Typic Subtype, High and Low elevation seeps, bog turtle, red burrowing crayfish, ducks

Viability

Viability is defined as the status or “health” of a conservation target. Viability indicates the ability of a conservation target to withstand or recover from most natural or anthropogenic disturbances and thus to persist for many generations or over long time periods.

The first step in assessing a target’s viability is identifying its **key ecological attributes (KEAs)**. Key ecological attributes are aspects of a target’s biology or ecology that, if missing or altered, would lead to the loss of that target over time. Key ecological attributes are grouped into one of three different categories: size – measure of the area or abundance of the conservation target; condition – measure of the biological composition, structure, and interactions of the conservation targets; landscape context – assessment of ecological processes, regimes, or connectivity necessary to maintain the conservation target. Within the Upper Little Tennessee, selected KEAs fit into either the condition or landscape context category. Key ecological attributes identified for the Upper Little Tennessee River Basin targets were:

+ Connectivity between a stream and the next larger order stream
+ Connectivity within a stream
+ Functioning riparian buffer
+ Thermal regime, sediment load
+ Water quality
+ Biotic integrity
+ Channel substrate
+ Hydrologic regime - (timing, duration, frequency, extent)
+ Network of linear connectivity in riparian buffer
+ Species composition / dominance in riparian buffer
+ Condition of surrounding landscape vegetation
+ Condition of surrounding landscape in terms of hydrology
+ Hydrology, soil condition, vegetation in wetlands

For each key ecological attribute, an indicator was identified and rated for all relevant targets (see Table 2 for an example of KEAs, indicators, and their ratings from the Upper Little Tennessee River Basin). Although key ecological attributes are specific descriptions of an aspect of a target, they are generally still too broad to measure or assess in a cost-effective manner over time. To this end, it is important to develop indicators that can be used to assess the attribute over time. An **indicator**, in simplest terms, is what you measure to keep track of the status of a key ecological attribute. For example, "Presence of Brook Trout" was used as an indicator of the key ecological attribute, "Thermal regime, water quality, sediment load". Each KEA was assigned a current rating based on selected indicators and also a desired rating, or a rating that is realistically achievable for a conservation target.

Table 2. An example of two key ecological attributes (KEAs), associated indicators, and viability ratings for the Small, low-gradient headwater streams conservation target.

Conservation Target	Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Rating	Desired Rating
Small, low-gradient headwater streams	Landscape Context	Connectivity within a stream	Presence/ absence of various barriers - Private lands	More than 1 barrier/1 mile	**More than 1 barrier/5 miles**	*Less than 1 barrier/10 miles*	None - entire stream without anthropogenic barriers	Fair	Good
Small, low-gradient headwater streams	Landscape Context	Connectivity within a stream	Presence/ absence of various barriers - Public lands	More than 1 barrier/1 mile	**More than 1 barrier/5 miles**	Less than 1 barrier/10 miles	*None - entire stream without anthropogenic barriers*	Fair	Very Good
Small, low-gradient headwater streams	Landscape Context	Functioning Riparian Buffer	Percent stream length and width (average) with native vegetation - Private	**< 25 %**	> 50 % length and at least 60 ft on both sides	*> 75 % of length and At least 60 ft on both sides*	> 300 ft wide with natural woody vegetation (100 %)	Poor	Good
Small, low-gradient headwater streams	Landscape Context	Functioning Riparian Buffer	Percent stream length and width (average) with native vegetation - Public	< 25 %	> 50 % length and at least 60 ft on both sides	**> 75 % of length and At least 60 ft on both sides**	*> 300 ft wide with natural woody vegetation (100 %)*	Good	Very Good

The ratings for all indicators were then rolled up across conservation targets to provide an overall assessment of the current status of the targets within the project area. The overall rating for the viability of the Upper Little Tennessee River Basin is considered to be fair; with wetland habitat types garnering a good rating, Large Creeks a poor rating, and all other targets considered to be in the fair category (Table 3). The ratings for each indicator were based largely on expert assessment, with some reference to the literature and previous reports (e.g., North Carolina Wildlife Resources Commission, unpublished data; Sutherland and Meyer 2007; NC WRC 2005; NC DWQ 2007).

The implication of these low ratings is that the freshwater habitats and species in the Upper Little Tennessee River Basin are currently under high levels of stress and action should be taken quickly in order to ensure their future survival. Of particular concern are Large Creeks, which are considered to be in poor condition. A poor rating means that if this system type remains in this condition for an extended period, restoration or prevention of extirpation of the target will be practically impossible (e.g., it will be too complicated, costly, and/or uncertain to reverse the alteration).

Table 3. Viability rankings of conservation targets in the Upper Little Tennessee River Basin.

Conservation Targets		Overall Viability Rank
1	Small, low-gradient headwater streams	**Fair**
2	Small, high-gradient headwater streams	**Fair**
3	Small and medium rivers	**Fair**
4	Riparian habitats	**Fair**
5	Wetland communities	**Good**
6	Large Creeks	**Poor**
Overall Project Biodiversity Health Rank		**Fair**

Threats

The next step in the CAP process is to determine threats within the project area. **Threats** are conditions that negatively impact and ultimately limit the viability of conservation targets. We first identified direct threats that exist within the basin. **Direct threats** are defined as the proximate activities that directly have caused, are causing, or may cause the degradation and/or impairment of focal conservation targets (e.g., logging). It is important to distinguish between direct threats (also called sources of stress) and stresses. **Stresses** are impaired aspects of conservation targets that result directly or indirectly from human activities (e.g., low population size, reduced extent of forest system; reduced river flows; increased sedimentation; lowered groundwater table level). For example, if logging is the direct threat, then the resulting stress on the target might be increased sedimentation. In our analysis we focused on identifying the direct threats and then ranking them in terms of their **severity**, **scope**, and **irreversibility** (Box 3). These rankings were then rolled up into an overall ranking of Very High, High, Medium or Low for each threat.

We defined those threats that rated either Very High or High based on their impact on the focal conservation targets as

Box 3. Types of Threat Ranking

Severity – The level of damage to the conservation target that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

Scope – Most commonly defined spatially as the geographic scope of impact on the conservation target at the site that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

Irreversibility – The degree to which the effects of a source of stress can be reversed.

critical threats (Table 4). These are the threats that are most problematic for the conservation targets. Thus, they provide guidance as to which strategies are going to be most important for conserving the targets over the long-term. Chief among the critical threats is uncontrolled development (called, "Land conversion and clearing (from forest/agriculture to commercial/residential)"). For example, Macon County's population grew 33.5 percent from 1990 to 2003 (US Census 2002, 2005). Examples of the stresses that this threat causes to the conservation targets are excessive runoff of sediment and flash flooding of streams and rivers. As impervious surfaces increase within a basin, streams and rivers are under increasing stress due to flashier flow regimes. At a threshold of about 10% impervious cover, the hydrologic regime is expected to change enough that sensitive stream elements are lost from the system (Booth 1991; Klein 1979; Limburg and Schimdt 1990).

Other top threats within the basin are existing roads and bridges, acid deposition, climate change, poor landuse practices (residential/recreational), and existing dams. Existing roads and bridges often act as barriers to the movement of species within the aquatic environment, as well as adding to impervious surface cover and providing a conduit for stormwater runoff. Acid deposition degrades aquatic habitats by lowering the pH. Acidic conditions can limit biological diversity both directly and indirectly by rendering certain toxic materials found in nature, such as aluminum, more toxic to aquatic life. Sources of acid deposition in the Upper Little Tennessee River Basin are automobile traffic and power plants, primarily located outside of the basin. Climate change is a particularly unpredictable threat. However, its scope is likely to be widespread and irreversible. Greater and more frequent fluctuations of temperature and precipitation and an increase in magnitude (and perhaps frequency) of tropical storms are potential effects of climate change. Floods, droughts, and unseasonable temperatures would have large impacts on aquatic species (Poff et al. 2002). Poor landuse practices include the application of chemicals to the land, floodplain and wetland filling, draining, paving, and eliminating riparian buffers or other vegetative cover. These practices contribute to the pollution and degradation of aquatic systems. Finally, existing dams not only act as a barrier to the movements of aquatic species, but also can significantly alter the thermal and hydrological regime of a river. Both of these affect the life history of many aquatic species and can cause population declines or extirpations, in the most extreme cases.

The full list of threats, definitions, and their rankings are given in Appendix II.

Table 4. Critical Threats. Threats with an overall ranking of Very High or High within the Upper Little Tennessee River Basin. Also shown is the ranking of each of these threats to the individual targets.

	Threats Across Targets	Small, low-gradient headwater streams	Small, high-gradient headwater streams	Small and medium rivers	Riparian habitats	Wetland communities	Large Creeks	Overall Threat Rank
	Project-specific threats	1	2	3	4	5	6	
1	Land Conversion/Clearing (from forest/ag to commercial/residential)	Very High	High	High	High	Medium	High	Very High
2	Existing Roads and Bridges	Very High	High	Medium	High	-	Medium	High
3	Acid Deposition	-	Very High	-	High	-	-	High
4	Climate Change	High	High	Medium	High	Medium	Medium	High
5	Poor Landuse Practices (residential/recreational)	High	High	Medium	High	-	Medium	High
6	Existing Dams	Medium	Low	High	High	-	Medium	High

Strategies

Developing conservation **strategies** involves deciding how to overcome critical threats and restore degraded targets. High leverage strategies are those that achieve the greatest results for the least amount of investment. Every project is challenged to develop specific strategies and to describe why these strategies were selected.

At the December 2007 meeting in Cherokee, North Carolina, more than twenty conservation professionals working within the Upper Little Tennessee River Basin met to brainstorm and select a set of conservation strategies that are expected to reduce critical threats and conserve the conservation targets of the basin. As a basis for the discussion, the group reflected upon a simple conceptual model, constructed based on the targets, threat ranking, and discussions on the root causes or drivers of these threats at the December 2006 workshop (Figure 4). A conceptual model is a visual method (diagram) of representing a set of causal relationships between factors that are believed to impact one or more biodiversity targets. It portrays graphically the situation at the site and provides the basis for determining where to intervene with strategic activities.

During the brainstorming session in Cherokee, the group came up with eleven main strategies that were most promising for addressing critical threats (Box 4). The group further narrowed this list by placing higher value on those strategies that: 1) could most benefit from the combined efforts of members of the LTNPST and 2) would avoid duplicating ongoing efforts of individual organizations in the basin. For example, the removal of problem barriers and acquisition of key wetland and riparian areas are both strategies that are currently being implemented by one or more members of the LTNPST. The group chose the following strategies to flesh out in greater detail: 1) Seek greater protection for all waters that support listed species through NCDWQ's Site-Specific Management Plans (SSMP); 2) Address planned and proposed inter-basin water transfers; and 3) Promote good landuse planning and associated ordinances (Appendix III). Several of the other strategies listed in Box 4 are nested as actions needed to achieve these strategies, including addressing knowledge gaps on stormwater runoff, providing natural resource economic analyses, and telling the story of the natural and cultural heritage of the basin.

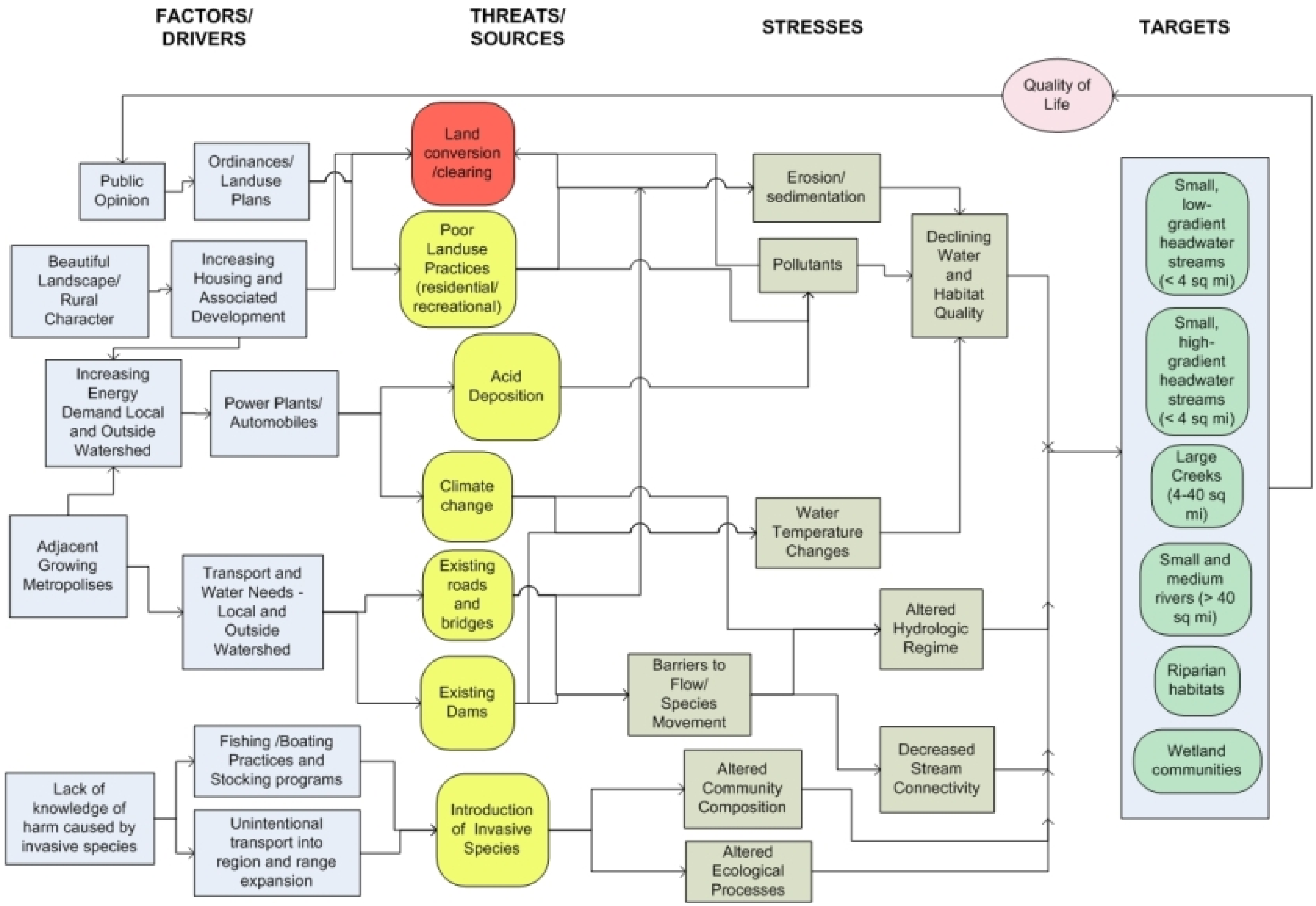


Figure 4. Conceptual model of the Upper Little Tennessee River Basin CAP. Factors/drivers are in light blue, threats/sources are in red (highest threat level) and yellow (high threat level), stresses are in grey, and targets are in green.

Box 4. Strategies Brainstormed at December 2007 CAP Workshop:

1) **Adoption of NCDWQ Site-Specific Management Plans (SSMP) for all waters that support listed species**
2) **Remove Problem Barriers**
3) **Land Acquisition of Key Wetland and Riparian Areas**
4) **Provide Natural Resource Economic Analyses to Promote Good Landuse Planning**
5) **Address knowledge gaps on Stormwater Runoff (scope of quantity and quality of problems) in order to advance management practices**
6) **Promote Good Landuse Planning and Associated Ordinances**
7) **Address Failing Sewer Line Infrastructure**
8) **Improve National Pollution Discharge Elimination System (NPDES) Content and Management**
9) **Increase Water Quality in Non-incorporated Areas/Grey Water**
10) **Address planned and proposed Inter-Basin Water Transfers**
11) **Tell the Story of the Value of the Natural and Cultural Heritage of the Upper Little Tennessee River Basin**

Monitoring

Monitoring is an important aspect of any type of conservation initiative. It is necessary to determine if particular conservation actions are producing desired results or are having effective outcomes. Within the framework of Conservation Action Planning, there are two main types of monitoring that may be used for evaluation: conservation status and strategy effectiveness monitoring. Status monitoring is used to assess current conditions and trends. It may be conducted over an extended period of time and involves gathering various types of information or data. Status monitoring can provide a measure of overall success or provide an early warning of change that may be occurring. Status monitoring can be conducted independently of specific conservation actions, although the results may be used to inform a variety of actions. Strategy effectiveness monitoring is used specifically to determine if a particular strategy has had the intended impact on a designated target or threat. This type of monitoring is incorporated into the design of a conservation strategy to better inform the outcome.

Within the Upper Little Tennessee River Basin Conservation Action Planning area there are two major rivers. One is the mainstem Little Tennessee River that flows from Georgia through Franklin to Fontana Reservoir, then below Fontana Reservoir into Tennessee. The second is the Tuckasegee River that begins in Jackson County and flows through Sylva and Bryson City before joining the Little Tennessee River at Fontana Reservoir. Although these are both part of the overall basin, there are fairly significant differences in the amount and type of aquatic data that have been collected in these subbasins. The Little Tennessee Watershed Association (LTWA), which focuses on the mainstem Little Tennessee River and tributaries upstream of Fontana Reservoir, has been collecting data on the fish communities since 1999. Their program is a continuation of work begun by the Western North Carolina Alliance ten years prior, such that data collection has been ongoing for 19 years. This biomonitoring program has provided data to inform decisions and keep track of the general health of the system. The Watershed Association of the Tuckasegee River (WATR) has partnered with the Volunteer Water Information Network (VWIN) program at the University of North Carolina-Asheville to gather water quality data on the Tuckasegee River and tributaries.

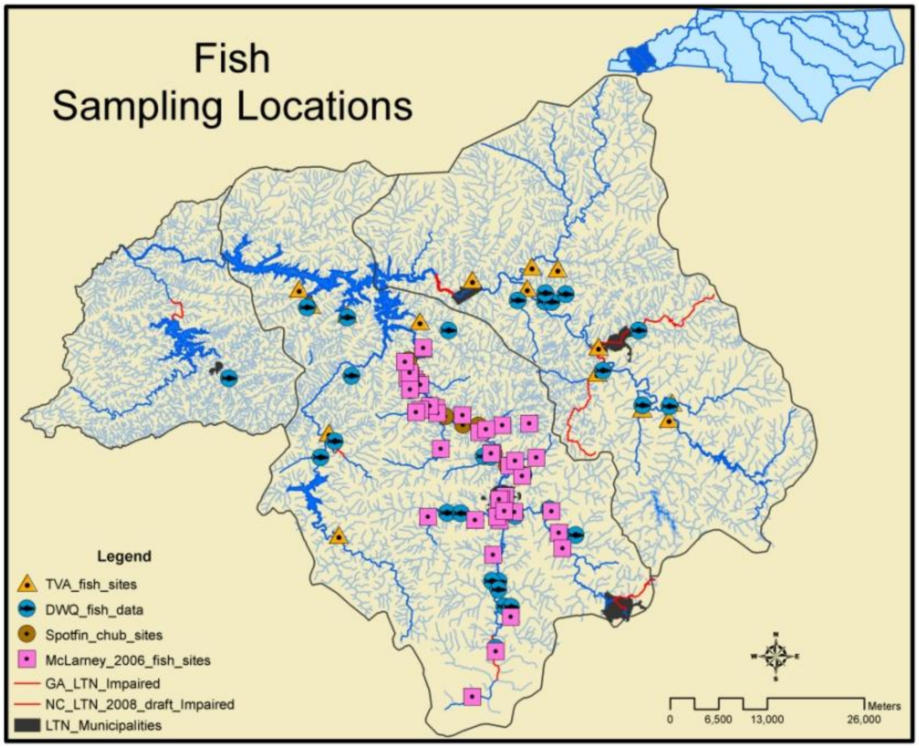
Volunteers gather monthly water samples at set stations which are analyzed for various water quality parameters, such as turbidity and fecal coliform. This type of water quality monitoring can provide an early alert for potential problems in the watershed; however, collected water samples are not linked to the hydrograph and therefore it may be difficult to analyze trends associated with storm events within the watershed. The Upper Cullasaja Watershed Association (UCWA) also collects water quality data through the VWIN program.

(see Figure 5 for locations of monitoring sites within the Upper Little Tennessee River Basin).

The North Carolina Division of Water Quality (NCDWQ) has established fish and benthic macroinvertebrate monitoring sites. These are sampled once every five years and the results are used to update and produce the Little Tennessee River Basinwide Water Quality Plan, compiled every five years. Additionally, NCDWQ has five ambient stations (two on the mainstem Little Tennessee River, one on the Cheoah River, one on the Nantahala River, and one on the Tuckasegee River) where they gather monthly water quality samples to analyze a variety of physical, chemical, and bacterial pathogen parameters. These monthly samples are not, however, linked to the hydrograph and therefore it may be difficult to use them in assessing and analyzing trends within the watershed.

The Tennessee Valley Authority (TVA) also has fish and benthic macroinvertebrate biomonitoring stations in the basin that are sampled on a five year rotational basis. These data, like the previously mentioned, can be used for trend assessment.

The North Carolina Wildlife Resources Commission (NCWRC) established monitoring sites along the mainstem Little Tennessee River in 2004 for mussel communities and in 2007 for spotfin chub. Mussel sites will be sampled at five-year intervals. Spotfin chub monitoring will occur annually for 10 years and is intended to satisfy monitoring criteria prescribed in the U.S. Fish and Wildlife Service Recovery Plan for the species. Priority crayfish populations are also monitored by NCWRC and include specific surveys every five years (began in 2005). In 2009, mussel communities will be sampled within the mainstem Little Tennessee River and also at several sites within the Tuckasegee River. Additionally, fish sampling stations will be established at sites not already covered by NCDWQ, LTWA, or TVA fish biomonitoring regimes. This sampling will target the full diversity of fish, not strictly spotfin chub as previously mentioned.



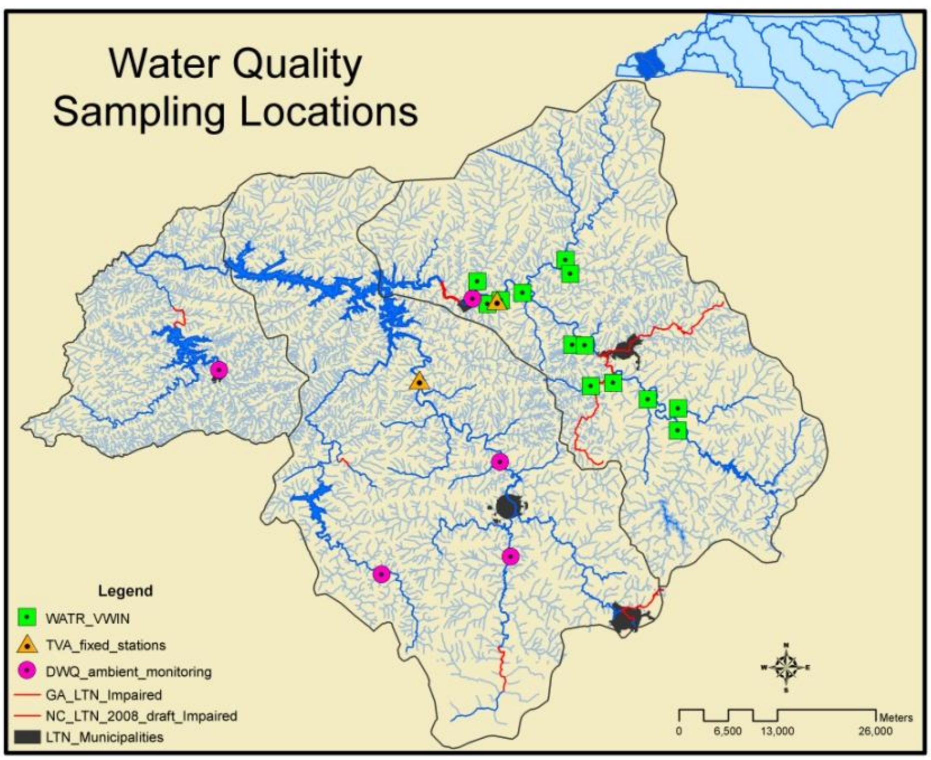


Figure 5. Water quality and fish sampling locations within the ULTN Basin.

Overall, there appears to be more water quality sampling data available for the Tuckasegee River subbasin and more biomonitoring data available for the Little Tennessee River subbasin. This is primarily due to WATR's VWIN monitoring and LTWA's biomonitoring program.

Based on discussions held with stakeholders at the December 2007 CAP workshop in Cherokee, North Carolina, there is a recognized need for targeted water quality monitoring during high flow events. Currently, there is no monitoring within the watershed that correlates samples with the hydrograph, therefore making it difficult to show connections between such things as rain events and increased sedimentation or pollution outflows. This type of monitoring would provide valuable insights into perturbations within the watershed that would then allow for more targeted sampling and research efforts.

Western Carolina University (WCU) has recently formed an Institute for Watershed Research and Management (IWRM) which will likely be involved in any new monitoring protocols established as a result of the CAP. There are a variety of avenues in which to involve IWRM, from acting as a data repository to conducting research on watershed level issues that may arise from targeted monitoring.

Additionally, there may be opportunities to collaborate with the North Carolina Ecosystem Enhancement Program (NCEEP) as they are beginning a Local Watershed Plan that will cover a 150 square mile area between Franklin and Fontana Reservoir. The purpose of this Local Watershed Plan is to develop a set of locally relevant management strategies to protect and restore aquatic resources of the watershed.   These strategies will include the identification of priority areas for stream and wetland restoration and preservation within the watershed. A detailed watershed assessment involving both intensive GIS analysis and field monitoring will be performed, and there will be involvement from multiple stakeholders within the basin.

There are multiple questions that should be answered by a status monitoring program within the Upper Little Tennessee River Basin. Primary among these is the need to gain a better understanding of distribution trends of aquatic fauna within the basin – fish, mussels, crayfish, snails, and benthic macroinvertebrates. An initial step in this process is to gather all existing data for the basin from partners such as NCDWQ, NCEEP, LTWA, WATR, EBCI, Coweeta Hydrological Laboratory, Great Smoky Mountains National Park, TVA, and NCWRC. After obtaining information on existing monitoring and known species, it is possible to fill in gaps pertaining to areas of interest and the type of future sampling needed.

Another important issue that can be addressed by status monitoring is the severity and extent of water quality problems within the basin. The first step is to gather all existing data, as noted above. For additional sampling, certain indicators must be chosen to provide the best possible assessment of water quality conditions. Options might include: dissolved oxygen, temperature, pH, fecal coliform, turbidity, total suspended solids, E. coli, chloride, mercury, nitrogen, phosphorus, nitrate, pesticides, or metals. These parameters must be defined in relation to state or other regulatory standards; for parameters in which standards do not exist, they must be defined in relation to some reference point. Additionally, sampling locations must be determined, along with the type of sampling. A mix of random and fixed sampling may be needed in areas of the watershed. Stage samplers could be placed in some areas to allow for correlations with high-flow events. Strategically placed sampling sites could give an indication of the effect of failing collection systems or sedimentation on water quality.

In summary, good baseline data exists from several groups and agencies that have been conducting long-term monitoring in the basin. The great need is to continue this status monitoring and expand its scope to meet gaps, ie, the relative lack of biomonitoring in the Tuckasegee River watershed and water quality monitoring in the Little Tennessee River watershed. An appropriate goal for the partners within the Upper Little Tennessee River Basin should be to evaluate the breadth and scope of current status monitoring and develop a plan that identifies specific prioritized monitoring needs, including identification of necessary collaborations. In order to determine the effectiveness of any strategy implemented as part of the CAP, strategy effectiveness measures would additionally need to be developed, although it is likely that these could draw on the data that are already being collected in the basin.

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Appendix I.   Attendees at the December 2007 CAP meeting in Cherokee, North Carolina.

Tony Able	Environmental Protection Agency Region IV
Mark Cantrell	US Fish and Wildlife Service
Paul Carlson	Land Trust for the Little Tennessee
Roger Clapp	Watershed Association of the Tuckasegee River
Darron Collins	World Wildlife Fund
Wes Cornelison	Eastern Band of Cherokee Indians
Steve Foster	North Carolina State University
Steve Fraley	North Carolina Wildlife Resources Commission
Anita Goetz	US Fish and Wildlife Service
Kayla Hudson	Natural Resource Conservation Service
Brad Huffman	US Geological Survey
Doug Johnson	Macon Soil and Water Conservation District
Linda Johnson	Watershed Resident
Mike LaVoie	Eastern Band of Cherokee Indians
Tom Massie	Clean Water Management Trust Fund /Jackson County Commissioner
Christine McKay	Environmental Protection Agency Region IV
Bill McLarney	Little Tennessee Watershed Association
Jerry Miller	Western Carolina University
Daniel Perlmutter	Watershed Association of the Tuckasegee River
David Ray	The Nature Conservancy – Asheville
Angie Rodgers	North Carolina Natural Heritage Program
Jenny Sanders	Little Tennessee Watershed Association
Michele Thieme	World Wildlife Fund
Dave Toms	North Carolina Division of Water Quality -Raleigh (Basinwide Planning)
Cathy Tyndall	North Carolina Division of Water Quality – Asheville
Erica Wadl	Tennessee Valley Authority

Appendix II. Threats

	Threats Across Targets	Small, low-gradient headwater streams	Small, high-gradient headwater streams	Small and medium rivers	Riparian habitats	Wetland communities	Large Creeks	Overall Threat Rank
	Project-specific threats	1	2	3	4	5	6	
1	Land Conversion/Clearing (from forest/agriculture to commercial/residential)	Very High	High	High	High	Medium	High	Very High
2	Existing Roads and Bridges	Very High	High	Medium	High	-	Medium	High
3	Acid Deposition	-	Very High	-	High	-	-	High
4	Climate Change	High	High	Medium	High	Medium	Medium	High
5	Poor Landuse Practices (residential/recreational)	High	High	Medium	High	-	Medium	High
6	Existing Dams	Medium	Low	High	High	-	Medium	High
7	New Roads and Bridges	Medium	Medium	Low	High	Medium	Low	Medium
8	Poor Landuse Practices (agriculture, forestry, livestock management)	High	Medium	Medium	Low	Low	Medium	Medium
9	Proposed Highways (I3 and 9A)	High	Medium	Low	Medium	-	Low	Medium
10	Existing Industrial and Municipal Point Source Pollution and any associated	Low	-	High	-	-	Medium	Medium
11	Channelization (historic, existing, and future)	High	Low	Low	Low	-	Low	Medium
12	Future Interbasin Water Transfers	Low	Low	High	-	-	-	Medium
13	Future Small Dams	High	Low	-	-	-	-	Medium

14	Failing Package Plants	Medium	Medium	Medium	Low	-	Medium	Medium
15	Invasive Animals	Medium	-	Medium	Low	-	Medium	Medium
16	Woolly Adelgid	Low	Medium	Low	Medium	Low	Low	Medium
17	Invasive Wetland/Riparian Plants	Low	-	Low	Medium	Medium	Low	Medium
18	Existing Dam Operations	-	-	Medium	-	-	Medium	Medium
19	Chemical Spills	Low	Low	Medium	-	-	Low	Low
20	Illicit Discharge - Residential	Medium	Low	Low	-	-	Low	Low
21	Illicit Discharge - Commercial	Medium	-	Low	-	-	Low	Low
22	New Point Source Pollution	Medium	-	Low	-	-	Low	Low
23	Direct Wetland Conversion	-	-	-	-	Medium	-	Low
24	Inappropriate Vegetation Management	-	-	-	-	Medium	-	Low
25	Inappropriate ORV Use	Low	Low	Low	Low	Low	Low	Low
26	Straight Pipes	Low	Low	Low	-	Low	Low	Low
27	Failing Septic Systems	Low	Low	-	-	Low	-	Low
28	Poor Aquaculture Practices	Low	-	Low	-	-	Low	Low
29	Recreational Gem Mining	Low	-	Low	-	-	Low	Low
30	Invasive Aquatic Plants	-	-	Low	-	-	Low	Low
Threat Status for Targets and Project		Very High	Very High	High	Very High	Medium	High	Very High

Threat Definitions and Notes:

Acid Deposition: Atmospheric acid deposition is a complex chemical and atmospheric phenomenon that occurs when emissions of sulfur and nitrogen compounds and other substances are transformed by chemical processes in the atmosphere, often far from the original sources, and then deposited on earth in either wet or dry form. The wet forms, popularly called "acid rain," can fall as rain, snow, or fog. The dry forms are acidic gases or particulates. Acid deposition can affect the chemistry of soils and acidify freshwater systems, adversely affecting the organisms that live within these systems. Sources of acid deposition for this region are power plants primarily outside of the basin and automobile traffic.

Channelization (historical, existing, and future): The straightening of rivers or streams by means of an artificial channel. Stream channelization significantly changes the character and habitat of a stream system and can have significant impacts on hydrology and biology.

Chemical Spills: Accidental discharges of chemicals into aquatic systems, e.g., from overturned vehicles or accidental discharge from a factory.

Climate Change: Expected effects of climate change on freshwater systems in the basin within the next ten years. There was a lot of debate on this one because of its inherent unpredictable nature. Expected effects include greater and more frequent fluctuations of temperature and precipitation causing floods, droughts, and unseasonable temperatures and the increase in magnitude (and perhaps frequency) of tropical storms.

Direct Wetland Conversion: Loss of wetland habitats through direct conversion, e.g., mowing of wetland vegetation, wetland filling, extraction of water for irrigation.

Existing Barriers: This threat is defined as both dams and culverts, and includes informal damming for irrigation or to create swimming holes. Barriers block the movement of species and can alter the hydrology.

Existing Dam Operations: Water releases from a dam affect the downstream flow regime, and in some cases, temperature regime, affecting the timing, magnitude, and duration of flood events. Large storage reservoirs in the upper Tuckasegee and Nantahala River systems capture water in the late winter and spring and release it as needed for hydropower throughout the year. Cold water is drawn from deep in these reservoirs to produce power, which significantly lowers water temperatures downstream. Many aquatic species' life histories depend on natural flow and temperature regimes and thus are significantly affected by some existing dam operations.

Existing Industrial and Municipal Point Source Pollution and any associated Failing Infrastructure: Includes both the illicit discharge from the waste water treatment plants (WWTPs) and from the failing infrastructure. Includes WWTP NPDES (National Pollutant Discharge Elimination System) and MS4 (Municipal Separate Storm Sewer System) NPDES. The major problem with WWTPs in the LTN basin is the aging pipelines that are "upstream" of the actual plant and resultant leakage from them.

Existing Roads and Bridges: Roads and bridges affect both connectivity and hydrology of freshwater systems. Many roads are built alongside rivers and thus replace the riparian buffer zone. Culverts can also act as a barrier to movement for some species. The hydrology of a river changes as the amount of impervious surface within a watershed increases. Irreversibility of threat -- if funds were available to retrofit these structures to make less of an impact, it could be affordable on an individual culvert/road crossing level, but because there are so many of these, it is unaffordable overall.

Failing Septic Systems: Individual septic systems serve one family. Only complicated septic systems require an operator and routine maintenance. These systems are not periodically inspected (about one out of ten households will have the septic tank pumped out within the recommended 3 to 5 years). Individual septic systems performing adequately will treat anywhere from 120 gallons/day (gpd) to over 3000 gpd (largest systems). North Carolina has determined that there are over 1 million individual septic systems in the state and growing daily. The biggest hazard to freshwater systems from septic tanks is that they will overflow and seep fecal coliforms and nutrients into surface water.

Failing Package Plants: Package treatment plants have qualified/certified operators, are periodically inspected at the state level for operation performance, and serve hundreds of thousands of households treating maybe a million gallons a day. Package plants can cause a large failure at any given time, for example dumping 100,000 gallons of water into the river (raw sewage). After a failure, large amounts of chemicals are released into the aquatic environment to neutralize the sewage. It is this release of large amounts of harmful chemicals (liquid chlorine, hydrosulfic acid) that causes the greatest harm to aquatic species.

Future Interbasin Water Transfers: Water is increasingly prized in the southeast US and there has recently been much discussion about transferring water out of the Little Tennessee River Basin to supply growing adjacent cities.

Future Small Dams: Numerous small dams are planned to be built in the basin within the next 10 years. Dams block the movement of species and can change the hydrologic cycle and temperature regime.

Illicit Discharge-Commercial: Intentional, illegal discharge from a commercial facility.

Illicit Discharge-Residential: Intentional, illegal discharge from individual residents, e.g. dumping oil.

Inappropriate Off-Road Vehicle Use: Driving of ORVs (off-road vehicles) through creeks and rivers and adjacent riparian areas, causing direct habitat destruction and increased sedimentation.

Inappropriate Vegetation Management: Specific to wetlands habitat type and refers to management actions that degrade the vegetation of the wetland. Primarily occurs on public lands. There is some debate about vegetational succession in bogs and whether succession should be allowed to occur naturally or whether the bog system should be artificially maintained.

Invasive Animals: Invasive species can have detrimental effects on the ecosystems in which they are introduced, both in terms of direct competition and predation on native species as well as indirectly through changes in the food web and altering habitats. Examples of invasive animals already present in the Upper Little Tennessee River Basin are the yellowfin shiner, rusty crayfish, Asian clam, and Chinese jumping worm.

Invasive Wetland/Riparian Plants: Invasive plant species in aquatic systems have various effects. In addition to directly changing the species composition, they can change the structure of habitat and food availability for other species. They may also alter the hydrological cycle within a wetland or basin, depending on how widespread they are and their water consumption rates relative to native plants. Common invasive wetland and riparian plants in this region are bamboo, privet, Japanese knotweed, multi-flora rose, honeysuckle, and Japanese stiltgrass.

Land Conversion/Clearing (from forest/agriculture to commercial/residential): Includes residential and commercial development and associated road construction, indirect and direct habitat losses (e.g., associated impacts from construction). Also included is acidification as related to disturbance of Anakeesta soils in the basin, which leach acids via soil erosion.

New Roads and Bridges: With the construction of new roads and bridges comes more stream crossings and increased impervious surface coverage in the watershed. Includes secondary and cumulative impacts from increased access to region, as well as increased runoff during construction.

New Point Source Pollution: Any future sources of point source pollution that are expected within the next ten years, e.g., new factories and any facilities that require a discharge permit.

Poor Aquaculture Practices: Practices that lead to either escapees of non-native species or pathogens and/or discharge of excessive nutrients and waste from the aquaculture facilities.

Poor Landuse Practices (agriculture, forestry, livestock management):   Refers to landuse practices in agriculture, forestry and livestock management that adversely affect freshwater systems. One example would be mowing of pasture up to the edge of the stream such that there is no riparian buffer. For small, low gradient headwater streams this threat was ranked High mainly due to the presence of pastures.

Poor Landuse Practices (residential/recreational): This captures residential and recreational (i.e. golf courses) mis-application of chemicals such as fertilizers. It also includes damage incurred from construction of golf courses and poor management of any residential, commercial, or recreational property.

Proposed Highways (I3 and 9A): These two major road projects would be routed through the Upper Little Tennessee River Basin. The construction of these roads and their secondary impacts (e.g. increased road runoff) were considered.

Recreational Gem Mining: Recreational mining for gems can cause local disturbances such as increased sedimentation.

Straight Pipes: Primarily residential waste that should be going through a septic or sewage system, but that is being piped directly to a stream.

Woolly Adelgid: Woolly adelgid is an invasive insect that feeds on hemlock trees and has caused extensive mortality and decline of hemlock trees in the eastern U.S. Rich and acidic cove forests are a mix of deciduous/hemlock/rhododendron, such that these other species provide shading to the streams. There are a few small, hemlock-dominated areas within the Upper Little Tennessee River Basin. Highlands Plateau has most extensive area with hemlock-dominated forest. Loss of hemlocks in these areas could have a significant effect on riparian conditions.

Appendix III. Focal Strategies

In the break-out sessions during the December 2007 workshop, participants brainstormed plans for executing the selected focal strategies. We used TNC's terminology for defining a conservation strategy and its parts:

> ***Conservation strategy*** - Broad courses of action that include one or more objectives and the strategic actions required to accomplish each objective.
> ***Objectives*** - Specific statements detailing the desired accomplishments or outcomes of a particular set of activities within a project. Objectives are typically set for abatement of critical threats and for restoration of degraded key ecological attributes. A good objective meets the criteria of being: specific, measurable, achievable, relevant and time limited.
> ***Strategic actions*** - Interventions undertaken by project staff and/or partners designed to reach the project's objectives. A good action meets the criteria of being: linked to objectives, focused, strategic, feasible, and appropriate.

Strategy #1: Support effective strategies, reclassifications, and other water quality rules through NCDWQ and local government
Objective: By 20XX, have an effective strategy to conserve listed species in the Little Tennessee and Tuckasegee Rivers (including HQW, ORW, and Site Specific Water Quality Plan [SSMP]).

Strategic Action 1: Submit ORW request to DWQ for all pertinent waters
Strategic Action 2: Cooperate with NCDWQ and technical advisory team to revive SSMP process and move it forward

- Action Step: Support completion of Technical Guidance Document by technical advisory team (USFWS, NCWRC, NCDWQ, NCNHP) using best available information.
- Action Step: Build positive support at the government level → local government, agencies, legislature, governor, etc.; potentially work through the Mountain Landscape Initiative
- Action Step: Build positive support at the community level.
  Community level target groups:
  *Quality of life/view folks
  *Farmland preservation
  *Floodplain protection
  *Hunters/fishers – Trout Unlimited, Ducks Unlimited, National Wild Turkey Federation, Ruffed Grouse Society
  *Boy/girl scouts/4H
  *Coosa example – need more information on this initiative

Strategic Action 3: Obtain information necessary to support and implement effective water quality rules (i.e. research needs)

*Economic Analysis (university/economist→ potential partners)
*Mountain-specific BMPs – engineered alternatives that may work (e.g. sediment control → large buffers vs. engineered designs) (NCSU/WCU/Coweeta→ potential partners)
1. Synthesize what is currently available into a usable format/document
2. New Research

*Projection build-out analysis under current ORW rules

- quantification needed
- consulting firm or university could complete this work
- there is interest within DWQ to have this done
- build support for projections of development under current policies (e.g. Trout Rules)

*Range of tolerance for species for water and habitat quality parameters (e.g. Sutherland has some of this type research completed for Spotfin chub; more research needed for mussels, particularly in regards to turbidity)
* Knowledge on Stormwater Runoff Needed (scope of quantity/quality of problems)

1. Spatial idea of where sediment is entering
2. ID high priority areas for remediation and protection
3. Quality – example: runoff from pavement vs. other runoff
4. Detailed watershed assessment (CWMTF, 319$ (EBCI has used this in the past))
5. IPSI (Integrated Pollutant Source Identification) in tandem with targeted areas (modeling capability → ties to build-out analysis (SSMP)); IPSI is tied to land use, which is tied to ordinance development (CWMTF, EEP – funding possibilities)
6. Chemical constituents of runoff vs. sediment only assessment

Strategic Action 4: Review permitting protocols to examine cumulative effects
Strategic Action 5: Review enforcement of existing laws → funding needed for enforcement positions; quantify lack of enforcement – building permits vs. number of enforcement personnel

Strategy #2: Prevent Inter-Basin Transfers (IBTs) from/to the Little Tennessee River Basin.
Objective: By 20XX, prevent all interbasin transfers from and/or to the Little Tennessee River Basin.

Strategic Action 1: Conduct aquatic/socio-economic studies to address the effects of IBTs at varying levels. Public education on results of studies

Strategic Action 2: Get moratoria/prohibitions in place while studies are being conducted and while policies are being reviewed and new policies generated

Strategic Action 3: Interstate compact/understanding/cooperation is needed for management of water across state boundaries. Work at local, state, interstate, national levels:

- Local levels – encourage moratoria; education; voice concerns to state officials
- State level – lower threshold for state permitting process
- Federal level – involve TVA for weigh-in [TVA Act – Section 26A – what affects navigation/natural resources → flows/quantities/water storage/use]; interstate water commissions (need federal authorization)

*Educate ourselves on TVA Act – as a means of applying pressure
*Educate ourselves on changes to NC IBT laws (Division of Water Resources – Water Allocation study currently underway; more info can be gained at http://www.ncwater.org/Water_Supply_Planning/Water_Allocation_Study/)

Strategy #3: Promote appropriate and compatible landuse in the Upper Little Tennessee River Basin

Objective: By 20XX, Jackson, Swain and Macon Counties and the Eastern Band of Cherokee Indians have in place and are implementing:

+ the highest and best use of their floodplains, agricultural lands (ie, a farmland preservation plan), and forests
+ steep slope ordinances
+ headwater development rules (ref: Mountain Landscapes Initiative (http://www.mountainlandscapesnc.org/))
+ site-specific stormwater rules; and
+ incentives for good landuse (eg, effective "conservation subdivisions").

Strategic Action 1: Create a community cost-share program to provide incentives for good landuse practices (eg, Polk County underway, may be expanding to others)

Action Step: Lobbying by district boards, COGs to ask for funds

Strategic Action 2: Undertake economic analyses of the true costs of poor landuse planning and practices (Target Audiences: EBCI, Local Governments, Chamber of Commerce)

Types of Analyses:

1. Cost of services analysis (ie, for $1 that the county receives for a new home, the county pays out so much more in services)

Action Step: Look at Macon County analysis (from 2000) and see if relevant/useful to do something similar for Swain County (Roger and Paul to follow up)

2. Analysis of good landuse planning in Jackson County demonstrating the economic benefits of doing so. Potential funders: Foundations (including Cherokee Preservation Fund)

Action Step: Provide recognition for good works in Jackson County by nominating for Governor's award (LTLT to take lead) and possibly for Soil Conservation Society Award

3. Analysis of revenue generated by tourists/fishing/boating (ie, part of motivation for coming is beauty of the place/outdoor activities – those aspects that would be affected by poor landuse and planning). Potential funder: Cherokee Preservation Fund.

Strategic Action 3: Basin-wide GIS analysis looking at soils, buffers, impervious surfaces, etc. to determine where development currently is having and in the future would have the highest impact. This could potentially be a tool for the Council of Governments (COG). Examples of this type of analysis: Holly Creek (GA) and IPSIs (Haywood County and Hyatt Creek).
Potential Funders: USFWS Recovery funds; EPA Targeted Watershed Grant, USGS Quick response funds, Foundations

Strategic Action 4: Provide well-packaged information on landuse planning to COG – make good use of window of opportunity available.

Action Step: Ask COG for types of information that might be most useful (see above)

Strategic Action 5: "Telling the Story" of the natural and cultural heritage of the basin
Potential Funders: USFWS Public schools outreach funding; Individual donors
Outlets: Public schools, WNCW/Gary Peeples show, Field professionals sharing their experiences to public audiences

Potential components of "Telling the Story":

1. Examples of what's happening in the basin, see "The Macon Prophet" as an example
2. Pull a few of the key/compelling results from the economic analyses
3. Ecosystem services (eg, water quality and quantity) – tell the story of what is happening to them, eg tap into public concern over the drought
4. Cultural landscape story
5. Sacredness of mountains/water and what we are doing to them

Strategic Action 6: Identify who is lending for construction projects within the basin and discuss with them aligning their investment policies with sustainable development
Key Player: Local county banks (eg, Macon County Bank)

Strategic Action 7: Growth Readiness Workshops (COG as vehicle to disseminate information?)
Key Players: NCRCD, NCSU, Watershed Education for Communities and Officials, Council of Government, Extension
Potential funding sources: Local communities, Grants from EPA and TVA

Action Step: Steve Foster to inquire with extension at NCSU to see if they would be interested and how much it would cost

Appendix IV. Abbreviations and Acronyms

CAP –Conservation Action Planning
CWMTF – Clean Water Management Trust Fund
EBCI – Eastern Band of Cherokee Indians
EPA – Environmental Protection Agency
IWRM – Institute for Watershed Research and Management
LTLT – Land Trust for the Little Tennessee
LTWA – Little Tennessee Watershed Association
NCDENR – North Carolina Department of Environment and Natural Resources
NCDOT – North Carolina Department of Transportation
NCDWQ – North Carolina Division of Water Quality
NCEEP – North Carolina Ecosystem Enhancement Program
NCNHP – North Carolina Natural Heritage Program
NCRC&D – North Carolina Resource Conservation and Development
NCSU – North Carolina State University
NCWRC – North Carolina Wildlife Resources Commission
SWCD – Soil and Water Conservation District
TNC – The Nature Conservancy
TVA – Tennessee Valley Authority
ULTN –Upper Little Tennessee
USGS – United States Geological Survey
VWIN – Volunteer Water Information Network
WATR – Watershed Association of the Tuckasegee River
WCU – Western Carolina University
WWF – World Wildlife Fund

Appendix V. Little Tennessee Nonpoint Source Team Stakeholders

Buck Engineering
Cherokee Preservation Foundation
Clean Water Management Trust Fund
Coweeta Hydrologic Laboratory
Duke Power Company
Eastern Band of Cherokee Indians
Environmental Protection Agency
Fontana Lake Users Association
Jackson County
Jackson County Soil and Water Conservation District
Jackson-Macon Conservation Alliance
Land Trust for the Little Tennessee
Little Tennessee Watershed Association
Macon County
Macon County Soil and Water Conservation District
Natural Resources Conservation Service
NC Department of Transportation
NC Division of Forest Resources
NC Division of Water Quality
NC Ecosystem Enhancement Program
NC Natural Heritage Program
NC State University
NC Wildlife Resources Commission
River Network
Southwestern NC Resource Conservation and Development Council
Swain County
Tennessee Valley Authority
The Nature Conservancy
The Wilderness Society
Upper Cullasaja Watershed Association
US Fish and Wildlife Service
US Forest Service
US Geological Survey
Watershed Association of the Tuckasegee River
Western Carolina University
Western North Carolina Alliance
World Wildlife Fund