

# CHATTOOGA WATERSHED CONSERVATION PLAN








A Project of the Chattooga River Watershed Coalition, the  
Southern Appalachian Forest Coalition, and The Conservation Fund





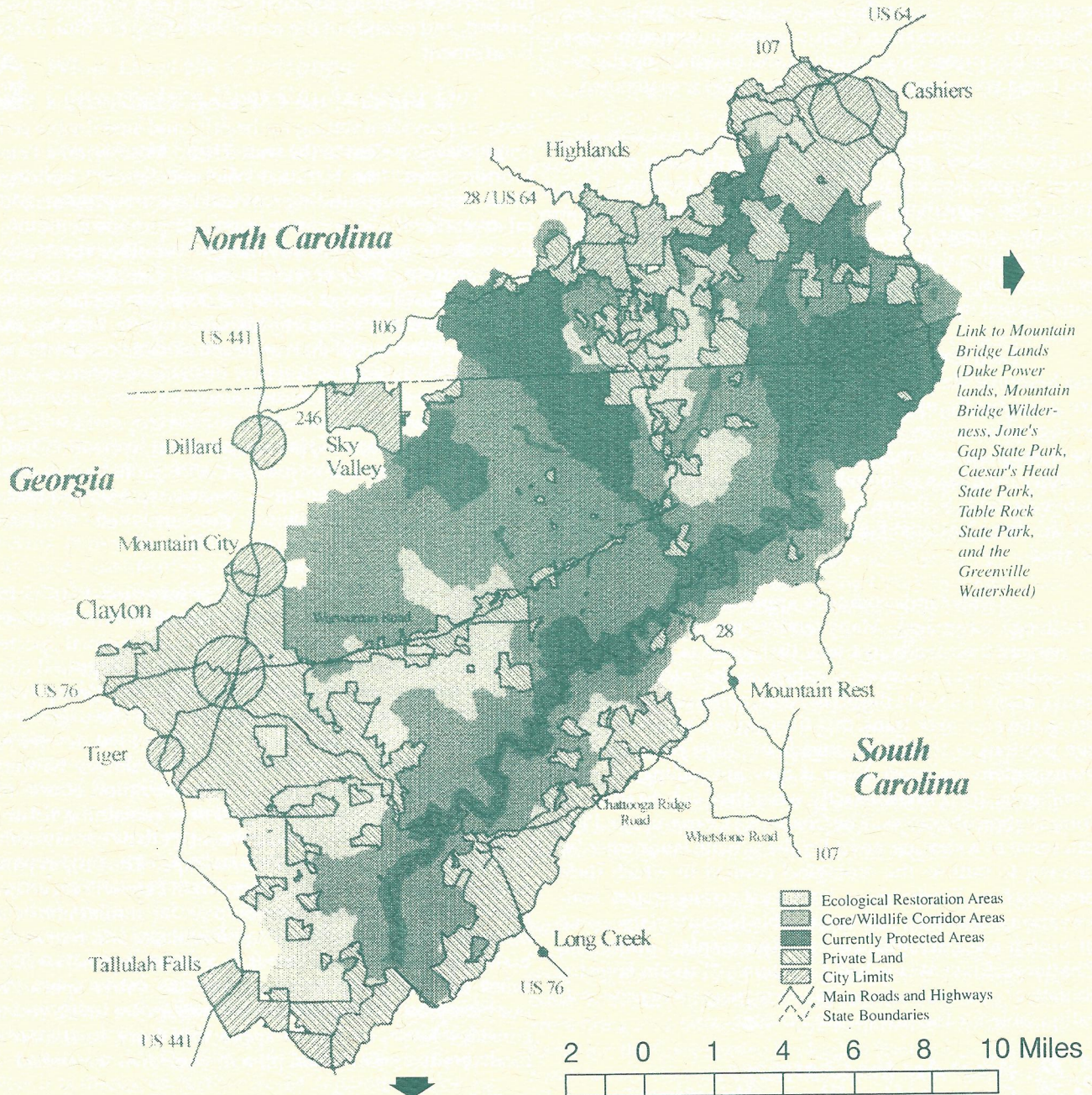
# The Chattooga Conservation Plan

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# Chattooga Conservation Plan



Link to GA Power lands, Brevard Botanical Zone (Tallulah Gorge, Panther Creek, Chauga drainage, and the new Brasstown Creek Heritage Preserve)



## I. Introduction



### *What is the Chattooga Conservation Plan?*

The Chattooga Conservation Plan is a collaborative project of the Chattooga River Watershed Coalition, the Southern Appalachian Forest Coalition, and The Conservation Fund. Using the best available information, the Chattooga Conservation Plan presents a common-sense approach to preserving, restoring and maintaining the native forest ecosystem in the Chattooga River watershed.

Public lands, which make up 70% of the Chattooga River watershed, are managed by three different national forest ranger districts in three states: the Highlands District of the Nantahala National Forest in North Carolina (23% by acreage), the Andrew Pickens District of the Sumter National Forest in South Carolina (19% by acreage), and the Tallulah District of the Chattahoochee National Forest in Georgia (58% by acreage).

Each National Forest is required to develop a Land and Resource Management Plan (LRMP), and these LRMPs are periodically updated to reflect new information on ecological resources, timber harvesting, and public sentiment for proposed management actions. The Chattooga Conservation Plan is intended to serve as a citizen's alternative in the U.S. Forest Service's LRMP revision process for the three National Forests in the Chattooga River watershed.

Private lands comprise approximately 30% of the Chattooga watershed. Many landowners here would like to manage their lands in a way that protects soil and water quality, and conserves or enhances the integrity of the native ecosystem. On the other hand, some property holders in the area may think that they cannot afford to manage portions of their land outside of "high productivity" management regimes. Even if they are willing, owners sometimes don't know exactly what they can do to reach conservation objectives. The Chattooga Conservation Plan can serve as a starting point for the private landowner by helping to outline the ecological context in which their property lies. Furthermore, land trust arrangements, conservation easements, and sustainable forestry plans, some of which are currently being implemented under the Chattooga River Watershed Coalition's "Private Forestry Initiative", can make conservation management economically viable for the private land owner.



### *What Are the Chattooga Conservation Plan's Objectives?*

The Chattooga Conservation Plan has been created to outline what steps might be taken, in this watershed, to address the regional and global issue of the conservation of biodiversity. In particular it seeks to identify, restore and protect large blocks of unfragmented forest habitat representing all native forest types in the Chattooga River watershed. Restoring and maintaining the native forest ecosystem will help to ensure the survival and flourish-

ing of native biological diversity, much of which is currently in decline locally and regionally. This will require (1) protection and restoration of forest interior and old-growth habitat for endangered and threatened animal and plant species (2) protection and restoration of aquatic habitats, and (3) maintenance and restoration of critical wildlife corridors linking adjacent natural areas within the watershed, and outside of the watershed along the Blue Ridge Escarpment.

In addition, the Chattooga Conservation Plan seeks to provide a setting for healthy and sustainable economic development in the watershed. As economist Peter Morton notes, "the National Wild and Scenic Chattooga River and the surrounding national forests represent natural assets for the four-county area and provide communities with a comparative advantage over other rural areas in diversifying their economic base ... the three national forests in the Chattooga watershed dominate the landscape, provide the scenic vistas, the hiking, camping, hunting and fishing opportunities that can retain existing residents and businesses while attracting new businesses, retirees, tourists and recreationalists to sustain the diversity of the area's economic base. As such, economic development will suffer if the forests are indiscriminately cut, recreation trails are not maintained or expanded, or if the habitat needed to sustain healthy populations of native species and hence the health of the ecosystem is not conserved" (Morton, 1995).

Finally, the Chattooga Conservation Plan is intended to be a model for others. Throughout the Southern Appalachian Bioregion, native plant and animal species are in trouble due to the lack of adequately large and connected native forest habitats. Conservation groups and activists in the region are keenly aware of the urgency of the situation, and spend much of their time defending immediately threatened fragments of native habitat. Longer-term success in regional conservation efforts requires, in addition to the protection of remaining natural areas, a strategic vision where the intact native ecosystems are also connected across the landscape. The project partners hope the Chattooga Conservation Plan will serve as a prototype watershed protection plan for similar efforts in other parts of the Southern Appalachians, and that eventually these efforts will result in a connected network of forest habitats adequate to support the native species of our bioregion. While reading this report, we invite you to consider how you might apply this work to initiate a biodiversity conservation plan in your own watershed.



### *Envisioning the Scope of the Chattooga Conservation Plan*

The Ellicott Rock Wilderness Area, the Blue Valley Experimental Forest, the Overflow Semi-Primitive Recreation Area, and the Rabun Bald, Rock Gorge and Terrapin Mountain Roadless Areas are significant blocks of mature forest, each containing fragments of old growth forest and tracts of maturing second-growth forest. Nearby are other areas of mature forest, isolated old growth frag-



ments in the central and southern portions of the watershed, and several specially protected areas. The Chattooga Wild and Scenic River Corridor serves to connect them all. Together, if properly designated and managed, these areas could form a viable core of mature interior forest habitat needed by so many of our native species, especially those currently in decline. With the addition of wildlife corridors, both within the watershed and to adjacent special forests outside the watershed, the plan is a feasible first step toward restoring the biological integrity of the Southern Appalachian region.



### ***What Does the Chattooga Conservation Plan Do, And Not Do?***

The ultimate objective of conservation planning is to protect endangered and threatened species from becoming extinct, rare species from becoming endangered, and native diversity from being diminished. Ideally, specific targets for key elements of biodiversity (e.g., particular species and populations) are identified and prioritized for conservation, and then monitored to measure the success of the plan. In this way, selected species and communities are used as indicators of the viability of habitat and landscape processes present within the region of interest. The focus on "target elements" has its problems, however, in that records of "element" occurrence typically don't recognize the needs of many organisms. For example, invertebrates and other "primary producers," and wide-ranging, area-sensitive species are generally ignored in favor of conspicuous, more easily monitored species such as flowering plants. In addition, using specific "target elements" as a measure of success presents a significant challenge if the habitat suitabilities of multiple rare species over many sites are to be statistically powerful.

In the Chattooga watershed, basic information on population demography and viability for many species of interest was lacking. Developing a plan based on target elements was not practical for this area (although ecological monitoring planned for some areas will provide an indication of the plan's success). The Chattooga Conservation Plan focuses on unfragmented forests, providing habitat for interior forest species in decline such as black bear, songbirds, salamanders and others, interconnected by corridors—an approach oriented toward ecosystems rather than species. It recognizes what Franklin (1993) calls "the fundamental impossibility of dealing with more than a small fraction of existing diversity on a species basis." We do not contend that species-based efforts should be abandoned, but rather that the immense and urgent work of preserving as much biological diversity as possible presents certain limitations. The logic behind this ecosystem approach is discussed further in the separate section below.

Collection of baseline data on wildlife in several study areas is planned, however. Timber sales approved in the area of the Tuckaluge timber sale in the Chattahoochee National Forest provide an opportunity for controlled study of the effects of logging. Projects for monitoring water quality, estimating population viability for selected species, and assessing the impact of recreation are also underway. The collaborators of this project welcome

input from citizens, scientists and state and federal agency personnel in developing projects for assessment and monitoring.

The Chattooga Conservation Plan proposes three special management areas in the Chattooga River watershed: (1) Core/Wildlife Corridor Protection Areas, (2) Cooperative Ecological Restoration Management Areas; and (3) Sustainable Economic Development Management Areas. The location of these management area designations within the watershed considers three elements: geography (naturally-occurring hydrological units), ownership (location of already protected lands, and their surroundings), and widely accepted principles of conservation biology and watershed management (designing of reserves featuring core, corridor and buffer zones). Management actions prescribed in the watershed's three LRMPs should be coordinated with one another, and be consistent with the Plan's recommended activities in each area (see section IV). The management area designations proposed here can serve as a guide to policy makers and private land owners for specific land management activities, and for the development of incentives for land stewardship to encourage the implementation of conservation management.

The Chattooga Conservation Plan places few restrictions on activities in the Core/Wildlife Corridor Protection Areas which already support legal hunting and fishing and limited trail development. In areas between Core/Wildlife Corridor Protection Areas and more densely populated areas in the watershed (including Clayton and Mountain City in Georgia, Highlands and Cashiers in North Carolina, and Whetstone and Long Creek in South Carolina), Cooperative Ecological Restoration Management Areas are proposed. The Plan encourages these restoration areas to support limited roads, forest, stream and wildlife restoration projects including selective logging, recreational development such as campgrounds and picnic areas, as well as legal hunting and fishing. Finally, in areas of the watershed towns themselves, the Chattooga Conservation Plan proposes Sustainable Economic Development Areas to encourage the development of sustainable and local economic structures. Specific activities promoted for each of these areas are outlined in section IV.

The Chattooga Conservation Plan calls for no heavy-handed regulatory regimes to affect private land owners in the watershed area. Instead, financial incentives (such as tax relief for conservation easements) and other voluntary agreements will benefit landowners who are willing and interested. The majority of private lands lie within the Cooperative Ecological Restoration Management Areas. Owners would have the opportunity to benefit from future educational programs focusing on ways to maintain and enhance their land's natural capital assets. The few private land owners within the Core/Wildlife Corridor Protection Areas would be encouraged to consider the conservation benefits and economic viability of participation in the Chattooga River Watershed Coalition's Private Lands Forest Stewardship Initiative. In addition, we are presently seeking opportunities for environmentally responsible and socially beneficial economic development projects within the watershed towns them-



selves, such as comprehensive county planning, "greenway" development for enhanced visitation to local businesses, and incentives for sustainable agriculture and local markets development.

In summary, this plan is a first-cut attempt at fashioning a more environmentally-friendly forest plan alternative. Baseline data collection, long-term monitoring, and sustainable economic development are also essential components of a long-term plan to restore, maintain and manage the native forest ecosystems of the Chattooga watershed.



### ***The Chattooga Conservation Plan Builds on Recent Success***

Twenty-five years ago, Georgia's pre-eminent ecologist and founder of the University of Georgia's Institute of Ecology, Eugene Odum, recommended that at least 40% of the land area of the region remain or be restored to natural forest communities. He argued that this amount of protection would be necessary to retain the full range of species and life processes that currently exist throughout the Southeast. Since then, habitat loss has been recognized as the single greatest cause of extinction; reversing our current rate of habitat destruction will be critical if we wish to conserve our threatened biological heritage. Adoption of the Chattooga Conservation Plan will be a big step toward the realization of Odum's vision for the Southern Appalachians.

Encouragingly, the recently revised LRMP for the Nantahala-Pisgah National Forest in North Carolina prescribes restoration of native forest habitat through the establishment of a network of mature, interior forest areas, many larger than 2,500 acres, and some exceeding 7,500 acres, interconnected by maturing forested lands—much of it maturing second-growth that resulted from the period of logging that occurred earlier this century. The plan states that the old growth restoration areas serve as permanent reservoirs of biological diversity with the intent to allow the restoration of functioning old growth ecosystems at the landscape scale.

The Chattooga Conservation Plan builds on the success of the Nantahala-Pisgah model. In fact, the Nantahala model has already been implemented on that portion of the Chattooga River watershed that lies in North Carolina. The Chattooga Plan will move a step further toward the responsible conservation and restoration of the entire Chattooga River watershed by integrating Georgia, South Carolina, and North Carolina public lands management, through the consolidation of these areas into a single federal management unit. In addition, it could aid private landowners in their search for sustainable and economically viable land stewardship alternatives. Furthermore, its ability to link with other forests of the Blue Ridge Escarpment satisfies a key tenet of conservation biology, namely that reserves need to be connected across the landscape in a systematic fashion. The Chattooga Conservation Plan is a concrete action that can be taken now to begin the conservation and restoration of a functioning native Southern Appalachian ecosystem.





## II. Conserving Biodiversity in the Southern Appalachians: The Need for More Native Forest Habitat

The Chattooga River watershed is unique and biologically rich. Its descent through a pronounced elevational gradient and numerous geological types, its inholdings of riparian, rocky outcrops, seeps and bogs, forest interior and other habitats, all provide for a great diversity of plants and animals with origins in tropical, temperate, and northern regions. Local researchers have established that the Chattooga River watershed is a unique ecotone for the temperate deciduous forest — a transitional area providing habitats for both northern boreal and southern tropical species in one drainage basin (Bruce et al., 1995).



### *What is the Native Forest of the Chattooga River Watershed?*

Historians and scientists generally agree that prior to human settlement, and certainly prior to European settlement of the area, forests covered a larger percentage of the land area of the Southern Appalachians than they do today. An issue of investigation has been the specific quality of that forest before the time of the Native Americans, during their predominance here, and after European settlement.

Recent studies have shed some light on the question, and generally support a common sense understanding of the area's ecological history. One study completed under the auspices of the U.S.D.A. Forest Service's "Chattooga River Basin Ecosystem Management Demonstration Project" offers new evidence of historical conditions in the watershed from which we may draw some conclusions about the quality of the forest in years gone by—in years when humanity's effect on its composition was entirely absent or less significant than in recent history. This study shows that large-scale natural disturbances that significantly affect the stand structure and species composition of the forest are a relatively rare phenomenon—perhaps once a century, or less—and would generally occur in the more southern reaches of the watershed (Meier and Bratton, 1995) or in ridgetops and summits where natural disturbances occur at relatively greater rates. In less exposed areas, conditions would encourage the development of what many people imagine to be a typical forest—grand and majestic, and dominated by old hardwoods. Indeed, researchers estimate that such a "mixed mesophytic" forest dominated the region long ago (Meier, personal communication), especially in the protected coves where a relative lack of disturbance would promote the development of the huge trees now found in remnant stands like those of the Joyce Kilmer Forest in the Great Smokey Mountains National Park.

In the more recent past, "...these forests have been classified as part of the oak-chestnut association. Early settlers saw that in many areas the canopy was dominated by the American Chestnut" (Horn, 1995). After the chestnut blight virtually eliminated this species from the canopy, a significant change occurred in the forest com-

munity where the chestnuts were previously dominant. "Other species which are taking their place include white oak, chestnut oak, several species of hickory, and red maple" (Horn, 1995). The trend seems to suggest that if the forests of the Southern Appalachians were generally left to their own development, they would be dominated by hardwoods, and further, that the age of these deciduous forests would be generally older than what dominates today.

Further evidence for the historical structure and composition of the landscape of the Chattooga River watershed and the region is provided by a critical look at the status of its living biological resources. Much research has been devoted over the past 20-30 years to the investigation of plant and animal species found here and the habitats upon which they depend. The "indicator species" approach has helped, when the proper species are chosen, to determine large scale changes in habitat types. In the southern Appalachians, most of the terrestrial species listed as threatened or endangered are associated with deciduous forest, especially older stands (Noss and Peters, 1995).

The scientific evidence supports the common sense understanding of the history of Southern Appalachian forests: in the not-too-distant past, the area was dominated by more majestic, older hardwoods than is the case today. Natural disturbances at small and large scales helped to maintain a heterogeneous mix of habitats over the landscape, but many presently-declining forest plants and animals were more common, because they had relatively more older, deciduous forest habitats in which to live and flourish. In order to conserve and restore the ecological integrity of the area and provide viable habitat for species in decline, we must allow more of this forest to mature toward its typical historical condition: generally mature and majestic hardwoods, influenced by natural disturbance regimes, but largely undisturbed by humans.



### *Old Growth Forests and Forest Interior Habitat*

Of all the natural biotic communities or habitats in eastern North America, old growth forests are one of the most scarce. By even the most generous estimates, they comprise barely one percent of all forest land in the Southern Appalachians. On national forest land in the Chattooga River watershed, a recent U.S. Forest Service survey establishes that old growth forest communities occupy only about four percent of the watershed area (Carlson, 1995). Plant and animal species associated with old growth are not abundant in the watershed itself, and are barely surviving in the region as a whole.

"Old growth forests are ecosystems distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of charac-



teristics which may include tree size, accumulations of large, dead woody material, number of canopy layers, species composition, and ecosystem function" (USFS, 1989). The last characteristic, ecosystem function, is particularly important from the standpoint of biodiversity at the landscape level.

Large blocks of old growth forest habitat offer a set of conditions which are not present in younger stands. The high degree of variability in chemistry, temperature, humidity, and other physical attributes across the terrain means a more diverse habitat, and a rich collection of organisms in the forest interior. Its diverse micro-environments have allowed for the evolution of some extremely habitat-sensitive species, including a wide range of plants and animals (e.g., Horn 1995, Andrew 1995). With the fragmentation of the forest landscape, many old-growth plants and animals are restricted to islands of remaining forest interior. As a result, many old growth plant and animals species are already listed as threatened and endangered, and others are destined to join them unless further loss of their habitat can be prevented.

As is typical for the Southern Appalachian region, most of the old growth in the Chattooga River watershed occurs in small, isolated fragments. Small patches of any habitat are generally less valuable than larger patches, because they result in small populations—a problem for species that require large home ranges, or have limited ability for dispersal. Small populations can quickly lose genetic diversity (the natural variation within a population); in addition, they are more susceptible to obliteration by chance events such as wildfire and disease. Thus, a highly patchy distribution of small old growth fragments does not provide for the long-term viability of species associated with this forest habitat. Connectivity among patches is also an important issue, since the food chains, reproductive processes and all the other strands in an ecosystem's web of life are coupled with those of adjacent communities, from habitat to habitat across the landscape. Existing old growth fragments should provide centers of distribution for old growth species throughout the forest, but today there are few mature forest corridors between the existing old growth fragments. Essential biological processes can be restored by linking isolated habitat islands with corridors of mature forest across the watershed. Allowing relatively mature forest between old-growth fragments to continue growing will help restore these critical corridors.



### *Herbaceous Understory*

The herbaceous understory of interior, old-growth forest is a source of rich diversity, beauty, and often, extreme fragility. Numerous herbs are restricted to mature forests and cannot survive clearcuts (Duffy and Meier, 1992) or even natural openings due to forest fires or tornadoes. In general, ferns are typically restricted to forests, and these interior forests provide habitat for a number of species including the bristle fern, dwarf filmy-fern, glade fern, mountain spleenwort, hay-scented fern, shield ferns, and silvery spleenwort (Horn, 1995).

Among the many flowering plants found along the forest floors, two of the most conspicuous plant groups in mature forests are the lilly and orchid families. In most cases, these species require a mature deciduous forest canopy over them in order to do well. Within the lilly family are the wake robin, painted trillium, large flowered trillium, blue bead lily, mandarin, false lilly of the valley, lilly of the valley, twisted stalk, turk's cap lilly, and wild yellow lilly. The better-known orchids include ladies' slipper, showy orchis, *Habeneria* spp., Appalachian twayblade, and spotted coral root. Other species of interest include wild ginger, baneberry, five-leaved windflower, papoose root, ginseng, spikenard, waterleaf, and bee-balm (Horn, 1995).

Horn (1995) argues that "even though the forests are defined by the canopy trees present, the real biodiversity of an interior forest is in the shrubs and herbs, which commonly go unnoticed. ...The small herbs live within such a small area (a microhabitat) that they have specialized to specific soil, sun, and moisture conditions. The herbs do fine as long as the canopy trees remain intact. But, with humans has come fragmentation of the forests such that all we commonly see are small areas of forest subjected to the 'edge effect': where greater wind and sun influence microhabitats, the forests are dryer and warmer during the summer. To the trees this is commonly not much of a problem, but to the herbs with shallow roots and exacting micro-habitat needs, this is just the change that may be detrimental to their survival."

The diversity of herbaceous vegetation supported by the mature forest environment in turn supports a great diversity of insects, fungi, and other invertebrates that remains largely undescribed by biologists. Promoting mature forest interior habitat will better the prospect for the survival and continued evolution of many species of the herbaceous understory—only some of which are presently listed as threatened or endangered.



### *Salamanders*

The interior forests of the Southern Appalachians, including the area around the headwaters of the Chattooga, have been described as the salamander capital of the world. Richard Bruce, a recognized expert and lead investigator of a five-year salamander survey in the Chattooga, says our salamander fauna "may be the richest in the world for watersheds of comparable area" (Bruce et al., 1995). The area's interior forests are the evolutionary fountainhead for a widespread group, the plethodon family of salamanders.

These animals are interesting, for although they are amphibians, the moist forest soils they inhabit permit them to skip the typical aquatic phase of an amphibian's life entirely. This evolutionary novelty allowed them to colonize terrestrial areas not usually accessible to most amphibians which must lay their eggs in water. Plethodon salamanders now serve an important function as insect-eaters on the forest floor. With their vast numbers—up to five or more individual salamanders in a single square yard of soil—they consume tons of insects in a forest stand every season. However, because they breathe through their skin, they must remain in moist areas all the time, and



emerge from their underground burrows only at night or in the rain.

Their specialization makes plethodon salamanders quite sensitive to disturbances to their forest interior environment. It also makes them potential indicators of ecosystem health in the mature forest. Dr. James Petranka, a biologist at the University of North Carolina at Asheville, has studied the effects of clear cutting on salamanders (Petranka, 1994). He found that salamanders are completely eliminated or reduced to very low numbers when mature forests are clear cut. Furthermore, comparisons between different-aged stands suggests that salamanders come back very slowly after an intensive timber operation. Their numbers return only over many decades as the stand grows back and the shaded, moist forest conditions return.

Given the logging history of the Chattooga, these sensitive animals are probably just beginning to return to their pre-disturbance population levels, and their proper ecological role as major forest-floor insect predators. "There's no doubt these animals are best adapted to old growth conditions," Petranka says. "Designating subsets of the landscape as permanent, non-harvestable sites is a management tool that can increase both landscape heterogeneity and regional densities of Southern Appalachian salamanders." Petranka advocates management techniques such as leaving buffer zones along headwater streams, and reversing the current trend of industrial-style management that results in forest landscapes dominated by relatively young stands of trees. Such management has the added benefit of providing greater lengths of streams that are suitable for trout and other aquatic species.



## Birds

While salamanders are an example of "site sensitive" species, birds are an example of "area sensitive" species. Area sensitive species need large tracts of intact forest (or other habitat) to survive and flourish. Many types of birds fall into this category. The decline observed in forest songbird populations since World War II has been attributed to the loss of the large, unfragmented forests that provide homes for forest interior birds. Human development, in the form of roads, clearings and construction, serves to break up forest tracts. The result is much less interior forest breeding habitat, and more nest predation (raccoons and opossums looking for an easy meal) and brood parasitism (by cowbirds looking for parents to unwittingly raise their young). Studies in the eastern United States have confirmed that many songbirds will breed only in large tracts of unfragmented forest, even though their individual territories consist of only a couple of acres (Robbins et al., 1989; Whitcomb et al., 1981). The most area-sensitive birds will only be encountered if the forest exceeds 3,000 hectares.

Forests within the Chattooga River watershed presently support populations of forest-interior birds. Bird enthusiasts can hear the songs, and may see the bright, colorful flash of a resident hooded warbler, blackburnian warbler, or Canada warbler. Less conspicuous but equally beautiful songsters like the wood thrush or the veery may be heard on a walk through these rich forests as well. The solitary vireo, an uncommon bird nationwide, is found here. The ovenbird is another warbler species that is highly sensitive to the effects of forest fragmentation. Their presence suggests that these forests provide at least some interior habitat for this ground-nesting species, which is a frequent cowbird victim in more disturbed areas.

Birds serve important functions in the forest interior: the huge number of insects they eat, the plants they pollinate, the seeds they disperse, and the nutrients they return to the soils, are a web of life on which many other plants and animals depend. Because they are conspicuous, and often environmentally sensitive, birds can serve as reliable indicators of the health of the ecosystem they inhabit. Many researchers have become concerned about the decline of forest bird populations in the region (e.g., Terborgh, 1992). Conserving and restoring interior forest habitat, across the watershed and the region, is predicted to help forest-interior bird populations recover (Robbins et al., 1989; Whitcomb et al., 1981).



## Mammals

Large carnivores like cougars, wolves and bears are further examples of area-sensitive species. These animals normally provide important controls on populations of deer and the smaller predators, which can otherwise become too numerous and destructive. The big predators are part of the natural heritage of the region, and have been a critical force in the evolutionary history of the ecosystem. Conservation biologists argue that a regional plan that does not include the large native carnivores is incomplete (Noss and Cooperider, 1994).

Black bears are one example of an interior forest-dependent, large omnivore. Scientists studying the habitat requirements of black bears highlight their need for the availability of abundant mature oaks (greater than 100 years) to provide a staple food: acorns (Pelton, 1986). In addition, bears require healthy old growth forests (a minimum of 5 to 10%) distributed throughout their range (Pelton, 1986), and low road densities (less than 0.5 kilometers of road per square kilometer of forest) (Brody, 1984). Protecting habitat for bears and other "charismatic megafauna" requires management of forest resources at a landscape scale—and thereby provides habitat for a wide variety of interior forest species, including those that are almost never monitored or even observed by human visitors to the forest.



### III. The Economic Setting

A recent economic study (Morton, 1995) investigates employment and income trends from 1969-1990, and highlights trends for selected industries in the four-county Chattooga watershed area. Portions of Jackson and Macon Counties in North Carolina, Oconee County in South Carolina and Rabun County in Georgia comprise the Chattooga watershed economic study area. This profile does include land, people and businesses outside of the watershed proper, because the economic data necessary for the analysis is grouped by whole counties, and because activities occurring in the watershed proper are directly tied to the economy of the entire county. Data from the Bureau of Economic Analysis, the Bureau of Census and economic reports issued by state-level government agencies was used for the analysis. Comparisons are made between local trends, and the same statistics for the three-state region (NC, SC and GA) and the United States as a whole. The report presents a picture of the economic base of the area, how the economy has evolved over a twenty-year period, and how its evolution compares to regional and national trends.



#### *Employment and Income Trends*

Between 1970 and 1990 population, jobs, and labor and non-labor income all increased in the Chattooga area at rates greater than in the three-state region and in the U.S. as a whole. Jobs in our area increased by 72% during these twenty years. The combination of retail trade, services, construction and government sectors created most (72%) of the new jobs. The slowest growing sector was manufacturing (12% increase in jobs), and the fastest growing were finance, insurance and real estate (406% increase), followed by construction (310% increase) during the same twenty years. The top employers for the Chattooga area in 1990 were manufacturing (25% of total employment) and service-related industries including services, retail trade, government and construction (this combination accounted for 53% of total employment in the area). Self-employment has more than tripled in the last twenty years: in 1990 self-employed workers made up 20% of total employment in the Chattooga area.

Real (adjusted for inflation) total personal income (TPI) in the Chattooga area increased by 120% from 1970-1990. This growth in TPI was greater than for the three-state region and greater than the country as a whole. Non-labor income accounted for a large part of our area's total personal income (35% of TPI in 1990, an increase from 21% in 1970). The migration of retirees with non-labor income from pension funds and home equity gains has changed the dynamics of the economy of the Chattooga four-county area.



#### *Individual Industries*

The manufacturing sector as a whole plays a more prominent role here than compared to its role in the three-state region or the entire U.S. The textile and apparel industry is arguably the most important industry in the area, accounting for nearly half of the manufacturing jobs. The wood products industry (a part of the manufacturing sector including lumber and wood products, paper and pulp, and furniture) accounted for only 1.3% of total personal income in the Chattooga area and 1-2% of total employment in our area. Dr. Morton refers to two separate studies (Wade and O'Conner 1993; USDA Forest Service 1988) that projected declines in employment in the industry due mainly to plant modernization. Such impacts of larger-scale modernization have already been felt by workers in the wood products industry in our area.

The recreation and tourism sector was estimated by using a composite of service-producing businesses (mostly wholesale and retail trade, non-business services, and transportation). Local residents use these businesses also, but assuming that 20-50% of their use is attributable to recreationalists and tourists, then the recreation and tourism sector accounted for 2-4% of total personal income and 3-8% of total employment in our area in 1990. Morton draws two conclusions from these figures. First, that recreation and tourism diversifies, but does not dominate, our economy. And second, that recreation and tourism are relatively more important than the wood products industry to our area's economy. Morton cites another study which found that rural areas experiencing rapid population growth in the 1970's and 80's were highly concentrated in areas adjacent to large tracts of public land that offered recreational and scenic amenities.



#### *The Economic Base*

The growth of an area's economy is somewhat dependent on exporting goods and services—attracting outside money into the area's economy. Industries bringing in new dollars are termed basic. Incoming money can be spent locally on goods and services, and hence support local jobs. Industries which are partially dependent on the basic industries for their survival are called non-basic.

Although textiles are still very important, the economic base of the four-county area has diversified over the twenty years under consideration, with a variety of sectors producing exports. The wood products industry's contribution to the area's economic base can be estimated based on its share of income and employment within the manufacturing sector (which was 7% of manufacturing income and 6-8% of manufacturing employment in 1990). Comparing these figures to the same statistics for the three-state region and U.S. in general leads to the conclusion



that the wood products industry is less important to the economic base in the Chattooga watershed area than it is for the region or the nation.

Many of the new service jobs are not dependent on other basic industries for their survival, because they too are exporting goods and services and importing cash into the local economy. Universities like Western North Carolina University in Cullowee, NC, and Clemson University in Clemson, SC, contribute to the economic base as well by exporting knowledge in exchange for tuition and other fees, and attracting research dollars to the area. Some employment in businesses catering to tourists and recreationalists should be considered part of the economic base as well, because they are not dependent on other basic industries in the area. Non-labor income is also a part of the economic base, as it acts in the area economy in the same way as export-derived income. "The increase in non-labor income is significantly changing the economic base of the four-county watershed area" (Morton 1995).



### *A Strategy for Economic Vitality*

As Morton argues (1995), the health of an area's economy depends somewhat on the growth and diversity of the economic base. The economic base in the United States is no longer composed primarily of the manufacturing sector. The increase in non-labor income, and income earned at knowledge-based services—including engineering and management, business, health and telecommunications firms, as well as colleges and universities—have diversified the nation's economic base.

Morton argues that the same basic services have helped diversify the economic base of the Chattooga four-county area. "Any analysis of the basic industries of the four-county area should fully account for the contribution of these 'basic' services and non-labor income to the region's economic base. This is an important point because many economists continue to ignore the contribution of these businesses to an area's economic base. A diverse economic base enhances an area's prospects for economic stability. Economic development plans should not

promote reliance on one industry but should strive to diversify an area's economic base. As Rasker (1994) notes:

The cornerstone of an economic diversity strategy is the creation of a favorable business climate and the protection of the cultural, social and environmental qualities that make a community a pleasant place to live and do business. In addition, the strategy should include investment in the infrastructure, such as education and telecommunications facilities, in order to promote entrepreneurial activity. In many instances the most economically productive role of public lands is not in resource extraction or tourism, but in protecting the landscape, the wildlife, the rivers and streams, and the scenery - all those things that collectively enhance the quality of life for local residents (Rasker, 1994).

"The National Wild and Scenic Chattooga River and the surrounding national forests represent natural assets for the four-county area and provide communities with a comparative advantage over other rural areas in diversifying their economic base. Rudzitis and Johansen (1989) conducted a random survey of recent migrants to wilderness counties and found that the most important reasons for relocating to a county with wilderness were the environmental and physical amenities, scenery, outdoor recreation and the pace of life. A survey of recent migrants to the four-county Chattooga watershed area might reveal similar results.

"The economic trends noted in the study provide an argument for the conservation of forest ecosystems in the area. The three national forests in the Chattooga watershed dominate the landscape, provide the scenic vistas, the hiking, camping, hunting and fishing opportunities that can retain existing residents and businesses while attracting new businesses, retirees, tourists and recreationalists to sustain the diversity of the area's economic base. As such, economic development will suffer if the forests are indiscriminately cut, recreation trails are not maintained or expanded, or if the habitat needed to sustain healthy populations of native species and hence the health of the ecosystem is not conserved" (Morton 1995).





## IV. The Context for Action: Ecosystem Management



### *Origins of Ecosystem Management*

Hike any two-mile stretch of the Bartram Trail through the heart of the Chattooga River watershed. You pass through and cross over the scars of an early environmental crisis that began about 1880 and ended in 1920: old logging skid trails, still-rotting stumps, pine stands delineating abandoned pastures, erosion gullies now healed over with a hardwood forest, fire scars on 200-year old oaks. Here and there you pass through a few acres of very old trees, relics of the old growth forest that once covered the entire Chattooga watershed.

The uniqueness of the Chattooga River watershed is due largely to its great diversity of elevations and land forms. From high elevation oak ridges and granite dome communities to moist coves and riparian forests, about a dozen different forest habitat types occur here, each with its own distinct combination of plants and animals. All of this was very nearly destroyed in the turn-of-the-century crisis. Only fragments of the original habitats remain intact.

The Southern Appalachian National Forests were established in 1920. "Land conservation" and "watershed preservation" were the bywords of those days, and for the next three decades forest management was limited largely to protection and restoration. Today a mature forest has restored itself over much of the Chattooga River watershed, not quite the same forest as before, but to modern conservationists this forest is regaining much of its earlier natural character. The old wounds have begun to heal, and it progresses slowly toward biological maturity.

Ironically, the rehabilitation of the Southern Appalachian forests has created a modern day conflict. This forest in transition has now grown to commercial size, and today timber extraction has replaced conservation as the top priority for national forest management on most of the Chattooga River watershed. At the same time, modern logging engineering has mastered the art of reaching every commercial tree on the watershed, putting at risk even the remnants of old growth forest that were too difficult to access a century ago.

Accelerated timber production over the past three decades, including the clear cutting of old growth forests throughout the United States, has expanded the logging versus conservation confrontation to every national forest in the country. The turning point came in the early 1990s with the political, social, economic and ecological conflict in the Pacific Northwest. A new image was clearly needed for national forest management: a shift from the dominance of timber production to something more palatable to the American public.

The term "ecosystem management" was born out of the Pacific Northwest crisis. It was created by the U.S. Forest Service in 1992 to appeal to and appease all fac-

tions. Ecosystem management was supposed to lead to a more reasonable dialog between forest managers and the diverse public and private forest interests. Although largely rebuked by the timber industry, ecosystem management has been generally embraced by the scientific community, by most conservationists, and by many foresters.



### *From Timber Management to Ecosystem Management*

There has never been a definition for ecosystem management that satisfies everyone; often it seems to satisfy no one. The conservation-minded publics, including conservation biologists, read "ecosystem" loud and clear, while the commodity-minded publics, especially forest industries, read "management". There are many interpretations of ecosystem management across the full spectrum from the preservationist to the clear-cutter. District-level managers seem to find themselves caught in the same old tangle of reconciling public concerns with Congressional timber directives, the same dilemma that led to National Forest conflicts in the first place.

But this is not hopeless. For the first time since the U.S. Forest Service embraced industrial-style management fifty years ago, the very term "ecosystem" gives managers an insight they have not been exposed to in recent decades. The entrenched objective of "forest" management was simply "timber" management: the growing of trees for commercial use and economic return. The intent of the shift from forest to ecosystem is (in theory at least) to recognize and protect the values of the forest community as a whole.

U.S. Forest Service policy makers are struggling with this shift. How can management ensure the sustainability of the full range of species and natural processes in forest ecosystems, and still provide all of the multiple uses and products required by law? Implementation of the new policy requires a large reduction in timber goals, which neither Congress nor the U.S. Forest Service is yet willing to authorize. Therein lies the current failure of ecosystem management to be implemented on the ground.

By almost any scientific assessment, ecosystem management must emphasize the long-term maintenance, or sustainability, of biological diversity in all of its dimensions (species and community composition, plus genetic and structural diversity). Fortunately, there is general agreement on the definition of biodiversity: the variety of life native to a region, including species and their habitats, and all of the natural processes that tie these elements together through time. Biodiversity is the support system of our planet and, ultimately, of our own human species. Enhancement of biodiversity is intended to be a top priority in ecosystem management decisions.



Ecosystem management on the Chattooga River watershed must focus on the landscape level. The modern science of conservation biology has devised a model for restoring and maintaining old growth across a forested landscape. The model is fundamentally the same as one proposed in 1932 by the Ecological Society of America (Shelford, 1993 cites a unanimous decision of the Society on December 28, 1932). Then, as now, scientists recognized the importance of natural habitats being large enough and sufficiently connected across the landscape to support evolutionary processes. More recently in 1988, the International Biosphere Reserve concept was introduced as a means for preserving native biodiversity on a large scale. This model was adopted by the United Nations for their Southern Appalachian Man and the Biosphere (SAMAB) program, with the Great Smokey Mountains National Park as its core. The same model can be adapted on a smaller scale to individual watersheds.

To fully implement the concepts promoted in 1932 and more recently in 1988, a network of biological reserves connected across the landscape of the Southern Appalachians must be established. The Chattooga watershed is uniquely suited to serve as a key element in such a reserve network design. Roughly seventy percent of its land area is in public ownership. This watershed contains several protected areas already, such as the Ellicott Rock Wilderness, the National Wild and Scenic Chattooga River Corridor and other special management areas. The Chattooga River watershed is situated in one of the two most diverse ecosystems in North America. The Wild and Scenic River Corridor in particular could serve a unique role as a link between this diverse Southern Appalachian mountain ecosystem and the adjoining piedmont ecosystem. Furthermore, the river is considered one of the "crown jewels of the Southeast" and provides some of the best opportunities in the area for wilderness experiences, whitewater recreation, hunting and fishing. These outstanding recreational opportunities have fueled a high level of public support for protection of this unique natural resource, and for the larger ecosystem of which it is a part.



### ***Chattooga Conservation Plan's Ecosystem Approach***

Large-scale approaches—at the level of ecosystems and landscapes that maintain whole regions with their unique assemblages of native flora and fauna—are the most reliable way to conserve biodiversity. Such approaches avoid the problems that plague species-by-species methods that quickly exhaust 1) the time available, 2) financial resources, 3) public patience, and 4) scientific research resources (Franklin, 1993). A landscape approach offers the advantage of supporting the large array of so-called "lesser" organisms: bacteria, fungi, insects, and other inconspicuous ones that carry out critical ecosystem

functions, like decomposition and nitrogen fixation, on which the rest of us depend. A healthy forest needs healthy populations of birds, large and small carnivores, plants and fungi, and other basic ecosystem elements to assure that the whole system functions sustainably.

The ecosystem approach is supported by a common sense look at the relative proportions of Earth's living things. Although most single-species conservation efforts are directed at vertebrates, the "charismatic megafauna" (eagles, bears, bobcats, etc.) actually represent less than one percent of living things. The vast majority of living things have not even been described, let alone studied for their practical applications, e.g., unique chemical compounds that may be useful in medicine or materials engineering. Practical limits in our capacity to research each and every species means we cannot always know which species will be directly useful for such purposes. Valuable species will persist, along with those whose values are as yet undescribed by science, only if their habitats are conserved across the landscape.

A conservative approach to maintaining healthy ecosystems would preserve each habitat type, approximating their proportions in the native landscape, and connect them across the landscape. It would create a secure network of reserves for large carnivores and other species that are sensitive to human activity (Noss and Cooperider, 1994). For land managers, the question then is: how big must a reserve system be to maintain native wildlife populations, considering the drastic changes in the environment brought on periodically by natural disturbances like fires, tornadoes and insect pests? It must be large enough that only a small part of it is disturbed at any one time. In an area dramatically altered by natural disturbances, wildlife "colonists" can move in and re-establish themselves; but only if healthy populations are present in other areas of the landscape and can easily migrate between the two. Large, landscape-level biological reserves are more secure from the major destruction that can be caused by powerful and unpredictable natural forces.

The amount of mature forest interior habitat needed to conserve and restore the ecological integrity of the Southern Appalachian region is not known precisely. A convergence of estimates suggests that "most regions will require protection of some 25 to 75 percent of their total land area in core reserves and buffer zones" (Noss and Cooperider, 1994). In any case, protection does not imply "locking it up" by restricting access only to native wildlife. Reserve designs can accommodate a variety of human uses, including hunting, fishing, hiking, education, and scientific research. Maintaining a variety of ecological, social and economic activities in the watershed broadens the appeal of the reserve, and the active participation and support of local communities.





## V. Chattooga Conservation Plan Methodology



### *Core, Corridor and Restoration Area Principles*

The issue of fragmentation has been identified recently as one of the most pressing issues in wildlife management and the conservation of biodiversity (Solheim, Alverson and Waller, 1987; Wilcove, 1988). Briefly described, fragmentation is what occurs when a forested area is permeated with relatively smaller openings like roads, wildlife openings, and clearings created by even-aged timber management. Even though the majority of the area may still be covered by a forest canopy, "edge effects" such as those noted above penetrate beyond the edge itself. Such effects can adversely impact species of plants and animals that require interior forest habitat, leaving them with less useable habitat than the land cover would suggest, and isolating specific populations of such species from each other.

The problems of isolated populations of plants and animals have been described by researchers in conservation biology and island biogeography (Fahrig and Merriam, 1994). Isolated groups may have trouble maintaining the genetic integrity and variability needed for their continued evolutionary viability and prospects for long-term survival, if they cannot move to or be reached by other populations of their species. Such a situation occurs if there are no corridors of appropriate habitat for the species to move through. This is the situation for forest interior species in the fragmented forests of the Southern Appalachians.

The idea of cores, corridors and restoration areas has been proposed to remedy this problem (Cutler, 1991). The idea is to first protect from further fragmentation currently existing remnants of mature forest interior habitat; second, to restore corridors of similar habitat to link the remnants; and finally, to buffer all this from intensive human activity by way of restoration areas. To be fully effective, a design such as this watershed management proposal should be linked on a larger scale to other forest interior blocks in the region (Noss, 1992).

Wildlife corridors can help restore the proper ecosystem functions only if they are wide enough to constitute viable interior forest habitat. An "edge", such as between the forest and a maintained road or clearing, must be far enough away so that its various ecosystem effects do not reach all the way into the corridor. The distance that edge effects penetrate into the interior will vary, depending on which particular species and associated effects are focused on (see brood parasitism, nest predation, and microhabitat variations discussed above). Some researchers suggest that a distance of one-half mile from openings is needed to ensure that no edge effects penetrate into an interior forest wildlife corridor (Hamel, 1990).

In addition to land-based wildlife corridors, stream-side corridors have been promoted as a means of linking isolated habitats of some species. This strategy

offers the benefits of protecting aquatic habitat and water quality, while at the same time serving the larger ecosystem's role (Naiman et al., 1993). Aquatic ecosystems are among the most threatened ecosystems in the country and are in need of immediate protective and restorative measures (Noss and Peters, 1995; Lydeard and Mayden, 1995).



### *Principles Applied to the Chattooga Watershed*

The Chattooga Conservation Plan is based upon the science of conservation biology and its associated ecological design principles (described above and in previous sections). A survey of the natural resource and conservation biology literature relevant to the region points to a set of general principles about the current state of the areas' biological resources, the habitats they depend on, and management techniques useful for the conservation of regional biological diversity. When applied to the Chattooga watershed, those principles guide us to focus on two types of habitat which host this area's most threatened biological resources: mature interior forest, and shaded, unsilted mountain streams. A set of questions (outlined below) was asked about the particular physical characteristics of the Chattooga watershed, and how these characteristics might be managed for the conservation and restoration of native biodiversity.

The strength of the Chattooga Conservation Plan lies in its common sense approach to identifying, protecting and restoring stream-side areas and large blocks of unfragmented forest habitat representing all native forest types in the watershed. The Plan presents a forest management option that will restore and reunite highly fragmented forest habitat to aid in the recovery of a collection of plant and animal species that are among the most threatened biological resources of our Southern Appalachian region.

### *Developing a conservation plan for the Chattooga River watershed required consideration of the following questions regarding management area delineations:*

#### 1. Which areas in the watershed closely approximate or are currently mature forest interior habitat?

The Chattooga River Watershed Coalition's Proposed Roadless Areas meet the criteria of having less than 1/2 mile of developed system road per 1,000 acres, and provide ample opportunities for the experience of solitude in the forest. These roadless areas are or closely approximate existing mature interior forest habitat. The roadless areas identified were found to contain a high percentage of the watershed's old growth forest as well. In particular, the high ridges of the Rabun Bald area contain one of the highest concentrations of old growth forest remaining in the entire Chattooga watershed (Carlson 1995). These



roadless areas are of the highest priority for protection, as they represent islands of mature, interior forest habitat that need further protection and linkages to other such areas.

Some other areas of relatively mature, interior forest habitat are currently under protective management, and are described below.

2. Which areas in the watershed are already protected from further fragmentation?

Existing protected areas include the Chattooga National Wild & Scenic River Corridor, the Ellicott Rock Wilderness Area, Forest Service Management Areas such as MA-4 (Georgia) and MA-5 (North Carolina) and other areas, such as those managed for old growth preservation and restoration, and recreational or botanical significance. These areas are or closely approximate native forest habitat and constitute key starting points for protection and restoration of a functioning native ecosystem in the Chattooga River watershed. The Wild & Scenic River corridor is a semi-primitive, non-motorized area, which should serve as an important wildlife corridor.

3. How wide should a stream or river corridor be to maintain its functional characteristics?

A river corridor should be wide enough to effectively perform the functions of 1) controlling water and nutrient flows from upland to the stream, and 2) facilitating the movement of upland forest interior animals and plants along the stream system (Forman and Godron 1986). To accomplish these objectives, the corridor should cover the flood plain, both banks, and an area of upland on both sides that is wider than an edge effect (defined earlier). Thus, we propose that the Wild & Scenic River corridor requires an area larger than the existing one-quarter-mile buffer to serve as a viable core habitat for many neotropical migratory songbirds, and as a wildlife corridor for black bear and other large mammals. A three-quarter-mile buffer was selected to provide sufficient protection from fragmentation caused not only from outside the river corridor, but by the presence of the river itself acting as an edge. This three-quarter mile distance should provide for the ecological requirements of interior forest-dependent species (Hamel, 1990). Aside from currently protected areas, the enlarged three-quarter-mile Wild and Scenic River buffer and the Chattooga River Watershed Coalition's Proposed Roadless Areas are considered to be critical core and wildlife corridor habitat.

4. Which areas in the watershed are most suitable for designation as Restoration Areas, to act as a buffer zone between Core/Wildlife Corridor Protection Areas and more densely populated areas of the watershed?

The lands which surround Core/Wildlife Corridor Protection Areas on both public and private lands are suitable for restoration management techniques. These areas were designated as cooperative Ecological Restoration Management Areas.

5. How would areas of high population density fit into the picture?

Private lands in areas of the watershed with higher population densities (e.g. Clayton and Mountain City in Georgia, Highlands and Cashiers in North Carolina, and Whetstone and Long Creek in South Carolina) were considered suitable as Sustainable Economic Development Management Areas. These areas include zones of existing economic enterprise, and also would support opportunities for projects which promote environmental education and stewardship. In addition, environmentally responsible and socially beneficial projects like markets for locally grown organic produce and locally manufactured wood products crafted from sustainably harvested timber could develop here.

6. What "rules of thumb" might be used to delineate boundaries between management areas that would aid in the maintenance of high quality aquatic habitat?

The Chattooga Conservation Plan uses fourth-order watersheds as boundaries (when possible) to avoid conflicting and counterproductive management activities within the same watershed. Sub-watersheds, smaller hydrologic units within the Chattooga River watershed, were considered important to protect water quality and critical plant and animal species habitat. Sub-watersheds where portions of them had already been designated as core habitat areas would be wholly incorporated into Core/Wildlife Corridor Protection Areas (described in more detail in the next section).

7. How could water quality be maintained or restored throughout the watershed, and across the different management areas which will host different land management activities?

It was decided that streamside management zones would be recommended throughout the watershed and in all management area delineations. Activities in these zones may vary from one management area to another, but would at a minimum adhere to state Best Management Practices (BMPs). Where possible, the zones would conserve or restore a 300-foot buffer around the stream where no soil-disturbing activity takes place. Streamside management zones would be considered part of the Core/Wildlife Corridor Management Areas.



## GIS Analysis—Step-By-Step

To organize the answers to these questions and develop the Chattooga Conservation Plan, the collaborators utilized a Geographical Information System (GIS): a computer-based method to collect, analyze, and display geographically referenced information in layers, in the form of a map. The GIS developed for the Chattooga Conservation Plan utilizes the latest information available for the Chattooga River watershed. Data on various landscape features were collected from studies completed under the auspices of the USDA-FS "Chattooga River Basin Ecosystem Management Demonstration Project", plus field surveys of roadless areas conducted by the Chattooga River Watershed Coalition, and the databases of the State



Natural Heritage Programs of North Carolina, South Carolina and Georgia. GIS analysis techniques were then used to overlay multiple data layers, producing maps that provide a visual representation of priority conservation locations in the Chattooga watershed. A step-by-step overview of the conservation plan process is described below, and the figures referenced appear on page 26. A review of management recommendations for the watershed follows the overview.

Figure 1 shows the Chattooga River watershed, with major roads, towns, and major tributaries. The map visually depicts the river's meandering path through North Carolina, South Carolina, and Georgia. The watershed encompasses approximately 179,000 acres in the three states, of which about 56,000 acres are in private ownership.

Figure 2 shows the currently protected areas, which include the Wild and Scenic River corridor, the Ellicott Rock Wilderness Area, and U.S. Forest Service management area designations such as MA-4 (Georgia) and MA-5 (North Carolina) and others. The Wild and Scenic corridor and wilderness area are protected by federal legislation. The Forest Service management designations are for areas already being managed for old growth preservation and restoration, or for recreational or botanical significance. These areas encompass 23% of the total acreage of the watershed.

Figure 3 shows the existing and potential old growth forest, relative to the currently protected areas. Data were collected from an old growth field survey (Carlson 1995) which identifies areas of both existing and potential old growth, and from the USDA Forest Service's Continuous Inventory of Stand Condition (CISC) which contains attributes of forest stand conditions throughout the watershed (including age). Figure 3 incorporates the CISC data that identified stands as greater than 100 years old, which were considered as potential old growth. Approximately 6,200 acres of the watershed (about 4%) was identified by Carlson as existing and potential old growth. CISC stands greater than 100 years old cover approximately 28,000 acres (about 16%) of the watershed.

Figure 4 shows the field survey data from the Chattooga River Watershed Coalition's Proposed Roadless Areas. These areas are large, contiguous blocks of forest habitat with unmaintained roads and/or low road densities. These "less roaded areas" are compared to currently protected areas.

Figure 5 depicts the results of "stacking" multiple GIS data layers on top of one another. Currently protected areas (1), the newly created 3/4 mile buffer around the Wild & Scenic river corridor (2), and the Proposed Roadless Areas (3) were considered essential components of the proposed Core and Wildlife Corridor Protection Areas. These were combined to create a first-cut conservation plan design (referred to as "Conservation Plan—First Step" in Figure 5). Combining these layers all together brought the size of the core protection area to approximately 76,000 acres (about 42% of the watershed), including 85% of the existing and potential old growth and 70% of the CISC

stands greater than 100 years old. Although the integration of these data layers increased the size of the Core and Wildlife Corridor Protection Area significantly, high fragmentation of core habitats and forest interior remained.

Figure 6 depicts the results of adding critical "sub-watersheds" to the proposed conservation plan. To reduce fragmentation, connect core habitats, and plan for improved water quality, a GIS technique was developed to incorporate sub-watersheds into the proposed conservation plan. Any smaller (fourth-order) watershed only partially covered by the first-cut Core and Wildlife Corridor Protection Area was added by expanding the boundary. Any first-cut boundary not adjacent to a smaller watershed was analyzed to find the nearest boundary (ridgeline) of any watershed size. If such a boundary did not exist within one-quarter mile of the first-cut boundary, a simple 1/4-mile expansion was used. This technique served to connect fragmented core habitats, and incorporate ecological landscape units in a defensible manner (a more detailed explanation is available on request from CRWC).

Figure 7 depicts the final Chattooga Conservation Plan. Figure 7 represents the culmination of each step in the GIS analysis process, with Core/Wildlife Corridor Protection Areas, cooperative Ecological Restoration Management Areas, and Sustainable Economic Development Management Areas. The final conservation plan includes approximately 111,500 acres (about 62% of the watershed) designated as Core/Wildlife Corridor Protection Areas.



## Evaluation

Once management areas with appropriate management activities were designated, there was a need to develop measures for evaluating the effectiveness of the proposed conservation plan. Specifically, it was important to answer the following questions: Are Core/Wildlife Corridor Protection Areas large, contiguous blocks of habitat that reduce existing fragmentation and establish forest interior habitat linkages within and outside of the watershed? How effective is the proposed conservation plan, relative to currently protected areas, in protecting forest interior habitat and element occurrences of sensitive species?

The GIS facilitated the modeling of different Plan alternatives, and was particularly useful to visually determine if the proposed conservation plan included contiguous blocks of forest interior habitat which connected existing forest interior fragments, and in calculating protection effectiveness. A GIS analysis was used to compare the effectiveness of protection under current management area designations, and under the designations proposed in the Chattooga Conservation Plan. Success was measured by comparing the percentage of critical habitat within the Core/Wildlife Corridor Protection Areas of the proposed conservation plan, relative to the currently protected areas. A significant percentage increase in the protection of existing and potential old growth forest and Natural Heritage Element Occurrence Record (EOR) sites in conjunction with large blocks of unfragmented forest



habitat were considered essential in the approval of a final proposed conservation plan for the Chattooga River watershed. Results of the comparison are described in the following section.

To assess the quality of the conservation plan, the percentage of (1) existing old growth, (2) CISC stands

greater than 100 years old, and (3) threatened and endangered species sightings encompassed by currently protected areas was compared to the percentage encompassed by the proposed core areas. Table 1 summarizes the results of this evaluation.

Table 1— Comparison of Currently Protected Areas Versus Proposed Core Areas

| Natural Resource                     | Currently Protected Areas |     | Proposed Core Areas |     | % Increase in Protection |
|--------------------------------------|---------------------------|-----|---------------------|-----|--------------------------|
| Natural Heritage Element Occurrences | 93                        | 51% | 154                 | 84% | 66%                      |
| Existing Old Growth                  | 4,111 ac.                 | 66% | 5,418 ac.           | 93% | 41%                      |
| CISC 100+ years                      | 12,769 ac.                | 45% | 24,641 ac.          | 87% | 42%                      |

Based on this comparison, the proposed conservation plan significantly increases the level of protection in the watershed. Although some of the critical resources are already protected, the Chattooga Conservation Plan protects a significantly higher percentage and includes the critical ecological linkages needed to ensure long-term viability of forest interior habitat and its associated plant and animal species.





## VI. Conservation Plan Recommendations

The collaborators on this project have deliberately left many specific management recommendations unspecified, with the intention of defining the specifics in cooperation with other partners (including the USDA-FS) during the LRMP revision process. We expect that compatible uses will be identified through citizen involvement to revise the forest plans, with dialogue among many local interests. However, some general goals for management of each area appear below.



### *Core/Wildlife Corridor Protection Areas*

Core/Wildlife Corridor Areas are generally to be left alone to mature into viable interior forest, old-growth habitat. Minimum-impact trails would be used to accommodate hunting, recreational, research-oriented, and educational outings. Any timber removal would go forward only with the approval of a committee of conservation biologists (appointed jointly by CRWC and the USDA-FS). More specifically, these areas permit:

- No new roads, and would close specific (unmaintained) roads, and change others to trails for hikers and/or horse back riding
- Specific maintenance on remaining roads, evaluated to determine these roads' effect on species at risk and water quality
- Allowable silviculture techniques and management actions, to be approved by a committee of conservation biologists with full decision-making authority over management activities within the Core/Wildlife Corridor Management Areas
- Economic incentives for private landowners to conserve soil, water, native grasses, and other native species, and to encourage the land owner's use of the Chattooga River Watershed Coalition's Private Lands Forest Stewardship Initiative. Such incentives include tax relief, land swaps, technical assistance with regard to habitat enhancement and restoration, co-location of public infrastructure (e.g., electric and gas lines), and public recognition for persons and entities that practice sound stewardship of their lands and take leadership roles in pursuing the goals of ecosystem protection.
- Legal hunting and fishing.



### *Cooperative Ecological Restoration Management Areas*

In Ecological Restoration Areas management techniques could be used to restore natural ecological processes. These restoration areas are encouraged to support limited roads, forest, stream, and wildlife restoration projects including selective logging, recreational development such as low-impact campgrounds and picnic areas, as well as all legal hunting and fishing. Forded creeks

should be bridged, and problem roads fixed to stop major sediment transport. On agricultural tracts in this area, experiments might be tried that would promote no-till farming, organic agriculture, creek fencing and livestock troughs, and other farming techniques which reduce harmful runoff. The conservation plan recommends these areas for:

- Promotion of sustainable timber management (e.g. selective logging and smaller-scale volumes of extraction and restoration forestry)
- Forest, stream, wildlife and aquatic ecology restoration projects
- Economic incentives for private landowners to conserve soil, water, native grasses, and other native species, and to encourage land owner's use of Chattooga River Watershed Coalition's Private Lands Forest Stewardship Initiative (see list in section above).
- Sustainable agriculture
- Some recreational development such as low-impact campgrounds and picnic areas
- Legal hunting and fishing.



### *Sustainable Economic Development Management Areas*

Sustainable Economic Development Areas are located in and around the larger towns of the watershed. Projects here focus on the development of a sustainable economic structure. An example could be developing markets for locally manufactured (value-added) wood products fashioned from sustainably harvested timber. Locally and sustainably grown produce might have a local outlet here as well. "Greenways" and other public spaces that encourage drivers to stop and explore our towns and area attractions would likely increase the traffic through local businesses, as well as serve as a visible connection between the towns themselves and the larger watershed ecosystem of which they are a part. Finally, the adequate management of the towns' water resources to meet the needs of current and future residents and businesses is perhaps the clearest example of how natural resource management can "make or break" healthy economic development. The Plan recommends these areas be used to:

Enhance tourism, local history, and recreation-related revenues

Promote local manufacturing (sustainable production), especially of value-added products.

Develop public-private partnerships to promote stream restoration and/or greenway efforts.





## Streamside Management Zones

Streamside management zones pass through all of the above Management Areas, and should be considered an extension of the Core/Wildlife Corridor Management Area for ensuring watershed health, including high water quality and the integrity of the aquatic ecosystem. Where possible, 300-foot buffer zones where no soil disturbing activities would take place are to be established around fifth- or higher-order streams. Where current use conflicts with this goal, smaller buffers could be established. At a minimum, state Best Management Practices should be strongly encouraged on private lands and strictly enforced on public lands. Where livestock creates erosion, volunteer labor might help defray the costs of fencing and building a creek-fed trough. Where urban development has treated streams as dumps, volunteer clean-up efforts could help, and long-term greenway development could foster a higher appreciation for their economic and aesthetic value by increasing traffic flow through local businesses.



## A Call to Action

If you would like to become part of this ground-breaking effort to restore and protect the native forests of the Chattooga River watershed for present and future generations, please contact the U.S. Forest Service and ask to be placed on the mailing list of those citizens to be consulted during the upcoming LRMP revision. Request that the Chattooga River Watershed Chattooga Conservation Plan be included as an environmentally responsible alternative during the LRMP revision process.

The addresses are:

Planning Staff Officer  
Chattahoochee National Forest  
508 Oak Street, NW  
Gainesville, GA 30501

Planning Staff Officer  
Sumter National Forest  
4931 Broad River Road  
Columbia, SC 29210

Planning Staff Officer  
Nantahala National Forest  
P.O. Box 2750  
Asheville, NC 28802





## VII. Implementation



### *On Federal Lands*

Implementation of the Chattooga Conservation Plan for restoring the native ecosystem of the Chattooga River watershed is hampered on public lands by the fact that three separate LRMPs, one for each portion of the watershed in each of the three states, govern management decisions. Upcoming revisions of these LRMPs will have to be reconciled so that management policy and objectives are coordinated throughout the watershed. This Plan is intended to build consensus among the public and among public land managers that LRMP revisions involving the Chattooga River watershed should involve environmentally responsible timber management and the restoration of the native forest ecosystem.

On federal lands implementation will be greatly facilitated by the establishment (through the Forest Plan revision processes in NC, SC and GA) of the entire Chattooga basin as a Research Natural Area under the management and budgetary authority of the research branch of the USDA Forest Service. The aim of the Chattooga Conservation Plan is to use the Chattooga River basin as a model and first step toward establishing a large enough and adequately connected regional network of native habitats to support viable populations of endemic species that are currently in decline. The single largest obstacle to achieving that aim is the set of financial incentives designed and passed into law by the U.S. Congress which apply to management of most lands under federal administration. These incentives include line item budgets for road building and timber harvesting; and timber quotas or "Annual Sale Quantities," which are interpreted by public land managers as production goals. Designating federal lands in the Chattooga River watershed as one large Research Natural Area would remove them from the grip of production-driven financial incentives by placing them under the management and budgetary authority of the research branch of the U.S. Forest Service. With the negative incentives removed, the real work of conservation and restoration of our diminishing natural assets can begin. Further details are outlined below.

- Establish the entire Chattooga River watershed (CRW) as a Research Natural Area under the management and budgetary authority of the research branch of the U.S. Forest Service.
- Establish a new professional staff position to coordinate all forest management activities in the CRW.
- Establish a Biodiversity Consulting Team (whose members are appointed jointly by the CRWC and the USDA-FS) to guide and counsel decisions relating to rare and uncommon habitats, existing PETS species, and landscape diversity. This team should have representation from conservation biologists, other university scientists and qualified lay persons. This team should review management decisions to ensure that all levels of biological

diversity are addressed in all management activities. These include genetic diversity within species, species diversity within habitats, and habitat diversity within the watershed landscape. Encourage scientific research by universities, colleges, and the Southeast Forest Experiment Station on the applications of landscape ecology, and on all aspects of the conservation of biological diversity.



### *On State and Local Government, and Private Lands*

The three management area designations and streamside management zones proposed by the Chattooga Conservation Plan (delineated on the attached maps and described above) can be implemented via different means for different types of land managers. The new management areas can be adopted formally on affected federal lands through the ongoing forest plan revision processes in North Carolina, South Carolina, and Georgia. They can be adopted informally on the much smaller amount of affected state land (Black Rock Mountain State Park and Tallulah Falls State Park) through collaborative conservation biology research, and restoration and protection efforts that begin with informational meetings. Management area designations can be adopted in local government jurisdictions through ordinances passed and implemented after community meetings that clarify the economic benefits and existing incentives of comprehensive planning for environmental protection. They can be adopted voluntarily on private lands through conservation easements, management plans, and land trust arrangements—some of which are already being implemented under the CRWC Private Lands Initiative.



### *Outside the Chattooga Watershed*

Develop public-private partnerships to protect adjacent critical habitat owned by Duke Power to the Northeast and Georgia Power to the South.

Link the Northeast areas to other "Mountain Bridge" lands, including the Mountain Bridge Wilderness, Jones Gap State Park, Caesar's Head State Park, Table Rock State Park, and the Greenville Watershed.

Link the South and Southeast areas to other reserves of native habitat, including the Tallulah River Gorge, Panther Creek, Chauga River Drainage, and the new Brasstown Creek Heritage Preserve.

Complete similar conservation plans for other special areas in the Southern Appalachians beyond the Blue Ridge Escarpment, such as the Black Mountains plan currently under development by the Southern Appalachian Forest Coalition. Link these and other conservation plans across the Southern Appalachian landscape.





## Peer Review

This document was reviewed by a group of independent, practicing scientists, who gave valuable criticism that we have incorporated into the final plan document. Where an issue raised by a reviewer was not directly incorporated above, we make an effort to explain why here.

Our evaluation assesses the occurrence of biological "elements"—species and communities—without analyzing whether these elements have the site and landscape processes needed for their persistence. However, we think this kind of analysis is important. Two efforts are now underway to facilitate such an assessment. The first is a careful review of existing literature on the species and communities of the Chattooga watershed, using an existing annotated bibliography (Rundle, 1995). The second is field studies of herbaceous plants, salamanders, and birds before and after timber harvest in areas presently slated for timber harvest in the Tuckaluge project area. The goal of these studies is to assess the effects of timber harvest on selected biodiversity elements, and the results will provide baseline data that will help address whether the proposed plan can provide sufficient habitat to maintain viable populations of the plants and animals monitored. Such baseline data provide the basis for tract-specific protection priorities, the seriousness of specific threats, target population trends for key wildlife, and the success of management activities, including recreation impact assessment, and restoration efforts. In short, many opportunities lie ahead for further cooperation and progress toward the long-term conservation of the Chattooga River watershed.



## References

- Andrew, Susan. 1995. "Promoting a 'delicate, knowing stewardship' on the Chattooga." The Chattooga Quarterly, February. Chattooga River Watershed Coalition, Clayton, GA.
- Brody, A.J., 1984. "Habitat Use By Black Bears in Relation to Forest Management in Pisgah National Forest, North Carolina". M.S. Thesis, Univ. Tennessee, Knoxville, Tenn.
- Bruce, Richard C., Gayle Livingston, Christine Spencer, and Bryan Stuart, 1995. "Amphibian and reptile survey of the Chattooga River watershed: A preliminary report." A report to the Highlands Biological Station, Highlands, NC.
- Carlson, Paul, 1995. "An assessment of the old-growth forest resource on National Forest System lands in the Chattooga River watershed." USDA Forest Service, Region 8, Chattooga Ecosystem Management Demonstration Project.
- Cutler, M. Rupert, 1991. "Meeting the biodiversity challenge through coordinated land-use planning." Renewable Resources Journal, Winter 1991.
- Duffy, D.C. and A.J. Meier, 1992. "Do Appalachian understories ever recover from clearcutting?" Conserv. Biol. 6:196-201.
- Fahrig, Lenore and Gray Merriam, 1994. "Conservation of fragmented populations." Conserv. Biol. 8:50-59.
- Franklin, Jerry F., 1993. "Preserving biodiversity: Species, ecosystems, or landscapes?" Ecological Applications 3:202-205.
- Hamel, Paul, 1990. "The fragmented forest." The Tennessee Conservationist. November/December, pp. 6-9.
- Horn, Charles N., 1995. "Plants of interior forests." The Chattooga Quarterly, February. Chattooga River Watershed Coalition, Clayton, GA.
- Lydeard, Charles and Richard L. Mayden. "A diverse and endangered aquatic ecosystem of the United States." Conserv. Biol. 9(4):800-805.
- Meier, A.J. and S. Bratton, 1995. "The natural disturbance history of the Chattooga watershed." Report to the U.S.D.A. Forest Service, Clemson University, Clemson, SC.
- Morton, Peter A., 1995. "An economic profile of the Chattooga River watershed study area." Unpublished ms.
- Naiman, Robert et al., 1993. "The role of riparian corridors in maintaining regional biodiversity." Ecological Applications 3:209-212.
- Noss, R.F., 1992. "The Wildlands Project land conservation strategy." Wild Earth special issue, The Wildlands Project: Plotting a North American Wilderness Recovery Strategy, pp. 10-25. Cenozoic Society, Canton, NY.
- Noss, R. F. and Robert L. Peters, 1995. "Endangered ecosystems: A status report on America's vanishing habitat and wildlife." Report to Defenders of Wildlife, Washington, D.C.
- Noss, Reed F. and Allen Y. Cooperider, 1994. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Island Press, Washington, D.C.
- Pelton, M.R. 1986. "Habitat needs of black bears in the East." In Wilderness and Natural Areas in the Eastern United States: A Management Challenge. Kulhavy and Conner (eds.)
- Petranka, James W., M. P. Brannon, M.E. Hopey, and C.K. Smith. 1994. "Effects of timber harvesting on low elevation populations of southern Appalachian salamanders." Forest Ecology and Management 67:135-47.
- Rasker R., 1994. "A new look at old vistas: The economic role of environmental quality in western public lands." University of Colorado Law Review. Vol 65. Issue 2.
- Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. "Habitat area requirements of breeding forest birds of the mid-Atlantic states." Wildlife Monographs 103:1-34.



Rudзитis, G. and H. Johansen, 1989. Amenities, migration, and nonmetropolitan regional development. Report to the National Science Foundation. Dept. Geography, University of Idaho, Moscow, ID.

Rundle, Trevor. 1995. "Annotated bibliography of research in the Chattooga River and adjacent watersheds." Report to USDA Forest Service from the Highlands Biological Station (Challenge Cost-Share Agreement #94-03-28), Highlands, NC.

Shelford, V.E., 1993. "Ecological Society of America: A nature sanctuary plan unanimously adopted by the Society, December 28, 1932." *Ecology* 14(2):240-245.

Solheim, S.L., W.S. Alverson and D.M. Waller, 1987. "Maintaining biotic diversity in National Forests: The necessity of large blocks of mature forests." *Endangered Species, Technical Bulletin* 4(8). University of Michigan, School of Natural Resources, Ann Arbor, MI.

Terborgh, John. 1992. "Why American songbirds are disappearing." *Scientific American*. 266: 98-104.

U.S.D.A. Forest Service, 1989. "Generic definition and description of old-growth forests." Washington, D.C.

Wade, J. and F. O'Conner. 1993. "Simulation analysis of the impact of wood products in western North Carolina." *Proceedings of the Southwestern Economic Review*. In press.

Wilcove, David. 1988. "Forest fragmentation as a wildlife management issue in the eastern United States. Paper presented at the Convention of the Society of American Foresters, Rochester, NY, October 16-19.

Whitcomb, R.F., 1981. "Effects of forest fragmentation on avifauna of the eastern deciduous forest." In Burgess and Sharpe, eds. *Forest Island Dynamics in Man-dominated Landscapes*. Springer-Verlag, NY.



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## **CTSP The Conservation Technology Support Program (CTSP):**

The CTSP is a collaborative effort between the Smithsonian Institute's Conservation and Research Center (CRC), the Hewlett-Packard Company (HP), and the Environmental Systems Research Institute (ESRI). The program is designed to enhance the effectiveness of conservation efforts by providing GIS hardware, software, technical training, and examples of conservation applications of the GIS tool. A 1995 basic GIS package award to the Chattooga River Watershed Coalition was used to produce the Chattooga Conservation Plan.



## **Chattooga River Watershed Coalition (CRWC):**

The Chattooga River Watershed Coalition is a 501 (c) (3) non-profit organization whose mission is to protect, promote and restore the natural ecological integrity of the Chattooga River watershed ecosystem; to ensure the viability of native species in harmony with the need for a healthy human environment; and to educate and empower communities to practice good stewardship on public and private lands. Director Buzz Williams steered the Chattooga Conservation Plan through all phases of its development and production. Rick Hester wrote the grant proposal for the CTSP hardware and software, and contributed to the GIS work. Funding for the Chattooga Conservation Plan was provided by the Lyndhurst Foundation, the Turner Foundation, and The Moriah Fund, and was gained through grant proposals written by Nicole Hayler. Robert Zahner, Ph.D, contributed to the Conservation Plan's narrative text.

Kerry Brooks, Ph.D, provided extensive GIS and planning assistance to the project, and supervised students during data development, analysis and transfer. Craig Campbell performed most of the project's GIS technical work, and produced the maps accompanying this document with assistance from Rick Hester. (Details on the tech-

nical process of overlaying the coverages is available upon request from the CRWC office.) Chris Kempton contributed scientific literature and technical support to the project.

## **The Conservation Fund**

### **The Conservation Fund, Southeast Regional Office:**

The Conservation Fund is a non-profit organization dedicated to advancing land and water conservation. The Fund works with businesses, other non-profits and public agencies, and strives to integrate economic and environmental goals for a sustainable future. Will Allen aided in the development of the GIS project design and analysis strategy, and wrote and compiled the narrative drafts of this document. Jamie Christensen worked on data collection and analysis. Page Crutcher helped initiate and direct the Fund's involvement.



### **Southern Appalachian Forest Coalition:**

The mission of the Southern Appalachian Forest Coalition (SAFC) is to promote the restoration and sound stewardship of our public lands, and the heritage of local communities in the Southern Appalachian region. Susan Andrew, SAFC's staff ecologist, aided the project's design and adherence to the principles and findings of the biological sciences. She also contributed to the Plan's narrative text, coordinated the scientific peer review of this project, and oversaw final production.



## Figure reference for the GIS Analysis

See pages 16-17 for detailed analysis.



Figure 1 - The Chattooga Watershed



Figure 2 - Currently Protected Areas

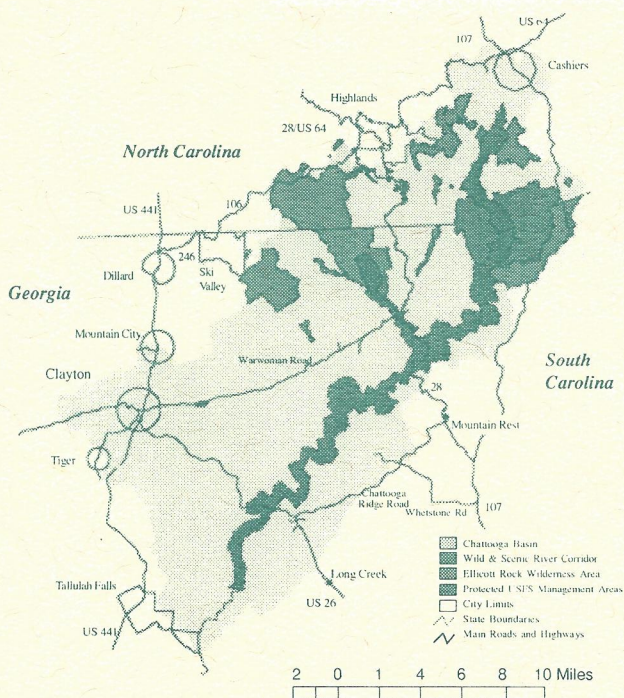


Figure 3 - Existing and Potential Old Growth Forest

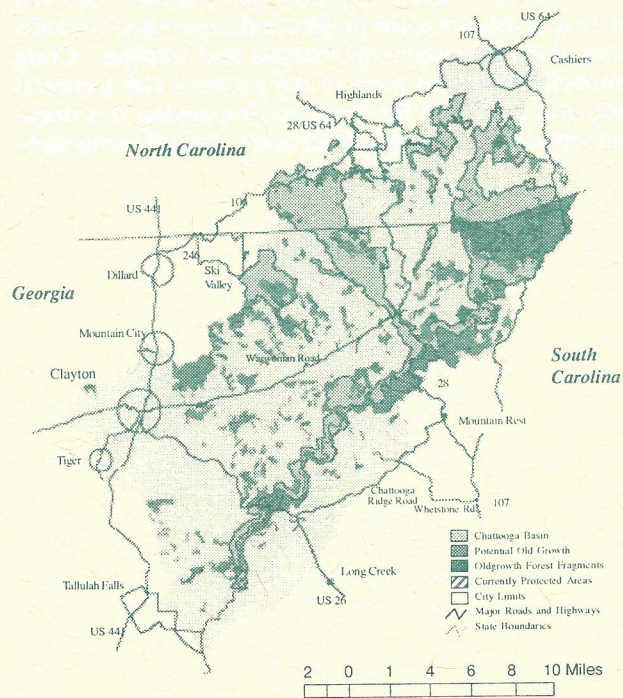




Figure 4 - Roadless Areas

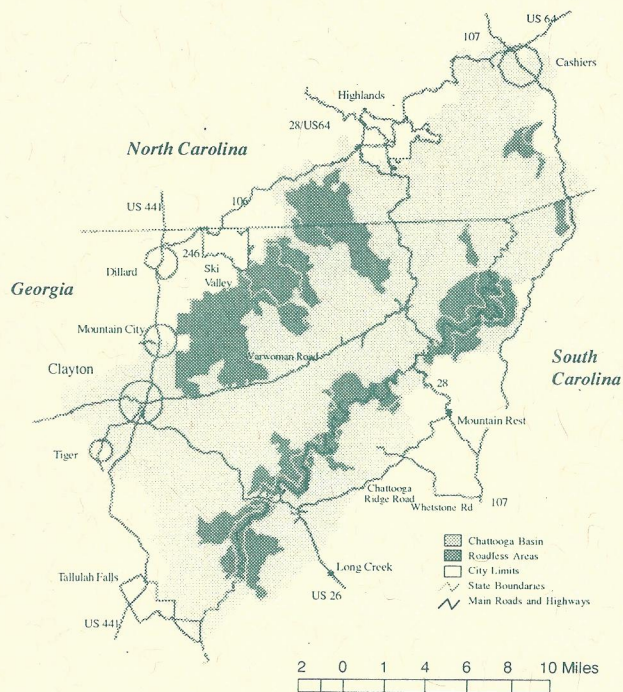


Figure 5 - Conservation Plan "First Step"

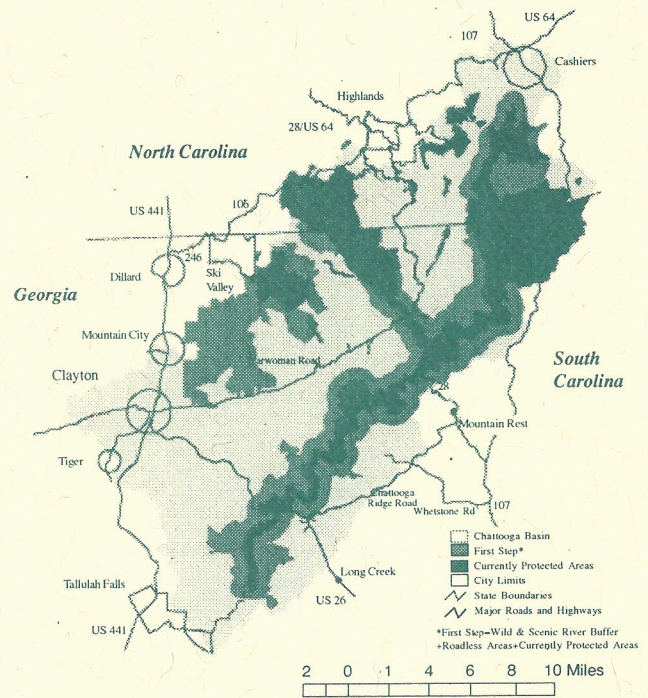


Figure 6 - Sub-Watershed Network

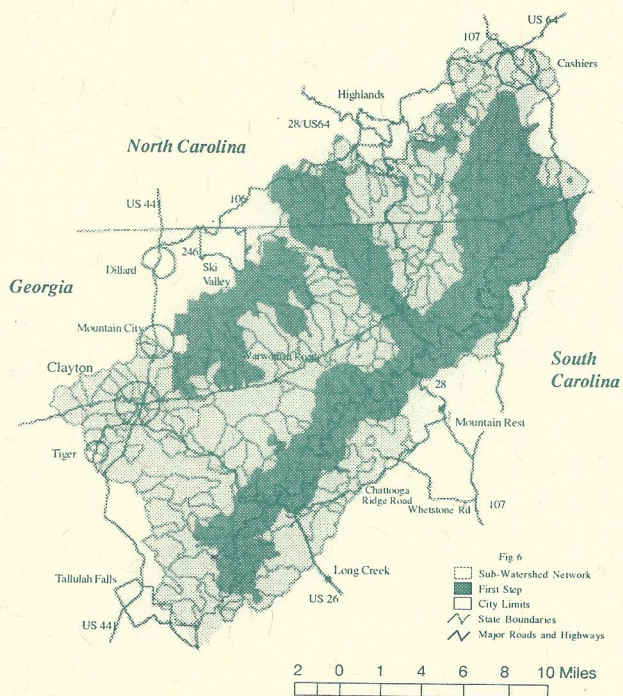
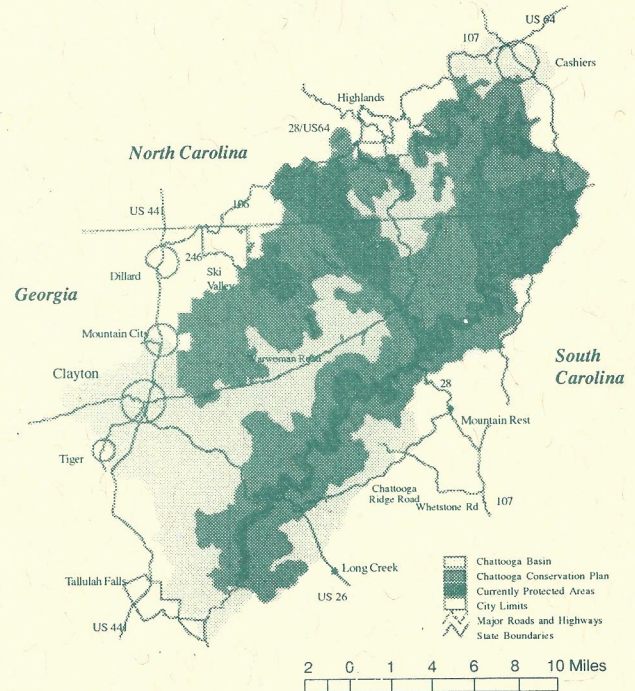


Figure 7 - Chattooga Conservation Plan





*"I found the Chattooga Conservation Plan to be extremely well written, logically organized, and easy to follow from beginning to end. I commend the authors for a fine job".*

— Randy Kautz, Biological Administrator,  
Florida Game and Fresh Water Fish Commission

*"This proposal clearly reflects a great deal of thought, collaboration, knowledge and dedication. It is written very well with a clear organization and effective style. The case is made without excessive jargon...This is a very good job".*

— Henry Wilbur,  
Department of Biology, University of Virginia

*"I am impressed with the Chattooga Conservation Plan...it is well organized, well written in a style and format that is understandable to multiple audiences, reflects good conservation science theory, provides an excellent overview of the region's ecological context, and has an excellent discussion of the economic setting".*

— Robert Sutter,  
Director of Biological Conservation, The Nature Conservancy



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