

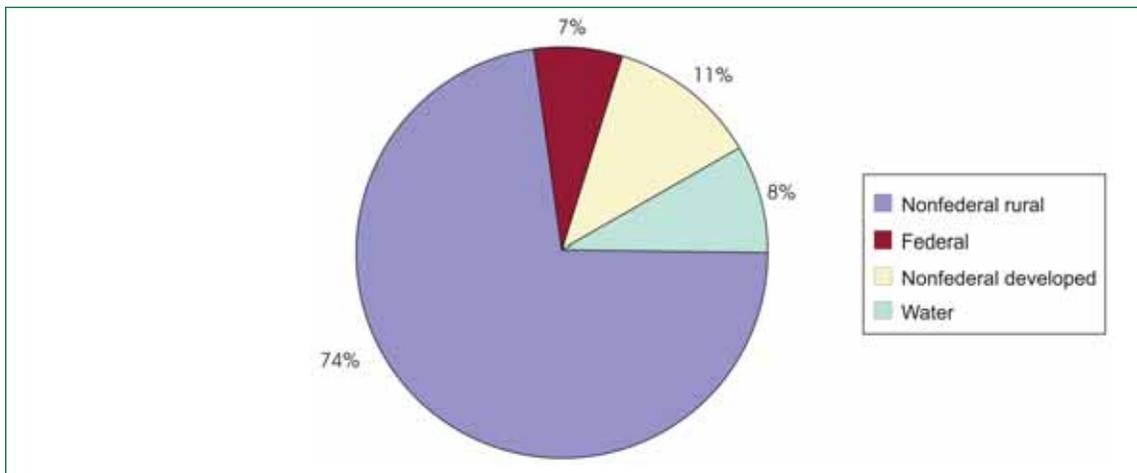
## CHAPTER 3. THE STATE OF THE STATE

### The Condition of Our Resources

The following section highlights basic information about natural resources in North Carolina. This information provides a benchmark by which to assess future needs and concerns associated with fish and wildlife species and their habitats.

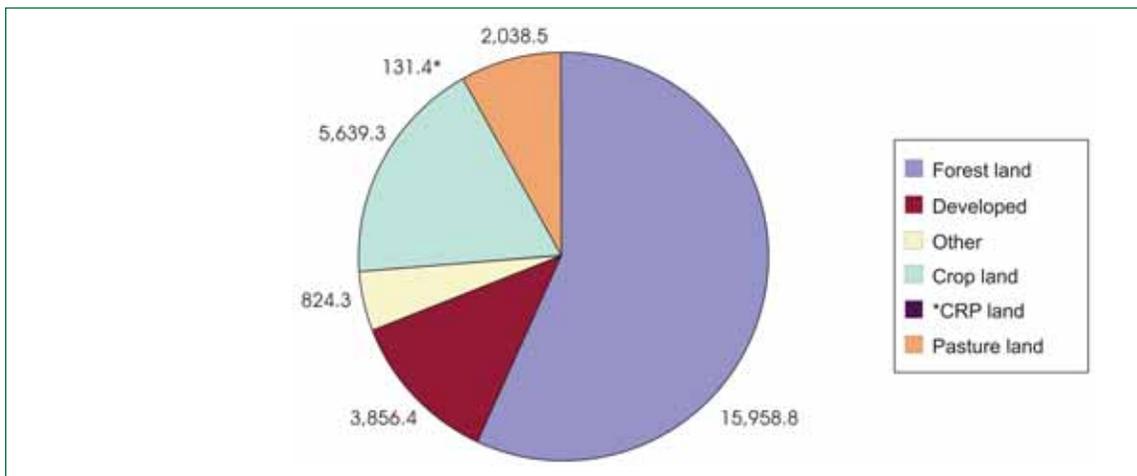
#### Land Use

The Natural Resources Conservation Service conducts a National Resources Inventory (NRI) approximately every five years. This report is a key resource on the status, condition, and trends of soil, water, and land resources across the country. According to the 1997 NRI, the total surface area of North Carolina is 33,709,300 acres, including water areas (Figure 3.1). The vast majority of the state is characterized as nonfederal rural lands ('nonfederal' referring to all lands in private, municipal, state, or tribal ownership).



**Figure 3.1.** Broad land-use characterization in North Carolina (source: NRCS, 1997).

Land use on nonfederal lands in the state, which total 28,448,700 acres, is primarily forest land (Figure 3.2).



**Figure 3.2.** Detailed land-use on nonfederal lands in North Carolina (million acres) (source: NRCS, 1997).

### Protected Species

In North Carolina there are 41 federally-endangered and threatened animal species protected by the US Fish & Wildlife Service under the Federal Endangered Species Act (16 U.S.C. 1531 to 1543). Twenty-nine of those species have recovery plans (Appendix I). In addition, there are 67 state endangered and threatened species, and 115 state species of Special Concern protected by the Commission under the State Endangered Species Act (General Statute 113–331 to 113–337).

There are 27 federally endangered and threatened plant species in North Carolina, protected under General Statute by the US Fish & Wildlife Service. The NC Plant Conservation Program, a unit of the Department of Agriculture and Consumer Services, is responsible for the protection of the 134 state endangered and threatened plant species and the 19 plant species of Special Concern in the state (General Statute Article 19B, 106:202.12–22).

### Endangered Ecosystems

In an assessment of risk to ecosystems in the United States, seven southeastern states (Florida, Georgia, North Carolina, South Carolina, Virginia, Alabama, and Tennessee) made the 'extreme risk' category based on number of endangered ecosystems, percentage of imperiled species by state, and development pressures. Indeed, eight of the top 21 endangered ecosystems in the United States can be found in North Carolina (Noss and Peters 1995) (*position on list shown in parentheses*):

- Southern Appalachian spruce-fir forest (2)
- Loblolly pine and savanna (3)
- Eastern grasslands, savanna, and barrens (4)
- Coastal communities in the lower 48 states (7)
- Large streams and rivers in the lower 48 states (11)
- Cave and karst systems (12)
- Ancient eastern deciduous forest (16)
- Southern forested wetlands (21)

### Critical Areas for Freshwater Conservation

In recent years, three aquatic assessments have been undertaken by conservation organizations, each addressing freshwater biodiversity conservation at different scales. These assessments have largely built on the information gathered in previous efforts in order to identify significant regions and priority areas for freshwater conservation. The World Wildlife Fund conducted a conservation assessment of freshwater ecoregions of North America (Abell et al. 2000). The Nature Conservancy assessed small-scale watersheds across the country (Master et al. 1998) and subsequently identified priority areas within four freshwater ecoregions in the southeast (Smith et al. 2002). All three efforts identify the southeast as a key region for freshwater conservation efforts. Many of the critical areas identified in those efforts overlap North Carolina's borders:

- Abell et al. (2000) identified the entire South Atlantic freshwater ecoregion (southern Virginia through central Georgia) as a key region in which to focus aquatic conservation efforts in North America;
- 21 of the 327 key small watershed areas identified across the country by Master et al. (1998) are found in North Carolina;
- Smith et al. (2002) identified 70 sites for priority freshwater conservation areas in North Carolina (14 in the Tennessee-Cumberland Aquatic Region, 56 in the South Atlantic Aquatic Region).

## Threats

Today, impacts to species and habitats across the country are ubiquitously tied to adverse anthropogenic activities. The following issues represent major threats to species and habitat diversity in North Carolina. Finding solutions to specific fish and wildlife conservation problems will have as much to do with addressing these overarching issues as it will with addressing more immediate sources of the problems. A key component to addressing these issues is the development of language conventions (among agencies and organizations) for defining and measuring threats, which will make it easier to set common priorities to address threats and to measure effectiveness at attaining threat-based objectives (Salafsky et al. 2003). (Discussion of more specific threats to terrestrial and aquatic species and habitats can be found in the individual sections of Chapter 5).

### Human Population Growth and Development

From 1950–1990, the population of North Carolina grew by 63% (US Census Bureau 2000). In a 10-year period alone (1990–2000) the state has experienced a 21% increase in human population size, and growth is projected to increase by the same amount over the next 25 years (2000). Human population growth in turn results in greater demands on land and water resources to support those populations. Indeed, the state ranks sixth in the country for total acres of land developed between 1992 and 1997 (NRCS 2000). Subsequent impacts to terrestrial and aquatic systems include habitat degradation, fragmentation and destruction.

### Physical Alteration of Terrestrial Habitats

Direct habitat destruction is the most widely acknowledged threat to biodiversity at the species and ecosystem level (Noss and Peters 1995). Across the southeast, less than 3% of presettlement upland longleaf pine communities (Frost 1993) and only 1% of presettlement canebreak and Atlantic white cedar communities exist today (Frost 1987). It is now estimated that half of North Carolina's original wetlands have been lost due to development and conversion to cropland (Mitsch and Gosselink 1993). Widespread fire suppression over the past century has contributed greatly to the alteration and succession of ecologically fire-dependent systems (e.g., longleaf pine, early successional habitats). Land fragmentation due to highway development, land-use conversion (e.g., from forests to plantations, farms, golf courses, housing developments) and alterations of landforms such as beach renourishment and spoil deposition banks are also significant threats (TNC 2000, TNC and NatureServe 2001). The Forest Service estimates that forest acreage in North Carolina has fallen by one million acres (5.6%) since 1990, primarily due to development (Brown 2004).

### Physical Alteration of Aquatic Habitats

Destruction and degradation of habitat are widely cited as the greatest threats to aquatic species in the United States (Angermeier 1995, Warren et al. 1997, Williams et al. 1993). Physical alterations such as channelization and dredging, aquifer depletion, impoundment and dam construction, and flow modification have contributed directly to the decline of aquatic species in the south (Walsh et al. 1995, Etnier 1997). Increases in impervious surfaces, and subsequently stormwater flows, have caused changes in sediment transport and stream energy, which has led to limitations in the amount of suitable aquatic habitat and stream bed material, especially near urban areas. The Nature Conservancy (2000, TNC and NatureServe 2001) identifies altered surface hydrology (e.g., flood-control and hydroelectric dams, inter-basin transfers of water, drainage ditches, breached levees, artificial levees, dredged inlets and river channels), and a receding water table as among the most significant sources of biological and ecological stress, especially in the Coastal Plain.

### Water Quality Impacts

In addition to physical alteration of aquatic habitat, sediments and contaminants delivered through point and non-point sources compound threats to aquatic systems (TNC 2000). Point source pollution is delivered primarily in the form of municipal wastewater and stormwater discharges. The majority of water quality problems in North Carolina, however, stem from non-point source pollution associated with land use activities such as development projects, forestry and agricultural practices, and road construction (NCDWQ 2000, SAMAB 1996).

## Invasive and Exotic Species Introductions

Non-native and invasive species introductions (both plant and animal) continue to pose a threat to native wildlife in North Carolina. Introductions have occurred in a number of different ways, ranging from intended stockings, to range expansions, to the pet trade. Impacts on native species are equally varied; some exotics out compete native species (e.g., kudzu and Japanese stiltgrass), others cause hybridization (e.g., red-eared sliders breeding with native yellow-eared sliders), still others cause direct mortalities to our native resources (e.g., red imported fire ants, the hemlock wooly adelgid).

Recognizing the importance of addressing invasive and exotic species introductions and their impacts on our native wildlife resources, each state Scientific Council<sup>1</sup> is currently (as of 2005) developing an invasive and exotic species report. These reports will identify exotic and invasive species potentially injurious to native species and habitats, and guide policy and management strategies. The reports are scheduled for completion by the fall of 2005, at which time they will be presented to the Commission's Nongame Wildlife Advisory Committee. They will serve as key resources to broaden awareness and address necessary actions to control the impacts of invasive and exotic species in North Carolina.

## Key Conservation Partners

Species and habitat conservation activities are carried out across the state by numerous agencies and organizations. Some key agency and non-profit groups are highlighted below. Each group serves a critical role in advancing the goal of maintaining and protecting our state's natural resources. There are also *numerous* other agencies and organizations (far too many to highlight individually) that serve a supporting role in protecting the natural resources of the state (e.g., through education, policy, and/or other forms of natural resource management).

### State Agencies

#### North Carolina Wildlife Resources Commission

The mission of the Commission is to conserve, protect, manage, restore and regulate the wildlife resources of the state. Toward this mission, Commission biologists conduct a variety of management and conservation activities, ranging from surveys and inventories, to habitat management, to land acquisition. Since 1984, when the Nongame Program was begun, nongame wildlife conservation has been an active part of Commission activities (*for a history of the program, see NWCRC 1999*). The Habitat Conservation Section within the Division of Inland Fisheries now oversees the Commission's Aquatic Nongame Program. The Wildlife and Lands Management Section within the Division of Wildlife Management oversees the Faunal Diversity (terrestrial nongame) Program. A standing Nongame Wildlife Advisory Committee provides external support and assistance to the Commission's nongame activities.

#### North Carolina Museum of Natural Sciences

Museum researchers maintain the state's extensive zoological collections, conduct primary research in the natural sciences, collaborate on research projects with area universities, state and federal agencies and international organizations, and interpret natural history to the public. Animal collections are maintained for terrestrial invertebrates, aquatic invertebrates, crustaceans, fish, amphibians, reptiles, birds and mammals. Scientists and policymakers rely on the collections and the data they contain for purposes as varied as judging the appropriateness of environmental permits, assessing historical pollutant levels at specific localities, and determining the level and/or significance of intraspecies differentiation in taxonomy. The Museum collections also play a major role in basic biodiversity research.

<sup>1</sup>Scientific Councils are made up of panels of expert biologists from across the state; each Council provides recommendations for species status listings to the Nongame Wildlife Advisory Committee. Councils exist for birds, mammals, amphibians and reptiles, freshwater fishes, freshwater and terrestrial mollusks, freshwater crustaceans.

### **North Carolina Natural Heritage Program**

The Natural Heritage Program inventories, catalogues and facilitates protection of the rare and most outstanding elements of the natural diversity of North Carolina. These elements of natural diversity include plants and animals which are so rare, or natural communities which are so significant, that they merit special consideration as land-use decisions are made. The Natural Heritage Program follows methodology developed by The Nature Conservancy and shared by the Natural Heritage Network and NatureServe. By consolidating information about hundreds of rare species and natural communities, the program is able to ensure that the public is able to get the information needed to weigh the ecological significance of various sites, and to evaluate the likelihood and nature of ecological impacts resulting from land-use activities. This information supports informed evaluations of the trade-offs associated with biological diversity and development projects. Finally, Natural Heritage Program data can be used to help set priorities for the protection of North Carolina's most important natural areas.

### **North Carolina Division of Marine Fisheries**

The Division of Marine Fisheries is responsible for the stewardship of the state's marine and estuarine resources. The Division's jurisdiction encompasses all coastal waters and extends to 3 miles offshore. Recognizing the need to both protect habitat and prevent overfishing, the North Carolina General Assembly passed the Fisheries Reform Act in 1997. The law contains the directive to protect and enhance habitats supporting coastal fisheries. The law requires cooperation among three rule-making commissions to develop, adopt, and implement plans and strategies to protect and restore fisheries habitats: Environmental Management Commission, Coastal Resources Commission, and Marine Fisheries Commission. The Division of Marine Fisheries was charged to coordinate the development of such strategies in a report entitled the Coastal Habitat Protection Plan (CHPP). The CHPP is organized across six key estuarine and marine fisheries habitats. It was completed and approved by the Commissions in late 2004.

### **North Carolina Division of Coastal Management**

The Division of Coastal Management works to protect, conserve and manage North Carolina's coastal resources through an integrated program of planning, permitting, education and research. The Division carries out the state's Coastal Area Management Act (CAMA), the Dredge and Fill Law and the federal Coastal Zone Management Act of 1972 in the 20 coastal counties, using rules and policies of the Coastal Resources Commission. The Division of Coastal Management is part of the Department of Environment and Natural Resources. The Division also receives oversight (and part of its funding) from the Office of Ocean and Coastal Resource Management, part of the National Oceanic and Atmospheric Administration. The Division of Coastal Management is responsible for several programs, including permitting and enforcement, CAMA land-use planning, public beach and waterfront access, North Carolina Coastal Reserves, and grants for marine sewage pumpout. Division staff also collect and analyze data for erosion rates, wetlands conservation and restoration, and to assess the impacts of coastal development.

### **North Carolina Division of Forest Resources**

The Division of Forest Resources is mandated to protect, manage and develop the forest resources of the state. The processes used to accomplish this mandate involve management of existing resources, development and creation of new and better forests, and protection of these valuable resources. The primary emphasis in conducting the programs under these objectives is directed at the 664,000 forest landowners who collectively own 11.54 million acres (69%) of the state's 16.77 million acres of privately owned forest land. The Division is directly involved with forest management assistance to private landowners, reforestation services, forest fire prevention and suppression, and insect and disease control programs. The Division also is involved in the operation of tree seedling nurseries, long-range forestry planning and technical development, water quality controls, urban forestry assistance, training and support to volunteer fire departments and forestry education.

### **North Carolina Division of Water Quality, Basinwide Planning Program**

Basinwide water quality planning is a nonregulatory, watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared for each of the 17 major river basins in the state and are updated at five-year intervals. While these plans are prepared by the Division of Water Quality, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholder groups in the state. The goals of basinwide planning are to: 1) identify water quality problems and restore full use to impaired waters, 2) identify and protect high value resource waters, and 3) protect unimpaired waters while allowing for reasonable economic growth. The Division of Water Quality accomplishes these goals by collaborating with other agencies to develop appropriate management strategies, assuring equitable distribution of waste assimilative capacity, evaluating the cumulative effects of pollution, and by improving public awareness and involvement.

### **Ecosystem Enhancement Program**

The Ecosystem Enhancement Program (EEP) was created in 2003 out of a memorandum of agreement between the US Army Corps of Engineers, the NC Department of Environment and Natural Resources (NCDENR), and the NC Department of Transportation (NCDOT), effectively merging the NCDENR Wetlands Restoration Program with resources from the NCDOT Office of Natural Environment. The mission of the EEP is to restore, enhance and protect the state's wetlands, streams and streamside buffers, with an aim to improve the state's compensatory mitigation process for unavoidable impacts to wetlands and streams. EEP will identify and implement projects within the context of a watershed approach based on multiple scales of planning, provide functional replacement based on watershed needs through stream, buffer and wetlands projects, and provide watershed planning and project implementation in advance of impacts. The existing Watershed Restoration Plans, developed by the Wetlands Restoration Program in cooperation with, and on the same five-year planning cycle as the NC Division of Water Quality Basinwide Planning Program, are key to these efforts.

### **One North Carolina Naturally Initiative**

The One North Carolina *Naturally* initiative promotes and coordinates the long-term conservation of North Carolina's land and water resources. The Office of Conservation and Community Affairs (within the NC Department of Environment and Natural Resources) manages the program by leading the development and implementation of a comprehensive statewide conservation plan involving government agencies, private organizations, landowners and the public. This voluntary program pursues the conservation of significant natural areas, working farms and forests, and our coastal estuarine system.

One NC *Naturally* also provides support for development of regional open space plans, providing assistance through regional meetings and resource materials. One NC *Naturally's* regional planning process provides an effective forum for decision-making about conservation in our communities. By first working with local and regional groups to address the specific needs of each region, the state can move in an overall direction that does not conflict with goals of any particular region. Currently, 92 counties across North Carolina are involved in 14 local and regional open space planning efforts. Local and regional open space planning efforts provide invaluable new information to add to the statewide conservation plan. Data from each of these regional plans is incorporated into the web-based NC Conservation Land Map Viewer (<http://www.onencnaturally.org/mapviewer/>) where the data is continually updated. This online decision support tool can provide key information vital to successful planning efforts.

## Federal Agencies

### US Fish & Wildlife Service

The US Fish & Wildlife Service oversees five field units nation-wide: National Wildlife Refuges, National Fish Hatcheries, Law Enforcement, Ecological Services offices and Fishery Resources offices. Since the mid-1990s, the Fish & Wildlife Service has operated within an ecosystem-based approach, bringing individuals within each of the different programs together to tackle species and habitat conservation. There are 53 ecosystem units nationwide (based on US Geological Survey defined watersheds). Three ecosystem teams fall within North Carolina's boundaries, the Roanoke-Tar-Neuse-Cape Fear Ecosystem team, the Savannah-Santee-PeeDee Ecosystem team and the Southern Appalachian Ecosystem team. The US Fish & Wildlife Service operates 10 wildlife refuges in North Carolina, and oversees recovery plans for federally listed species occurring in the state. Wildlife Action Plans for each of the 10 refuges in the state are to be completed by 2006.

### Natural Resources Conservation Service

The mission of the Natural Resources Conservation Service (NRCS), an agency within the US Department of Agriculture, is to provide leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment. In order to meet this mission, NRCS offers a variety of incentives-based programming aimed at species and habitat conservation, including Farm Bill programs like the Wetlands Reserve Program, Wildlife Habitat Incentives Program, and Conservation Reserve Program, among others. The NRCS provides assistance to land users for developing and implementing conservation plans on their lands. The National Resources Inventory, a nationwide survey conducted annually by the NRCS, is the Federal Government's principal source of information on the status, condition, and trends of soil, water and related resources in the United States.

### National Oceanic and Atmospheric Administration Fisheries

The National Oceanic and Atmospheric Administration (NOAA) Fisheries unit (formerly known as the National Marine Fisheries Service) is the federal agency responsible for the stewardship of the nation's living marine resources and their habitat. NOAA Fisheries is responsible for the management, conservation and protection of living marine resources within the United States' Exclusive Economic Zone (waters three to 200 miles offshore). Using the tools provided by the Magnuson-Stevens Act, NOAA Fisheries assesses and predicts the status of fish stocks, ensures compliance with fisheries regulations and works to reduce wasteful fishing practices. Under the Marine Mammal Protection Act and the Endangered Species Act, NOAA Fisheries recovers protected marine species (e.g., whales, sea turtles) without unnecessarily impeding economic and recreational opportunities. NOAA Fisheries works to promote sustainable fisheries and to prevent lost economic potential associated with overfishing, declining species and degraded habitats. NOAA Fisheries strives to balance competing public needs and interest in the use and enjoyment of our oceans' resources.

### US Forest Service

The US Forest Service, an agency within the US Department of Agriculture, manages public lands in national forests and grasslands. The mission of the Forest Service is to sustain the health, diversity and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. North Carolina falls within the Southern Region of the Forest Service (Region 8). There are four National Forests in North Carolina: Croatan, Uwharrie, Nantahala and Pisgah. Each has its own Land and Resource Management Plan (LRMP), a document that provides direction for the future management of the forest and its resources. The Croatan National Forest underwent a LRMP revision in 2003. Significant updates to the Nantahala, Pisgah, and Uwharrie National Forest plans are scheduled for 2008 – 2009, according to the Forest Planning schedule.

### **National Park Service**

The National Park Service preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout the United States and the world. Across their properties, the National Park Service conducts ecosystem restoration, invasive species management, integrated pest management, migratory bird studies, threatened and endangered species management, wildlife health and disease studies, wildlife and habitat management, and cooperates with partner agencies and organizations to fulfill shared missions. The National Park Service manages 12 sites in North Carolina: Appalachian National Scenic Trail, Blue Ridge Parkway, Cape Hatteras National Seashore, Cape Lookout National Seashore, Carl Sandburg Home National Historic Site, Fort Raleigh National Historic Site, Great Smoky Mountains National Park, Guilford Courthouse National Military Park, Moores Creek National Battlefield, Overmountain Victory National Historic Trail, Trail of Tears National Historic Trail and Wright Brothers National Memorial.

### **Gap Analysis Project**

The NC Gap Analysis Project is the state level representative of the National Gap Analysis Program sponsored by the Biological Resources Division of the US Geological Survey. The mission of Gap Analysis is to conduct regional assessments of the conservation status of native terrestrial vertebrate species and natural land cover types and to facilitate the application of this information to land management activities. This is accomplished by addressing the following five objectives: (1) map the land cover of the United States, (2) map predicted distributions of terrestrial vertebrate species for the United States, (3) analyze the representation of vertebrate species and land cover types in areas managed for the long-term maintenance of biodiversity, (4) provide this information to the public and those entities charged with land use research, policy, planning and management, and (5) build institutional cooperation in the application of this information to state and regional management activities. NC Gap Analysis Program staff provided critical assistance in mapping species distributions and habitat types for the Plan.

### **Non-profit Organizations**

#### **The Nature Conservancy**

The Nature Conservancy's mission is to preserve the plants, animals and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. This mission is carried out through partnerships, alliances, and collaborations with a variety of state and federal agencies, land trusts, and conservation groups. The Nature Conservancy has developed a strategic, science-based planning process, called *Conservation by Design*, which is used to help identify the highest-priority places—landscapes and seascapes that, if conserved, promise to ensure biodiversity over the long term. North Carolina falls within three The Nature Conservancy-defined ecoregions (the Mid-Atlantic Coastal Plain, the Piedmont, and the Southern Blue Ridge), each with its own ecoregional plan, the purpose of which is to identify priority conservation areas within the ecoregion.

#### **North Carolina Audubon**

The mission of the National Audubon Society's North Carolina State Office is to conserve and restore natural ecosystems, focusing on birds, other wildlife, and their habitats for the benefit of humanity and North Carolina's biological diversity. The Important Bird Areas (IBA) Program is key to this mission. The IBA program operates under two objectives: 1) to identify those places that are essential to sustaining the diversity and abundance of naturally occurring populations of birds in North Carolina, 2) to protect or ensure the appropriate management of these sites for the long-term conservation of birds and their habitats. As of 2004, 92 sites have been approved as IBAs across the state. North Carolina Audubon is a key partner for beach-nesting bird and colonial waterbird conservation efforts in the state.

### **North Carolina Wildlife Federation**

The mission of the North Carolina Wildlife Federation (NCWF) is to be the leading advocate for all North Carolina wildlife and its habitat. The goals of the NCWF are: 1) to advocate the conservation and enhancement of all wildlife and its habitat, 2) to advocate ethical and biologically sound hunting, fishing, and other outdoor activities, 3) to advocate education, for children and adults, that increases public awareness of wildlife, its dependence on habitat, and the importance of both to human existence, 4) in affiliation with member organizations, to communicate, cooperate and partner with the North Carolina General Assembly, state resource agencies, corporations, and other interested groups to advance the well being of wildlife and its habitat, and 5) in affiliation with the National Wildlife Federation, to support national and international issues of mutual interest. NCWF was instrumental in bringing about the creation of the Commission in the mid-1940s and they continue to be a key advocate for wildlife and wildlife-related policy in North Carolina.

### **The Conservation Trust for North Carolina**

The Conservation Trust for North Carolina (CTNC) was created in 1991 to help protect North Carolina's land and water resources, both by direct action and by assisting private, local land trusts, other community groups, and private landowners. CTNC is the statewide land trust working with communities, landowners, local land trusts, and other conservation organizations to protect North Carolina's natural and cultural resources. CTNC serves as the resource center for North Carolina's 24 local and regional land trusts. It acts as a "hub" for information exchange, coordination, public policy representation, and financial assistance. CTNC works cooperatively with land trusts across the state to help landowners protect natural resources through voluntary conservation methods.

## **Administrative and Management Challenges**

Agencies and organizations face many bureaucratic obstacles to administering and monitoring the efficacy of their programs. The following section was developed to highlight some of the ubiquitous challenges faced by agencies and organizations across the state with the thought that we cannot hope to change or reduce these challenges without addressing them head-on.

### ***Fragmented Responsibility and Jurisdiction***

Conservation of habitats and their associated flora and fauna is a process of managing the resources and the anthropogenic impacts to those resources. Yet species regularly migrate across political boundaries and the factors that can influence their abundance and distribution are many (e.g., habitat availability, air quality, water quality, habitat connectivity, habitat composition). What's more, the impacts to species and habitats can include any number of human influences: agricultural practices, road construction, urban sprawl, industrial water demand, municipal sewage treatment, invasive species releases. While species and habitats may be affected by the sum of these impacts, we must manage their influence in piecemeal fashion, under the jurisdiction of multiple regulatory agencies and organizations. Thus we have fragmented responsibility for managing the resources as well as the *impacts* to wildlife and habitats, both of which impose organization obstacles to effective conservation. Inter-agency technical guidance and the permit review process are two examples of how agencies attempt to bridge those gaps. Critical considerations include:

- How effective are technical guidance procedures to protect, conserve and reduce impacts to habitats and individual species?
- How many permit review recommendations actually get implemented?
- Are policies and regulations complimentary or consistent among agencies that have jurisdiction over a shared resource?
- Are permit conditions enforced?
- Are policy-based recommendations sound, e.g., minimum stream flows, instream mining restrictions, buffer policies, and breeding season moratoriums on development activities?
- What are the barriers to success and how do we measure success among so many entities?

### *Communication Challenges*

Considering the diversity of goals and responsibilities among the many disparate units of government, effective and efficient communication among agencies is imperative, but challenging. If the goals and priorities of conservation agencies aren't even "part of the calculation" for other governmental entities that influence those very goals and priorities, again obstacles will be raised to practicing effective conservation. Clear communication of a larger suite of goals, including conservation goals, is needed throughout a broader portion of government if institutional obstacles to conservation are to be lessened. Within agencies, too, it is imperative that there is communication between programs, divisions, and departments so that the objectives and goals of each are in concert with, not in opposition to, one another. Natural resource agencies must also strive to work more closely with the broader non-governmental conservation organizations in order to identify common goals and work towards cooperative achievement of those goals. For example, critical considerations for the Commission might include:

- Is the Commission effective in communicating its messages to other agencies, organizations, user groups?
- Is it effective in influencing their decisions, in affecting change?
- What are the desired impacts of inter-agency communications; are the communications producing those impacts?

Agencies must also periodically examine their own organizational structures and processes to look for ways to remove impediments to doing good conservation on the ground. Within the Commission for example, nongame and permit review programs are relatively new (as of 2005) and their effectiveness is related to how well their functions are integrated into the larger agency program. Similarly, coordination among the Aquatic Nongame, Faunal Diversity, Land Management, Private Lands, Technical Guidance, Stream Restoration, and Permit Review functions is critical. Organizational considerations affect that coordination. The fractious structure will require extra effort to make sure that broad conservation goals are set and met and resources are allocated appropriately.

### *Information Management*

Multiple agencies in the state collect and manage species and habitat information. Data are inevitably collected in different formats, using different managing systems, and for different purposes. The challenge agencies face is to reduce redundancy in data collection and improve data sharing capabilities. A more unified database management system, with access to as much data as possible, could help to identify data gaps (e.g., survey efforts needed), provide a one-stop comprehensive view of data collected about a particular species or habitat (rather than having to search multiple, independent databases), and ultimately lead to better resource efficiency. The ultimate goal of information management improvements is to better inform management decisions, using the most up-to-date and accurate information possible, regardless of who collected it. Critical considerations include:

- What type of information is available and from whom?
- How accessible is data?
- Is the most up-to-date data being used to inform decisions?
- Is data collection from one agency redundant of another?

## References

- Abell, R. A., D. M. Olsen, E. Dinerstein, P. T. Hurley, J. T. Diggs, W. Erichbaum, S. Walters, W. Wettengel, T. Allnutt, C. J. Loucks, and P. Hedao. 2000. Freshwater ecoregions of North America. A conservation assessment. Island Press, Washington, D.C.
- Angermeier, P. L. 1995. Ecological attributes of extinction-prone species: loss of freshwater fishes of Virginia. *Conservation Biology* 9:143–158.
- Brown, M. J. 2004. Forest Statistics for North Carolina, 2002. Southern Research Station. US Department of Agriculture, Forest Service, Asheville, NC.
- Etnier, D. A. 1997. Jeopardized southeastern freshwater fishes: a search for causes. Pages 87–104 in G. W. Benz and D. E. Collins, editors. Aquatic fauna in peril: the southeastern perspective. Southeast Aquatic Research Institute, Decatur, GA.
- Frost, C. C. 1987. Historical overview of Atlantic white cedar in the Carolinas. Pages 257–264 in A. D. Laderman, editor. Atlantic white cedar wetlands. Westview Press, Boulder, CO.
- Frost, C. C. 1993. Four centuries of changing landscape patterns in the longleaf pine ecosystem. Pages 17–43 in S. H. Hermann, editor. Proceedings of the Tall Timbers fire ecology conference, No. 18. Tall Timbers Research Station, Tallahassee, FL.
- Master, L. L., S. R. Flack, and B. A. Stein, editors. 1998. Rivers of life: critical watersheds for protecting freshwater biodiversity. The Nature Conservancy, Arlington, VA.
- Mitsch, W. J., and J. G. Gosselink. 1993. Wetlands, 2nd edition. John Wiley & Sons, New York.
- Natural Resources Conservation Service (NRCS). 1997. 1997 National Resources Inventory. U.S. Department of Agriculture, Washington, D.C.
- Natural Resources Conservation Service (NRCS). 2000. 1997 National Resources Inventory, revised December 2000. U.S. Department of Agriculture, Washington, D.C.
- N.C. Division of Water Quality (NCDWQ). 2000. Water quality citizen's guide. N.C. Department of Environment and Natural Resources, Division of Water Quality, Raleigh, NC.
- N.C. Wildlife Resources Commission (NCWRC). 1999. North Carolina wildlife diversity plan. Division of Wildlife Management, N.C. Wildlife Resources Commission.
- Noss, R. F., and R. L. Peters. 1995. Endangered ecosystems: a status report on America's vanishing habitat and wildlife. Defenders of Wildlife.
- Salafsky, N., D. Salzer, J. Ervin, T. Boucher, and W. Ostlie. 2003 (DRAFT). Conventions for defining, naming, measuring, combining, and mapping threats in conservation. An initial proposal for a standard system. Foundations of Success, Bethesda, MD.
- Smith, R. K., P. L. Freeman, J. V. Higgins, K. S. Wheaton, T. W. FitzHugh, K. J. Ernstrom, and A. A. Das. 2002. Priority areas for freshwater conservation action: a biodiversity assessment of the Southeastern United States. The Nature Conservancy.
- Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment aquatic technical report. Report 2 of 5. U.S. Department of Agriculture, Forest Service, Southern Region, Atlanta, GA.
- The Nature Conservancy (TNC). 2000. Conservation by design: a framework for mission success. The Nature Conservancy, Arlington, VA.
- The Nature Conservancy (TNC) and Natureserve. 2001. Mid-Atlantic Coastal Plain Ecoregion Plan. The Nature Conservancy, Durham, NC.
- U.S. Census Bureau. 2000. 1990 to 1999 total population estimates. U.S. Census Bureau, Population Distribution Branch. <http://www.census.gov/population.html>
- Walsh, S. J., N. M. Burkhead, and J. D. Williams. 1995. Southeastern freshwater fishes. Pages 144–147 in E. T. LaRoe, G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac, editors. Our living resources: a report to the Nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of Interior, National Biological Service, Washington, D.C.
- Warren, M. L., P. L. Angermeier, B. M. Burr, and W. R. Haag. 1997. Decline of a diverse fish fauna: patterns of imperilment and protection in the southeastern United States. Pages 105–164 in G. W. Benz and D. E. Collins, editors. Aquatic fauna in peril: the southeastern perspective. Southeast Aquatic Research Institute, Decatur, GA.
- Williams, J. D., M. L. Warren, K. S. Cummings, J. L. Harris, and R. J. Neves. 1993. Conservation status of the freshwater mussels of the United States and Canada. *Fisheries* 18:6–22.

