The Aquatic Technical Report

1.0 INTRODUCTION

The Southern Appalachians serve as habitat for numerous species and headwaters for nine major rivers. Streams support three species of trout, a number of threatened and endangered species, and other aquatic species of concern. There is a growing public awareness of the importance of aquatic resources and the need to prudently manage the land in such a way that protects, maintains, and restores water quality.

The aquatic assessment addresses a number of issues identified through public participation and consultation with state, local, and federal agencies. These five questions should provide information which could be used to better manage aquatic resources across state, political, and forest boundaries. The questions relate to the basic values of water resources, the living organisms that depend on those water resources, and how these resources are being affected by human activities. The assessment is a compilation of existing data and information about the aquatic resources and, wherever possible, addresses likely future trends. The data and information have been limited by availability of data and a compressed timeframe in which to assemble the data.

The aquatic team, comprised of representatives from a number of agencies, set goals to identify and develop information that could be assimilated and analyzed using Geographic Information System (GIS) technology. GIS products were developed to answer the five questions and compiled in a unified database. The team soon determined that aquatic resource data across the SAA are lacking or may be available only in some locations that do not necessarily represent the SAA area as a whole. Consequently, the assessment has identified a number of research and data needs necessary for a comprehensive understanding of the current status and future trends of aquatic resources.

The study area boundary and the counties within that boundary are mapped in figure 1.0.1. The major drainages of the study area are shown in figure 1.0.2. River systems draining the Southern Appalachians eventually flow to

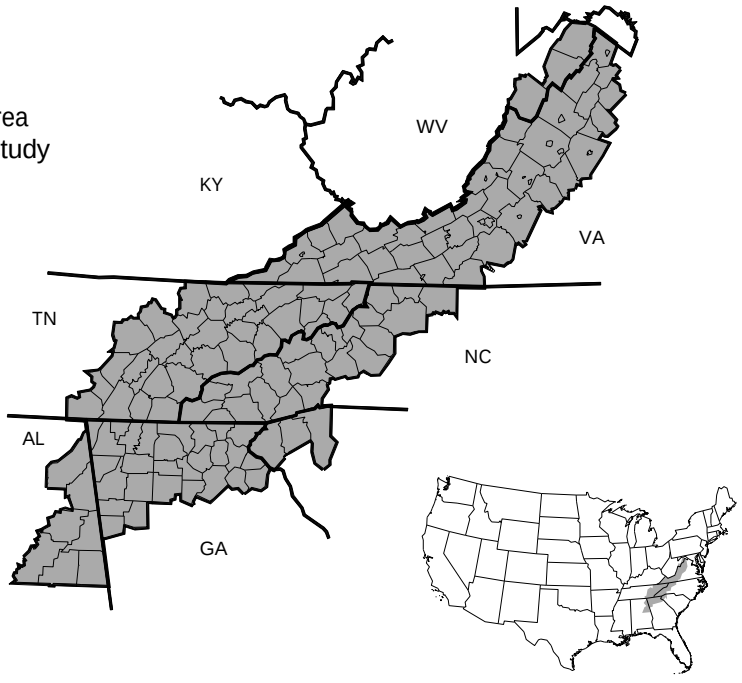


Figure 1.0.1 Southern Appalachian Assessment study area. The study area boundary and counties within the study area are shown.

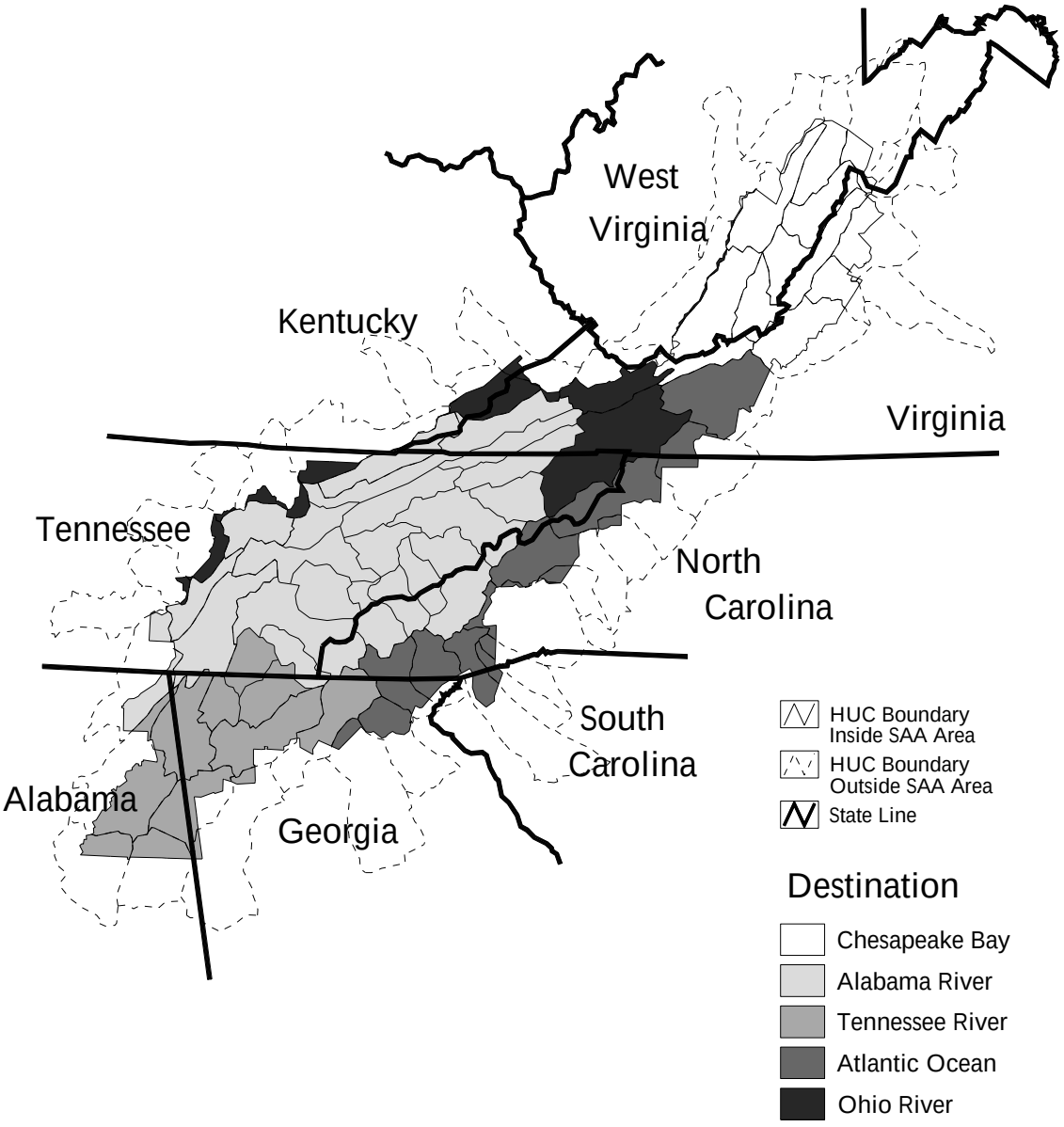
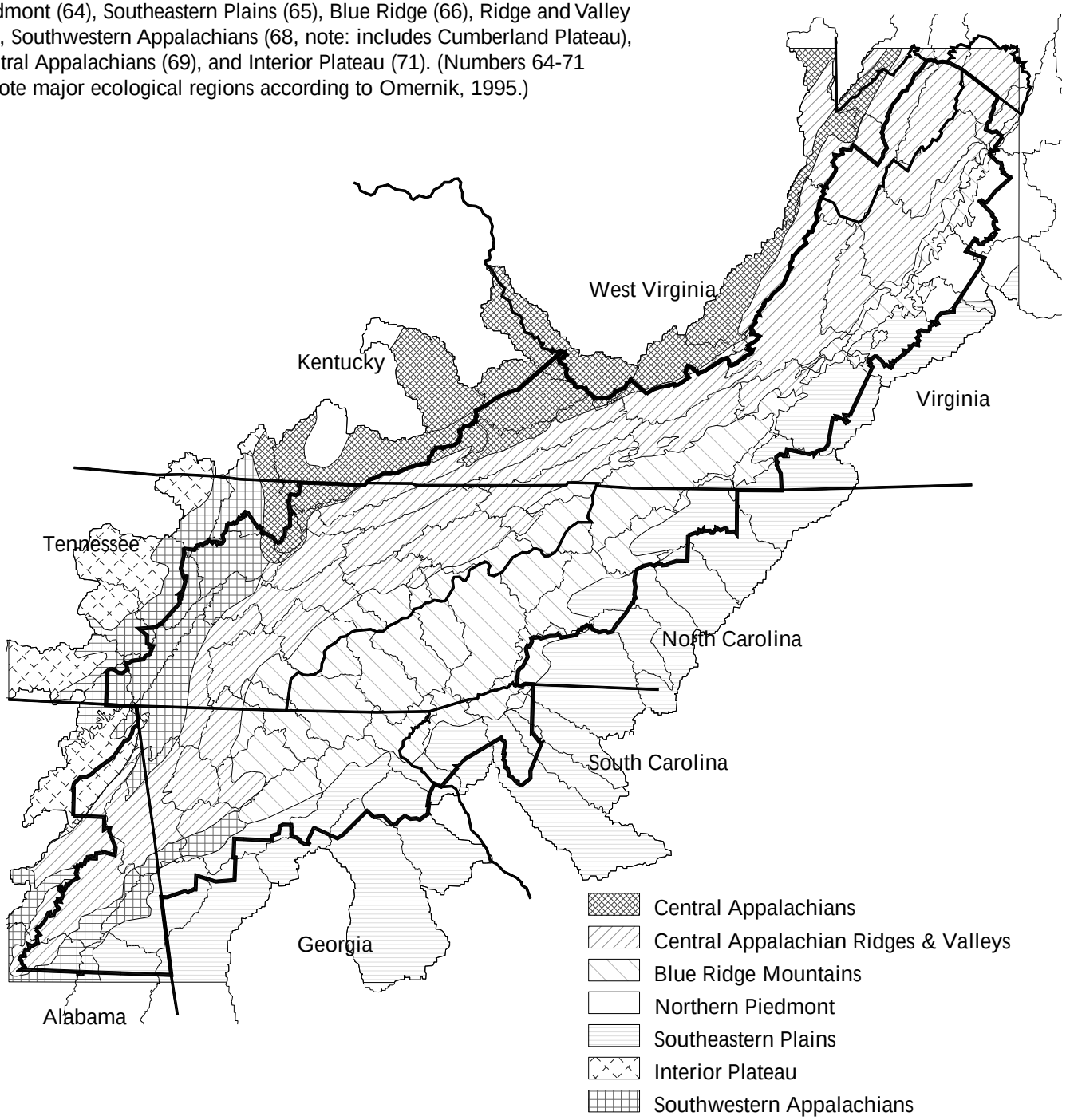


Figure 1.0.2 Major drainages of the SAA study area. Streams and rivers draining the Southern Appalachian mountains flow to the Chesapeake Bay, the Ohio River, the Atlantic Ocean, the Gulf of Mexico (via the Alabama and Chattahoochee/Appalachicola rivers), and the Tennessee River (to the Mississippi River and to the Gulf).

the Chesapeake Bay, the Ohio River (thence to the Mississippi River and the Gulf of Mexico), the Atlantic Ocean, the Tennessee River (again to the Mississippi and the Gulf), and to the Gulf of Mexico. Figure 1.0.3 shows important hydrologic areas, indicated by Hydrologic Unit Code (HUC), boundaries in conjunction with the major ecological regions within and overlapping the assessment area boundary: the Northern Piedmont, Southeastern Plains, Blue Ridge, Ridge and Valley, Southwestern Appalachians (note: includes Cumberland Plateau), and small areas of the Central Appalachians and Interior Plateau. (Omernik 1995). Watershed and ecosystem areas are useful for organizing, analyzing, and understanding data and information that describe aquatic resource integrity. Some information in this aquatic technical report relies on county or state boundaries. Generally, political lines are less useful for enhancing knowledge of aquatic systems.

Figure 1.0.3 Ecological regions of the Southern Appalachians. Major ecological regions of the study area are indicated. These include the Northern Piedmont (64), Southeastern Plains (65), Blue Ridge (66), Ridge and Valley (67), Southwestern Appalachians (68, note: includes Cumberland Plateau), Central Appalachians (69), and Interior Plateau (71). (Numbers 64-71 denote major ecological regions according to Omernik, 1995.)



This information should provide land managers and property owners with valuable information about current conditions and available data, and lend support and credence for future research that can be accomplished through cooperative interagency efforts.

1.1 HISTORICAL PERSPECTIVE OF WATERSHED MANAGEMENT

The landscape of the SAA area has changed dramatically since the 1880s. Prior to this time, forests covered virtually all the area except for small openings created for agriculture or towns. The forests were a source of building material and food, as well as an impediment to development. Settlers used the land and its wildlife for their survival with little concern for the consequences. Subsistence agriculture was widespread because markets were distant and transportation difficult. Slash-, burn-, and plant-agriculture was commonly practiced, with settlers moving on as the soil lost its productivity. Trees were often deadened and crops planted under the standing dead trees.

The building of the railroads opened the mountains to the outside world. Transport of products and people into and out of the area became faster and easier. Land became a commodity, to be bought, sold, and used for a profit, particularly by outsiders. By the turn of the century, millions of acres of mountain land had been bought by developers, whose main interest was to exploit the land for profit (Eller 1985).

Throughout the Southern Appalachians, timber companies purchased vast acreage of forest land and began cutting the virgin ash, cherry, oak, spruce, and yellow-poplar. By 1910, the southern mountains yielded nearly 40 percent of the total timber production in the United States (Eller 1985). By 1919, most of the region had been logged and timber production fell to about half of its pre-war level. In the 1920s, the timber companies were abandoning their land and moving to the timberlands of Oregon and Washington.

Loggers had little regard for aquatic systems. Roads and railroads were built in many of the river and stream bottoms. They extended up the narrow mountain hollows where the stream channel itself was commonly used as the road bed. Stream crossings were numerous and were not constructed with any intent to protect the channel or its resources. Splash dams were constructed on many small streams to store water and flush logs downstream to saw mills. Riparian vegetation was often cut to clear the channel so logs would not hang up while floating downstream. Small mining operations for minerals, gems, and coal frequently used streams for disposal of waste materials. Acid runoff from some mined areas and acid deposited from smelting operations killed life in some streams.

Logging often resulted in excessive erosion and sedimentation of the channels, frequently causing braided or multichannel streams. Streams sometimes began flowing down the abandoned road instead of the natural channel. Some streams were scoured clean, while other streams were choked with logging debris. Impacts to stream biology ranged from little effect to a total change in species mix or even total elimination of fish life. Wetlands were created in places where they didn't previously exist, while other wetlands were drained so that land could be developed.

The passage of the Weeks Act in 1911 authorized the purchase of forested, cutover, or denuded private lands within watersheds of navigable streams, as necessary, to secure favorable flows of water (USDA Forest Service 1983). These lands created the national forest reserves in the East. The first acquisition under the Weeks Act was a tract of land in the Curtis Creek area of the Pisgah National Forest's Grandfather Ranger District, within the SAA area. By 1920, the Forest Service had acquired more than 2 million acres of Appalachian forest land. Nearly 70 percent of the land eventually acquired had been severely cutover or burned. By 1940, the total acreage acquired for national forests had risen to more than 5 million acres. During this same period, additional lands in the SAA area were also acquired by the National Park Service (NPS), the Tennessee Valley Authority (TVA), and other federal and state agencies.

Much land coming into federal ownership needed rehabilitation-revegetation, erosion control, and stream restoration. During the 1930s and early 1940s, the Civilian Conservation Corps labored throughout the newly acquired federal lands. They constructed hiking trails, removed weed trees and misshapen scrubs, built fire towers and fire roads, improved streams, fought fires, built picnic areas, erected bridges, and performed a host of other tasks necessary to restore and produce a bountiful and highly useful forest (Jolley 1985).

The change in forest land in the SAA area has continued to the present. The functions and

processes of the natural forest ecosystem today are better understood than ever before. Both public and private land managers seek multiple goals and objectives from their lands with emphasis on sustained use rather than single-resource outputs. Public concern for the environment has resulted in a host of legislation aimed at protection and enhancement of the resources, including the Clean Water Act, the National Forest Management Act, and the National Environmental Policy Act.

The past trend of improvement in the area's water resources is likely to continue. The hydrologic conditions of the forest lands have improved steadily since widespread forest exploitation has stopped. Continuing natural restoration of area streams is slowly reducing the effects of the devastation that resulted during early logging, although evidence of the devastation is still present in many streams. Present environmental controls such as voluntary and required state Best Management Practices (BMPs), erosion and sediment pollution control regulations, and land use controls greatly reduce the likelihood of widespread land disturbance or exploitation in most areas.

The major land use change influencing SAA watersheds, now and in the future, is urban, suburban, and rural home development and its associated roads and service facilities.

1.2 HISTORICAL PERSPECTIVE OF TROUT MANAGEMENT

Trout are important gamefish in the SAA area and have been the focus of much attention throughout the history of the area. Thus, a brief history of trout management in the Southern Appalachians provides some insight into the history of aquatic resources.

The SAA area is home for three species of trout: native brook trout (*Salvelinus fontinalis*), introduced rainbow trout (*Oncorhynchus mykiss*), and introduced brown trout (*Salmo trutta*). Originally, brook trout were distributed down the spine of the Appalachian Mountains through western Virginia and North Carolina, and eastern Tennessee to northwest South Carolina and northeast Georgia, on the southern edge of the species' range (MacCrimmon and Campbell 1969). Stocking programs have not significantly extended this range. Rainbow trout and brown trout were introduced to the region in the late 19th and early 20th centuries. Historical attempts have been made to introduce other salmonids. However, none appear to have survived, except for occasional reports of kokanee (*Oncorhynchus nerka*) and lake trout (*Salvelinus namaycush*) in certain reservoirs.

Historical trends in the Great Smoky Mountains National Park have been well documented since the park was established in 1934. Park fisheries biologists have published results of survey work beginning with Willis King (1937) and continuing to the present. For the rest of the SAA area, little published information is available to document historical trends. The trends described herein are based on data from the park, with a general presumption that similar changes have occurred elsewhere, at least in the areas around the park.

Since the early 1900s, native brook trout ranges have shrunk, and rainbow and brown trout ranges have expanded in the park (King 1937; Lennon 1967; Kelly and others 1980). Several causes for loss of brook trout range have been identified: logging and associated activities, including fires that increase sediment and temperature; overfishing; and introduction of exotic rainbow trout (King 1937; Kelly and others 1980; Larson and Moore 1985).

The lower elevations where trout species are found were generally more accessible to removal of forest cover during Native American and European settlement (Pyle 1985; Williams 1989). In addition, where agricultural land uses and forest harvest practices remove streamside vegetation, stream temperature may increase. (Brown and Krygier 1970; Swift and Messer 1971). Other stream habitat alterations, such as removal of large woody debris, roadbuilding, and channelization, may accompany these land use changes. Furthermore, streams at lower elevations may be more accessible to both angling and trout stocking programs.

Trout in the SAA area have been managed by state and federal agencies at least since the early 1900s. Stocking of selected streams with trout of all sizes and all three species continues to this day. Trout habitat management has been carried out for at least 60 years and continues today, with increasing emphasis on re-creating natural habitat conditions.