

THE
SOUTHERN
APPALACHIAN
ASSESSMENT

SOCIAL | CULTURAL | ECONOMIC
TECHNICAL REPORT

Prepared by Federal and State Agencies

*Coordinated through Southern Appalachian
Man and the Biosphere Cooperative*

July 1996



REPORT
4 OF 5

Abstract

This report is an analysis of social, cultural, and economic forces that are a part of the ecosystems in the Appalachian Mountains in Virginia, North Carolina, South Carolina, Tennessee, Georgia, and Alabama. Population, employment, wages, housing, education, and ethnic makeup are described. The history of human influences is outlined, and current conditions and trends are reported for outdoor recreation, the timber economy, and management and use of wilderness and roadless areas.

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Preface

Our vision for the Southern Appalachian region is an environment for natural resources management that applies the best available knowledge about the land, air, water, and people of the region. Applied on public lands, this knowledge would provide a sustainable balance among biological diversity, economic uses, and cultural values. All would be achieved through information gathering and sharing, integrated assessments, and demonstration projects.

The Southern Appalachian Assessment takes a major step toward fulfillment of that vision. It is an ecological assessment – a description of conditions that goes beyond state, federal, or private boundaries. In using Southern Appalachian Assessment data, land managers can base their decisions on the natural boundaries of ecosystems rather than on the artificial boundaries of counties, states, or national forests and parks.

The assessment was accomplished through the cooperation of federal and state natural resource agencies within the Southern Appalachian region. It was coordinated through the auspices of the Southern Appalachian Man and Biosphere (SAMAB) cooperative.

Members of the cooperative are: U.S. Department of Agriculture, Forest Service; Tennessee Valley Authority; U.S. Environmental Protection Agency; U.S. Department of the Interior, Geological Survey, National Park Service, National Biological Service, Fish and Wildlife Service; Appalachian Regional Commission; U.S. Army Corps of

Engineers; Georgia Department of Natural Resources; North Carolina Department of Environment, Health, and Natural Resources; Tennessee Department of Environment and Conservation; U.S. Department of Commerce, Economic Development Administration; and the U.S. Department of Energy, Oak Ridge National Laboratory. This cooperation significantly expanded the scope and depth of analysis that might have been achieved by separate initiatives. It also avoided duplicating work that might have been necessary if each agency had acted independently. The findings in this assessment do not reflect unanimous (unqualified) views of all agencies involved on all points.

Although the Southern Appalachian Assessment is broad and comprehensive in subject matter and geographic scope, there are many opportunities to further expand the analyses based on this data. Urgent demands for the assessment data restricted our time-frame. So, identifying data gaps became as important a task as identifying and gathering existing data. The Southern Appalachian Assessment serves as both a useful reference and as a benchmark for future analyses.

There was no specific statutory requirement for the assessment. However, national forest land and resource management plans authorized under the 1976 National Forest Management Act have been in place for almost 10 years and are therefore subject to revision. Due to the relationship of the national forests and other federal lands

to the biological, social, and economic conditions in the assessment area, more comprehensive and more scientifically credible data are needed to facilitate land management planning. This assessment supports individual forest plans by determining how the lands, resources, people, and management of the national forests interrelate within the larger context of the surrounding lands. The broadly identified pollutants and impacts of concern are not intended as a source of information upon which to base future regulatory or permitting action.

This report is one of five that document the results of the Southern Appalachian Assessment. The reports include a summary report, atmospheric, social/cultural/economic, terrestrial, and aquatic reports.

The five reports are available in printed form and via the Internet. By providing

direct access to assessment materials via Internet, we hope that users can obtain information more quickly and at a lower cost than would have been possible otherwise. As with most reference documents, users will need only a small portion of the assessment for their specific projects at any given time. Moreover, an Internet document can be revised or updated when the occasion arises.

In-depth versions of data are available on the SAMAB, Forest Service, and Info South Home Pages on the World-Wide Web (WWW). These versions can be accessed at <http://www.lib.utk.edu/samab> for SAMAB's Southern Appalachian Home Page, at <http://www.fs.fed.us/> for the Forest Service Home Page and at <http://wwwfs.libs.uga.edu> for the Info South Home Page. Additional materials such as maps and data that support the assessment are described and referenced in each report.

The Southern Appalachian Assessment is presented in five separate reports. The reports can be cited as follows:

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Summary Report. Report 1 of 5. Atlanta: U.S. Department of Agriculture, Forest Service, Southern Region.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Aquatics Technical Report. Report 2 of 5. Atlanta: U.S. Department of Agriculture, Forest Service, Southern Region.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Atmospheric Technical Report. Report 3 of 5. Atlanta: U.S. Department of Agriculture, Forest Service, Southern Region.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Social/Cultural/Economic Technical Report. Report 4 of 5. Atlanta: U.S. Department of Agriculture, Forest Service, Southern Region.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Terrestrial Technical Report. Report 5 of 5. Atlanta: U.S. Department of Agriculture, Forest Service, Southern Region.

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Chapter 1

Authors:

Gerald Helton, USDA Forest Service
Caffilene Allen, U.S. Environmental
Protection Agency

Other Contributors:

Kenn L. Frye, USDA Forest Service
Robert Biesterfeldt, Contractor
Diana Quinn, USDA Forest Service
Shela Mou, USDA Forest Service
Dan Dossin, Georgia Forestry Commission
Joel Rudy, University of Georgia

Chapter 2

Team Leaders:

Ken Cordell, USDA Forest Service
Gerald Helton, USDA Forest Service
John Peine, USDI National Biological
Service

Authors:

Ken Cordell, USDA Forest Service
Gerald Helton, USDA Forest Service
Michael Tarrant, University of Georgia
Clair Redmond, USDA Forest Service

Reviewers:

Tom Coffin, Consultant
Tom DesJean, USDI National Park Service
Pete Morton, Environmental Consultant
Benic M. Clark III, The Lyndhurst
Foundation
Howard A. MacCord, Sr., Archeologist
(retired)
Darlene Wilson, University of Kentucky
Grad School
Terry Seyden, USDA Forest Service
Anne P. Hoover, USDA Forest Service
Dr. Rob Bixler, Cleveland (OH)
Metroparks
Doug Bachtel, University of Georgia
J. Kathy Parker, Oriskany Institute

Other Contributors:

Robert Biesterfeldt, Contractor
John Bergstrom, University of Georgia
Mike Brown, Bureau of Land Management

Pam Kleiber, University of Georgia
Jeff Teasley, University of Georgia
Roggie Boone, University of Georgia
Diana Quinn, USDA Forest Service
Mary Jo Brown, University of Georgia
Beth Kivel, University of Georgia
Jacki Gossett, University of Georgia
Jeff Price, University of Georgia
Jeremy Thomas, University of Georgia
Shela Mou, USDA Forest Service
Dean Fenton, University of Georgia
Becky Stephens, University of Tennessee
Mark Fly, University of Tennessee
Christine Overdevest, USDA Forest Service
Tom Birch, USDA Forest Service
Joe Carbone, USDA Forest Service
Linda Caldwell, Pennsylvania State
University

Chapter 3

Team Leader:

David Wear, USDA Forest Service

Authors:

David N. Wear
Tony Johnson
John F. Kelly
David Loftis
William Luppold
William G. Martin
Clair Redmond

Reviewers:

Peter Morton, Consultant
David Newman, University of Georgia
Fred Cabbage, North Carolina State
University
Debra Baker, Southern Timber Purchasers
Council
Mark Rasmussen, Timber Data Company
Chris Zinkhan, Campbell University

Other Contributors:

Judy Binns, USDA Forest Service
Diane Riggsbee, USDA Forest Service
Linda Weaver, Tennessee Valley Authority
Robert Wright, State of Tennessee

Chris LeDoux, USDA Forest Service
Joanne Faulkner, USDA Forest Service
Bernard Bell, U.S. Department of Labor
Karen Lee, USDA Forest Service
Will McWilliams, USDA Forest Service
John Pye, USDA Forest Service

Chapter 4

Team Leader:

Larry Hayden, USDA Forest Service

Authors:

Larry Hayden, USDA Forest Service
Steve Hendricks, USDA Forest Service
Michael Bowker, USDA Forest Service
Don English, USDA Forest Service
Nancy Stremple, USDA Forest Service
Donna Bayless Ray, USDA Forest Service

Reviewer:

Randy Gimblett, North Arizona State
University
Peter Morton, Consultant
Doug Wellman, North Carolina State
University

Other Contributors:

Kurt Riitters, Tennessee Valley Authority
Karl Hermann, USDI National Biological
Service
Holly Selig, USDA Forest Service
Linda Johns, USDA Forest Service
Shawn Benge, USDI National Park Service
William Orr, USDI National Park Service
Bob Marker, Tennessee Valley Authority
Melinda McWilliams, USDA Forest Service
Jack Coleman, USDA Forest Service
Nancy Ross, USDA Forest Service
Harry Fisher, USDA Forest Service
Carolyn Hoffman, USDA Forest Service
Bill Hughes, USDA Forest Service
Dan Allega, USDA Forest Service
Robin Cooper, USDA Forest Service
Ken Cordell, USDA Forest Service
Burt Lewis, USDA Forest Service
Carter Betz, USDA Forest Service
John Peine, USDI National Biological
Service
Carol Milholen, USDA Forest Service
Diana Quinn, USDA Forest Service
Robert Biesterfeldt, Contractor

Chapter 5

Team Leader:

John Romanowski, USDA Forest Service

Authors:

John Romanowski, USDA Forest Service
Al McPherson, USDA Forest Service

Steve Sherwood, USDA Forest Service
Melinda McWilliams, USDA Forest Service

Reviewer:

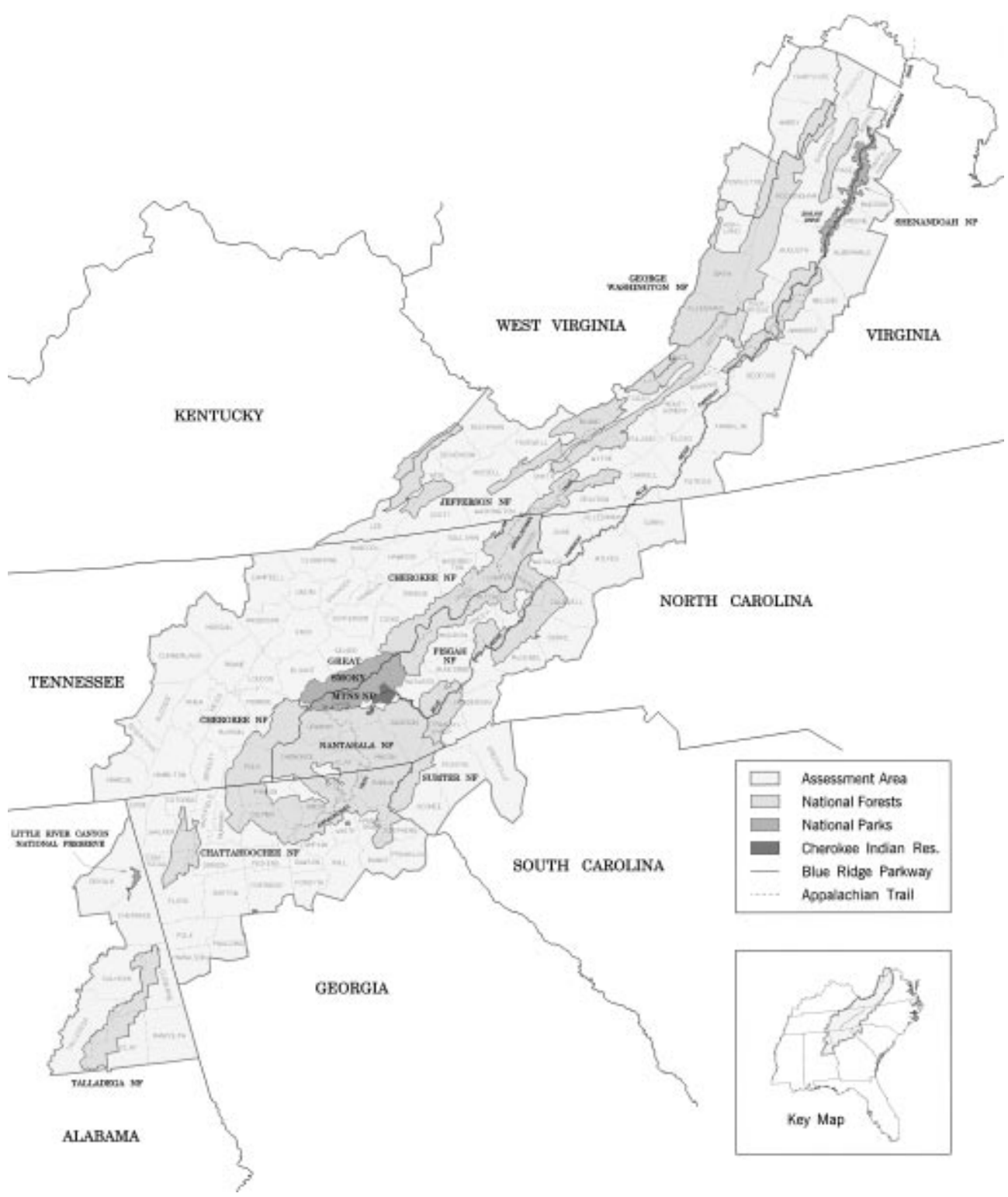
Alan Watson, USDA Forest Service

Other Contributors:

Carl Scardina, Alabama Division of State
Parks
Charles Kelly, Alabama Game and Fish
Division
Don Owen, Appalachian Trail Conference
Ronald Hedlund, Virginia Department of
Conservation and Recreation
Burt Weerts, Georgia Parks, Recreation,
and Historic Sites Division
Nathan McClure, Georgia Forestry
Commission
Harvey Young, Georgia Wildlife Resources
Division
Bambi Teague, USDI National Park Service
Joe Abrell, USDI National Park Service
Keith Langdon, USDI National Park Service
Steve Bire, USDI National Park Service
Ted Dinkle, USDI National Park Service
Tom Piehl, USDI National Park Service
Todd Robertson, North Carolina Division
of Parks and Recreation
Tony Bebbler, South Carolina Department
of Parks, Recreation, and Tourism
Joe Hambright, South Carolina Department
of Parks, Recreation, and Tourism
David Waller, Georgia Wildlife Resources
Division
Linda Pearsall, North Carolina Division of
Parks and Recreation
Bill Marrell, South Carolina Department of
Parks, Recreation, and Tourism
Jim Sorrow, South Carolina Wildlife
Diversity Section
Duane Wyrick, Tennessee Department of
Environment and Conservation
Bob Rochell, Tennessee Forestry Division
Geoff Roach, Tennessee Nature
Conservancy
Jim Brown, Tennessee River Gorge Trust
Fund
Gary Meyers, Tennessee Wildlife Resources
Agency
Judith Bartlow, Tennessee Valley Authority
Paul Arndt, USDA Forest Service
Anita Bailey, USDA Forest Service
Edwin Dale, USDA Forest Service

Figure 1

SOUTHERN APPALACHIAN ASSESSMENT AREA



Executive Summary

The Southern Appalachian ecosystem is widely recognized as one of the most diverse in the temperate region. The headwaters of nine major rivers lie within the boundaries of the Southern Appalachians, making it a source of drinking water for much of the Southeast.

The Southern Appalachian Assessment (SAA) area (fig.1) includes parts of the Appalachian Mountains and Shenandoah Valley extending southward from the Potomac River to northern Georgia and the northeastern corner of Alabama. It includes seven states, 135 counties, and covers approximately 37 million acres. The Southern Appalachians are one of the world's finest remaining ecological regions. Early in the 20th century, the Appalachian landscape and natural resources were being exploited; croplands, pastures, and hillsides were eroding; and timberlands were being cut with little thought for sustaining the resources. National forests and national parks were created to preserve and restore the natural resources in the region. The seven national forests in conjunction with three national parks, the Blue Ridge Parkway, and the Appalachian Trail form the largest contiguous block of public lands east of the Mississippi River.

The SAA, a comprehensive, interagency assessment, began in the summer of 1994 and was completed in May 1996. It was designed to collect and analyze ecological, social, and economic data. The information provided will facilitate an ecosystem-based approach to management of the natural resources on public lands within the assessment area.

Public participation has been, and will continue to be, an important part of the assessment. One of the first actions of the assessment was to conduct a series of town hall meetings at which the public gave suggestions on the major themes and questions to be addressed. These questions, supplemented by additional concerns expressed by land managers and policy makers, form the structure for the assessment.

Historically, the Southern Appalachians have greatly influenced transportation and commerce. Native Americans and the later settlers

that replaced them relied upon combinations of hunting and subsistence farming, and in those times, transportation was not a big concern. The land was ideal for that lifestyle. Until well into the 20th century, families, kinship groups, and small communities dominated most aspects of life. People had strong attachments to the land.

In the late 19th and early 20th century, exploitive logging and farming of hillsides threatened the watersheds of major rivers originating in the region, and national forests were established to protect watersheds. But poverty in the region was extensive and people left for better opportunities elsewhere.

In the last 20 years, economic progress has been faster in the mountainous portions of Virginia, North and South Carolina, eastern Tennessee, northern Georgia, northern Alabama, and a piece of eastern West Virginia than the average across the seven states that contain the highlands. As the highland economy grew, it became more diverse and less dependent on manufacturing. At the same time, the proportion of families living below the poverty level decreased from 20 percent in 1970 to 11 percent in 1990.

Newcomers in the last 20 to 30 years have dramatically changed the social climate for management of public land. Retirees and employees in service industries are more interested in scenery and recreation than in resource extraction. Residents of communities near national forests favor balance between local and regional interests. They also seek a balance in the way national forests are used. To them, recreation and tourism are important, but so are timber and other commodities from the land. Management of public land and the way natural resources are used can sometimes impact groups of people within a region differently. In the Southern Appalachians, there is no indication of environmental injustice toward any particular ethnic group based on the limited data available.

The attitudes of residents of the study area toward natural resources and ecosystem management are generally similar to those across the

nation. A survey of residents indicates that most feel that the Endangered Species, Clean Water, and Air Quality Acts have not gone too far to protect highland ecosystems.

Groups inside and outside of the region represent environmental protection and various resource uses. These groups influence management of public land by providing information and analysis and by expressing opinions. They have considerable scientific expertise and consider education of the public to be a major goal.

Of the 37 million acres in the study area, 28 million are privately owned. Many owners of private tracts get little or no monetary return from ownership. They might be attracted by potential profits, but they would be reluctant to take any action that would reduce the future selling price of their land.

There are almost 25 million acres of forest in the Southern Appalachians. Government agencies manage a little over 20 percent of the region's timberland.

Over the last 20 years, the region's timber markets have been strong. High-quality sawlogs are becoming increasingly scarce, and prices for them have risen rapidly. In contrast, lower quality material has been relatively abundant. Recently, markets for the lowest quality timber also have grown to make products such as pulpwood and composite board.

Since 1980, national forests have provided 10 to 12 percent of Southern Appalachian timber production. National forest production expanded from the late 1970s through the mid 1980s. Since 1985, production has dropped, and levels now are comparable to those in the late 1970s. In some localities, national forests make up the majority of the area and sales from these lands dominate local markets.

The wood products industries have provided stable employment and income in the region over the last 20 years. However, since these industries grew at a slower rate than the economy as a whole in the last 20 years, their share of the economy declined from 6 to 4 percent.

Outdoor recreation is an important use of forest lands. In order to determine the character of the recreation resource, the study area was divided into "settings" based on suitability for various kinds of recreation. The public owns about 16 percent of the land in the study area. It has considerably higher percentages of the remote and natural-appearing settings. Public

land appears to be best suited for recreation activities in which people interact with nature. The private sector is best suited for providing expensive facilities for specialized activities.

Over the last 10 years, the number of older individuals recreating in the study area has increased. In addition, the population as a whole has risen, increasing demands for most types of activities. Improvements in equipment have created demands for new activities such as mountain biking, jet skiing, and sailboarding.

In general, amounts of various types of settings appear to be sufficient to meet most demands for nature-based activities. However, some capacities will have to be increased on private and public land, and new investments in facilities will be required.

Rising demands for nature-based activities will have to be met primarily on public land. Many key corridors on public land are already operating at or above capacity. Overcrowding results, but it can be overcome by increasing the capacity of facilities and by dispersing use to new facilities.

There is little doubt that recreation opportunities improve local communities. In some communities in the study area, however, rapid changes have been made to accommodate recreators. These changes have created conflicts with long-time residents. Ways are needed to preserve important community values while necessary development is occurring.

People are interested in the number, size, location and status of roadless areas and wildernesses because they are thought of as the last remaining large tracts of unroaded natural appearing lands in the region. The region's national forests, national parks, and state parks contain 144 roadless areas that cover 1,231,961 acres, about 3 percent of the study area. There are 39 units of the Wilderness Preservation System in the Southern Appalachians. They cover 428,545 acres or about 1 percent of the study area.

Designation as a roadless area does not necessarily preclude a wide range of management activities that can change the area's status. Any project that would change the character of a roadless area, however, must be analyzed with full public participation.

To date, most of the Forest Service management activities in wilderness have been oriented toward inventory and monitoring. Many research and administrative activities are underway.

The use of wilderness appears to depend primarily on the attractions that are found there. For southeastern wilderness, the effect on use of nearness to a city does not appear to be very strong.

Using other assessment teams' data and GIS analysis, about 3 percent of the national forest land in the Southern Appalachians has been

identified as potential old-growth forest. Roadless areas and wilderness account for 48 percent of the land in this category. In addition, about 56 percent of the land in the Southern Appalachians is classed as potentially suitable habitat for black bears. Roadless areas and wilderness account for about 7 percent of these acres.

Introduction

This report describes the social, cultural, and economic status of the Southern Appalachians. It is one of four technical documents that resulted from the Southern Appalachian Assessment (SAA), which was conducted to help federal land management agencies plan for the future.

The Southern Appalachians contain the largest concentration of federally owned land in the Eastern United States. Most of the land was acquired early in the 20th century. National forests, the largest single designation of public land in the region, were created to protect the headwaters of major streams from erosion, sedimentation, and floods caused by abusive logging and agricultural practices. The area's national parks were created to preserve areas with nationally significant scenic and recreational qualities. In addition, the Tennessee Valley Authority was established to control flooding and produce hydroelectric power from the Tennessee River system.

Early in the century, the Southern Appalachians were considered a poor area with an undereducated, undernourished, and underemployed population. Pockets of poverty still persist, but the mountains are now considered an excellent place to visit, to settle and raise a family, and to retire.

The federal land that once was purchased so cheaply has become an enormous asset to visitors and residents. The primary purposes of the SAA were to determine the health of the natural ecosystems in the area and to provide data that will help determine how the public land should be used, protected, and managed in the years ahead.

Much of the work in the SAA focused on the area's natural systems – its forests, its air, and its water. This portion focuses on human dimensions and human activities. The history of human influences is outlined, and recent changes in human communities and human influences are described in some detail. Since the Southern Appalachians are a tourism and recreation destination for people throughout the nation, supplies of and demands for

recreation are analyzed. Finally, the areas of public land where human activities are mostly restricted – the roadless areas and officially designated wildernesses – are described.

Ecosystems are important in themselves because they provide essential life functions, but they also are important because they are the places where people live, work, and play. In attempts to understand ecosystems, scientists often try to exclude human influences, but outside the world of research, human influences are pervasive.

The area for the SAA is the Southern Appalachian Mountains in Virginia, North and South Carolina, Georgia, Alabama, eastern Tennessee, and a small portion of West Virginia. The work was divided among four subteams that examined: (1) communities and human influences, (2) the timber economy, (3) outdoor recreation supplies and demands, and (4) roadless areas and designated wilderness.

For each of the four efforts, numerous meetings were held in the study area to discover public concerns. These concerns were used to frame specific questions that would be addressed in the assessment. These questions guided both the SAA and the structure of this report. In all but a few cases, the answers are based on information that existed at the start of this assessment.

All four subteams gathered far more information than we could present in this report. Much of the quantitative information was analyzed with a Geographic Information System to display patterns across the counties of the region.

Social and Cultural History of the Southern Appalachians

Studies of Appalachia have usually focused on the people, the geography, and the economy. Historically, the income of its residents has been described as lower, and their health status and educational attainment as poorer than in the rest of the nation. In the past, this region was often described as an American subculture.

Appalachia has certain unifying features, the most distinctive of which are its mountains (Ergood and Kuhre 1976). The mountains make access difficult, limit the amount of level, buildable land, and increase flood dangers. The general north-south orientation of the Appalachians restricts east-west access and divides the region into a number of north-south valleys.

Much of the nation's bituminous coal and virtually all of its anthracite are found in the Appalachians. Drastic reductions in employment in the region's mines have left many communities in serious economic straits.

The farmers of the region have had to cultivate steep slopes and narrow valleys that are less productive than the more level, richer soils in other parts of the nation. High-density plantings of cropland, a short growing season, a lack of level land, and high losses of topsoil to erosion have caused a continuing decline in the region's agricultural economy. Most Appalachian farms are small and undercapitalized and yield low incomes to their owners.

Another unifying feature of the Appalachians is the nature of its inhabitants. To a significant degree, the region's people are of Anglo-Saxon extraction. However, other ethnic groups, including Native Americans and African Americans, are represented in the region.

A fifth unifying feature is chronic economic problems that have plagued many parts of the region. In most counties, incomes were relatively low and unemployment and underemployment rates were high. Serious labor surpluses led to high rates of outmigration of people seeking improved economic opportunities.

We will examine some of these features as we take a closer look at a portion of this region – the Southern Appalachians. Our study area takes in several counties in north-eastern West Virginia. It includes all of the western portions of Virginia and North Carolina, and all of eastern Tennessee. Its southern boundary includes the northwestern tip of South Carolina, northern Georgia, and northeastern Alabama.

We will look at the settlement of the region – who the settlers were, how they lived, the uniqueness of their culture, how they adapted to their surroundings, and how their institutions were formed.

Origins of Appalachian Identity

Long before there was a place called Appalachia, cultures flourished and faded in the southern mountains. According to Hudson and Tesser (1993), the first inhabitants came to Appalachia about 9000 B.C. during the Paleoindian period. They were small bands of nomads, who hunted big game such as mammoth and mastodon. Diverse forests supported a number of cultures that relied on combinations of hunting, fishing, and gathering. These cultures possessed woodworking tools, fish-hooks, harpoons, awls for basketry, and needles, together with stone vessels (Spencer, Jennings, and others 1977).

Later, agriculture developed, using native plants of the region, such as gourds, squash, and sunflowers. Seed crops, which are no longer known in their cultivated forms, were also important. The earliest of these were goosefoot and marshelder (Yarnell 1995).

By 2500 B.C., most of the groups depended heavily on agriculture for their survival. About 500 years before the first Europeans arrived in the Appalachians, dramatic changes occurred among the southeastern Indians – changes that signaled the beginning of the Mississippian Period (Hudson and Tesser 1993). The Mississippian civilizations left behind impressive burial mounds that are still being studied today (Hudson and others 1989).

The Mississippian culture was so named because its influence was very strong along the Mississippi River and its tributaries. People of this culture lived throughout the Southern Appalachians, as well as in present-day Oklahoma, Missouri, southern Illinois, and Ohio (Burt and Ferguson 1973).

Life was very different than in earlier cultures. For the first time, the bow and arrow was the major weapon and hunting tool. Farming was all important, and corn was the major crop.

In addition to the burial mounds each major Mississippian center had one or more temple mounds, which were surrounded by village dwellings and cornfields. At the top of the main mound was the temple containing the holy fire, which was kept constantly burning. Most mounds were no higher than 30 feet and no more than 250 feet around at the base, but some were as high as 75 feet and 600 feet around. Usually temple mounds were set to face each other, or the burial mounds, across

an open plaza that served as a meeting place for ceremonies and games (Burt and Ferguson 1973).

When Europeans entered the Southern Appalachians, they found a number of Indian groups so populous and well organized that they called them nations.

Many different languages were spoken among the nations in the region. Four predominant language families were Algonquian, Iroquoian, Siouan, and Muskegon. With the exception of Muskegon, these languages were also spoken by people in other regions.

The Cherokee Nation was the largest tribe in the region. Some of its cultural practices included a religious system with a priesthood, rituals and ceremonies centered around corn, a sacred perpetual fire symbolizing the sun, and temple mounds. In addition to village or town life, a military system existed in which skill in war could advance an individual in social rank. Government was usually by a chief or group of chiefs, and in some tribes the office was so honored that the chief was carried everywhere on a litter. Women were influential in council, and in some places they cast the deciding vote for war or peace (Burt and Ferguson 1973).

The first Europeans who explored the Appalachians were Spaniards looking for treasures in the mid-1500s. Spanish expeditions in the Southeast were led by Lucas Vasquez de Ayllon (1526), Panfilo de Narvaez (1528), Tristan de Luna (1559-61) and Juan Pardo (1566-68). However, the most famous Spanish expedition through the Southern Appalachians was by Hernando de Soto (1539-1543). After hearing stories from the Appalachee Indians in Florida of great stores of gold and silver in the mountains, de Soto came to the Appalachians in the mid-1500s. Although he searched extensively, he found no treasures. The first in a long series of travel narratives written about the Appalachians was by a member of de Soto's expedition – a man known today as the Gentleman of Elvas. Some accounts of history state that the Appalachians received their name from de Soto, who named them after the Appalachee Indians.

The Native American population in the Southern Appalachians was about 1 million when the first Europeans arrived. In addition to the Cherokee were the Powhatan, Shawnee, Catawba, Choctaw, Tuscarora, Seminole, Tunica, Yuchi, Natchitoches, and the

Chitmacha. Each had its own distinct language and culture and many of their words have become a part of our modern language. Words such as hammock, opossum, bayou, hominy, and persimmon are all of Indian origin. The names of many southern states are of Indian derivation: Alabama, Arkansas, Kentucky, Mississippi, Tennessee, and Texas. The same is true for the cities of Chattanooga and Tupelo.

As European settlements were established, the Indians were forced to relocate, and mass expulsions to the Indian Territory occurred between 1820 and 1840. At least 50,000 Cherokees, Chickasaws, Choctaws, Creeks, and Seminoles were driven from their home areas in several southern states. The Cherokees called their route the "Trail of Tears" because of the suffering and high mortality rate on the journey from northern Georgia through Tennessee, western Kentucky, southern Illinois, southern Missouri, and into Oklahoma. In 1989, the Native American population in the Southern Appalachians was estimated at 195,000 (Wilson and Ferris 1989).

Along with the Native Americans, African-Americans were present in the region long before the major migration of European settlers. Black Appalachians, together with the Spaniards and the French, fought against the Appalachee and Cherokee native tribes in the 1500s. Historical records from this period indicate that Black Appalachians were some of America's first blacks – appearing almost a century before the landing at Jamestown (Turner and Cabbell 1985).

One of the first group of blacks to settle the area were the descendants of the first black arrivals to the New Land and of runaway slaves. This group of settlers were also relatively well assimilated, having become landowners at the time of emancipation. A second wave were the blacks who came from the lowlands of the South to work in the mines and on the rail lines. The largest number of blacks in the region migrated between 1900 and 1930, most notably from Alabama to southeastern Kentucky, West Virginia, and southeastern Virginia. Another generation of blacks was born in the region after 1925, the time of the precipitous decline of the black population in the coal mining sections, and a fifth generation of Black Appalachians was born after World War II (Turner and Cabbell 1985).

While Appalachia is usually identified as the

home of the “white mountaineer,” it is estimated that more than 1,400,000 Appalachians – about 1 in every 14 – are black (Turner and Cabbell 1985).

Early European Settlers

The most profound and lasting European influence in the Appalachians came in the 18th century when the Scotch-Irish flooded into the area. By 1700, one of the most heavily populated of the European settlements along the Atlantic shore was in the Chesapeake region. During the next century, additional footholds were established, especially in places such as Charleston, WV. In the 18th century, 250,000 Scotch-Irish and 200,000 Germans migrated to the colonies and spearheaded a movement from the Philadelphia area down the Great Valley of Virginia, then westward across the mountains (Wilson and Ferris 1989).

Anne DeWitt Watts (1981) describes the settlement of the region in this way: “In 1732, Joist Hite Of Pennsylvania, with his family and 16 other families, traveled down the Shenandoah (Great Valley) to settle in an area south of present-day Winchester, VA. This is thought to be the first settlement by white people east of the Blue Ridge Mountains. Other groups followed, going further south, and soon there was rapid settlement and “considerable” population.

From that point on, European settlers continued to filter into the Appalachian area. In his dissertation on “The Southern Mountaineer in Fact and Fiction,” Cratis Williams (1972) discusses these various patterns of settlement in Appalachia: “The valley of Virginia was being settled in the 1730s, the valley of East Tennessee a generation later, and favored spots in the Blue Ridge country of North Carolina by 1790. But such immense mountain areas as West Virginia, Eastern Kentucky, the Cumberland Plateau region in Tennessee, and the mountainous country of North Georgia were not settled in any kind of permanent way until after 1800.”

The early settlers in the Southern Appalachians were generally of three ethnic origins: Scotch-Irish, English, and German. Large numbers of Ulster Scots left the British Isles and came to America during the early part of the 18th century. They originally came to Maryland and Pennsylvania but found that the land along the Delaware and the Chesapeake had been occupied by early arrivals from England. Therefore,

they moved in a southwestward direction. Following the great Appalachian Valley, they journeyed southward into the Piedmont and mountains of North Carolina and Tennessee. These were the descendants of Scots who had survived hundreds of years of struggle against invaders who, repeatedly, had pushed them back into the hill country of the Scottish border, but had never conquered them. They were fierce warriors, willing to die for their freedom. The uncertainty of living in these barren lands taught them the value of hard work and frugal living. When the Protestant Reformation challenged the authority of the Catholic Church, they supported the Protestant cause and the stern doctrines of John Calvin. Their strong religious faith played a central role in their lives, and they withstood persecution for their beliefs. Consequently, their commitment to the Presbyterian Church grew even stronger.

When King James I of England decided to colonize northern Ireland, he chose some of these lowland Scots to help with the effort. Hundreds of Scottish families were moved to Ulster and given land. They flourished as farmers and then as manufacturers of woolen and linen cloth. James’ plan failed, however, because the Scottish Presbyterians had little influence on the independent spirit of the Irish Catholics. Furthermore, the English industrialists soon became angered by the Scottish competition in linen and woolen goods. Under pressure from the industrialists, Parliament took measures to eliminate the trade from Ulster, and the Scottish industries were ruined. Thousands were left without work, and many lost everything they had. There was only one alternative to poverty and starvation – migration to the New World. Such men and women, who had worked hard and made do with what they had, were good settlers for the new land (Boland and others 1979).

Another group of settlers, equally large in number, was of English origin. These settlers were of dissenting faiths, such as Baptists, Presbyterians, and Quakers. Much like the Scots, the English settlers had an intense devotion to the constitutional principles of liberty, law, and justice.

A third and smaller group of settlers, the Germans, came during the second quarter of the 18th century. They fled war and religious persecution to find land and a better life in America. The Germans were generally

recognized as the best farmers in America, and many of them were also skilled craftsmen. Welsh, Irish, Swiss, French Huguenots, and other northern Europeans were among additional ethnic groups that settled the region in the 18th century. Cultural conflicts soon developed between these new immigrants and the more well-established New Englanders and Philadelphia Quakers. The conflicts led newcomers to look for land in the backcountry.

By the mid-18th century, the Mississippian Indian culture had been replaced by the Cherokee. War between the European settlers and the Cherokees was common, but cooperative efforts, especially in education, also occurred. As Sharlotte Neely (1975) points out, the Cherokees themselves encouraged the establishment of white-run schools in the early 19th century: "More formal education, at least in the southern part of the Cherokee area, came early in the 19th century, and surprisingly the establishment of white-run schools among the Cherokees of Georgia was encouraged by the Indians themselves. The Cherokee Council was assertive about the proper activities of white missionaries, and in 1802 the mission of the Moravian Society of United Brethren was threatened with banishment if measures were not taken to board and educate young Indians. The Moravians thereupon reluctantly diverted much of their time from purely religious activities to educational activities, and in the fall of 1804 the first Cherokee school began operations with eight students."

The Moravian educational efforts were disrupted by the enforced removal of the Cherokee Indians from North Carolina to Oklahoma in the late 1830s. By 1880, however, the Society of Friends (Quakers) had contracted with the U.S. Government to establish schools for Cherokee children. These efforts, which promised equal education for both sexes and encouraged the training of Cherokees to become teachers themselves, continued until the end of the 19th century, when the Quakers, to settle a dispute between the Cherokee and Quaker leaders, turned over the operation of the schools to the federal government (Neely 1975).

The idea of Appalachia as a unique place arose in the late 19th century. After the Civil War, a sense of national awareness swept the country. People became fascinated with the "hidden corners" of the country, where cultural

norms differed from the mainstream. Editors of periodicals, which also came into their own during this period, were quick to respond to reader interest by publishing countless travel narratives, sketches, and stories about these "hidden" regions; thus, the local-color school of writing was born.

The first story about Appalachia appeared in 1873. It was written by Will Wallace Harney, a physician who recorded observations from his first trip through the Cumberlands. The article, published in *Lippincott's* magazine, was entitled "A Strange Land and Peculiar People." Although no factual observations in his article support his title, the title and the idea stuck, and Appalachia became defined by its "otherness," as Henry Shapiro (1978) notes in *Appalachia on Our Mind*. Proclaiming that he had journeyed through a land of "geological and botanical curiosities" where the natives were characterized by marked peculiarities of the anatomical frame, Harney's article heralded the advent of numerous works of fiction and non-fiction about Appalachia.

Culture of the Southern Appalachians

Culture is the whole system of language, values, beliefs, knowledge, and norms that people in a society create. It is the way that they organize themselves to provide meaning for their lives. Culture is the whole system of practices and procedures that tells us what we can expect from each other. It lays out the rules of our society.

The early settlers shared many common characteristics that illuminate their way of life. Many of these traits can be found in modern-day residents who trace their ancestry back to early settlers.

These people were proud of their cultural heritage and proud of overcoming many obstacles to their survival. Because they had borne many hardships and struggled for their existence, they were willing to make the necessary sacrifices to get a better life for their children. They had a vision of America as a land of promise and independence, where they could become their own rulers – the masters of their own fate.

Their sense of pride made them very sensitive to the patronizing attitudes of "outsiders." Religion was an integral part of their lives, and they tended to be strongly individualistic and

self-reliant. Because they were conservative, they moved cautiously towards change before accepting that which was new or different.

A deep devotion to family gave rise to a kinship system that controlled politics, schools, and churches. The people loved the home place, the community where they were born and grew up. Although they might leave the area to find a job, they usually came back to retire, and when they died they were buried in the family cemetery. These same characteristics are evident today.

Even though Appalachian residents tend to be reserved towards strangers, they are courteous and hospitable when they become acquainted. They use politics as a means of expressing their opinions and securing their rights (Boland and others 1979).

The pioneers who settled the Southern Appalachians loved the land. They loved the majestic mountains, the beauty of the forests, the good and plentiful water, the rich soil of the valleys and coves, and the cool summers and mild winters. The region reminded many of them of the European homelands that they had left behind.

Until late into the 19th century, life for residents of the Southern Appalachians was tied to the land and its resources. During their migrations, most of the early families had only what they could carry on their backs or by pack horse. Later, when immigrants came by wagon, they were able to bring more bedding, utensils, tools, seeds and plants, and such items as a spinning wheel and loom. But for many years, all needs had to be supplied by the family from the resources at hand. Forests provided materials for houses, barns, household furnishings, tools, fences, and fuels. The first homes were simple cabins made of logs and covered with boards split from logs. When sawmills were brought in, sawn lumber replaced logs as a building material. The settlers turned walnut, cherry, maple, and oak lumber into furniture for their homes and tools for their farms. Good soil in the valleys and coves, and even on hillsides until erosion carried it away, provided food for the family and feed for livestock. Each family made its own clothing. Grazing sheep on the hillsides provided wool, and women spun the thread and wove the cloth for garments and blankets. Quilts were made from scraps and unworn parts of discarded clothing. Leather for shoes and harnesses was made by tanning

hides of cattle; deerskins provided a softer leather for britches and jackets.

Perhaps more than in other rural areas, physiography shaped the development of culture and social patterns in the mountains. Each community occupied a distinct cove, hollow, or valley and was separated from its neighbors by a rim of mountains or ridges. Land ownership usually terminated at the ridge top, reinforcing the community's identity and independence. Hillsides were often considered to be "public land" open to the use of all members of the community. Economic and social activities were largely contained within these geographic "bowls." Households relied upon themselves or their neighbors for both the necessities and pleasures of life. The land was such a dominant factor in the mountain culture that neighborhoods often drew their names from the creeks or branches that penetrated the settlement (i.e., Spring Creek community, Walker's Branch community), and which further divided the larger community into sub-communities (Boland and others 1979).

Although few modern-day residents make their living directly from the land, many continue to share this value. The land is to be used, to be cultivated, to bear the fruits of one's labor. Generally, those who place a different set of values on the land, and who want to make different uses of the land, are looked upon with skepticism. In the Appalachians, the belief is widely held that private ownership of land conveys a legal right to do with the land as one pleases.

A majority of long-term residents do not view land as something to be bought or sold. Rather, it is viewed as a common heritage, held by individuals on behalf of the family and community. Local customs extend rights of free access to and use of the land to all those who live in the area. Local norms allow for the communal right to gather firewood and blackberries, or to hunt and fish on what some may consider as their private property.

One can easily see potential conflicts when these norms run up against different norms from new residents or from various government agencies.

During the days of the pioneers, the family was at the core of social life. It provided the context for development of politics, government, and organizations for religion, education, and other social relationships. The family and

kinship group influenced almost every aspect of mountain life. For the mountaineer, the collective welfare of the family was a primary value, and individual needs were subordinated to the needs of the family.

After reproduction, the primary responsibility of the family was economic – to provide the subsistence of family members. In the Southern Appalachians, the family not only functioned as a self-contained economic unit, but it dominated the economic system. The mountain farm was a family enterprise, with family members as proprietors, laborers, and managers; and satisfaction of the needs of the family was the sole purpose for running the farm (Sorokin 1965).

As parts of a working and consuming unit, family members depended heavily on each other. The heavier work of clearing land and building houses was shared not only by the nuclear family, but often by other relatives and neighbors. In the daily rhythms of farm life, each family member had well-defined roles and responsibilities. Individuals were allowed to pursue their own needs and interests, but these were not allowed to take precedence over the collective needs of the family. Intense family loyalties not only insured the survival of the group, but provided a strong feeling of security and belonging for individuals.

This close-knit family system also dominated education in the mountains, especially after Reconstruction, when state support for public education declined. The family also provided practical on-the-job training and experience in interpersonal relationships. Whatever formal education the mountain youth acquired in the 19th century usually occurred in the small community school, which was often taught by an aunt or uncle and attended primarily by neighbors and relatives. Opportunities for higher education were always available outside of the mountains (and in some cases within), but advanced schooling was a luxury that only the wealthier families could usually afford. For most mountaineers, education took place within the family and community. This type of education provided continuity for the culture, reinforcing traditional values and beliefs (Frost 1915).

Other social institutions functioned in a similar manner. Religion was organized around family and kinship units, and a few families often dominated the neighborhood church. These families maintained a strict independence

from mainline denominations and usually drew their ministers from the local congregation. Religious beliefs and practices varied among communities and churches, and differences over doctrine and interpretation of the scriptures led to a proliferation of small churches throughout the region. The mountain church was an important center of social control, legitimizing and sustaining the moral standards of the community. In rural areas, where law enforcement was sparse, the family and its church were responsible for policing the wrong-doing of community members. Violations of social standards cast a shadow not only upon the individual but also upon the larger family unit. Thus, social order was maintained not so much through legal institutions and governmental agencies as through kinship and primary family group relationships.

The basic unit of political organization was the kinship group. Family membership, rather than economic class, determined the voting patterns of mountain communities, and family patriarchs became the brokers of local political power. Office seekers measured their support by the size of their family, neighbors, and kin, and office holders considered the interests of families to be among their top priorities. Although such a system was not always efficient, it encouraged a high rate of participation and a feeling of local control. Throughout most of the 19th century, the influence of government on the lives of the mountain residents was marginal and had much less impact than the family group itself.

The Economy of the Southern Appalachians

The backbone of the preindustrial Appalachian economy was the family farm. Each mountain homestead functioned as a nearly self-contained economic unit, depending upon the land and the energy of a single family to provide food, clothing, shelter, and other necessities of life. Whereas farms in the Midwest and non-mountainous South moved steadily toward single cash crops, mountain family farms remained essentially diversified and independent. By 1880, Appalachia contained a greater concentration of noncommercial farms than any other area of the nation.

The typical mountain farm of the preindustrial period consisted of a mixture of

bottomland and rugged mountainside. On the average, these farms contained about 190 acres, of which about 25 percent was cultivated, about 20 percent was cleared pasture, and the remainder was forest.

Corn was the staple crop, occupying about 50 percent of the acreage under cultivation, but oats and wheat were also harvested as were hay, sorghum, rye, potatoes, buckwheat, and other crops. By the late 19th century, large portions of the mountain hillsides had been cleared (usually by burning or girdling of trees) for the raising of cattle, sheep, mules, and fowl. But the greatest proportion of the farm acreage remained in woodland, and it was here that the family hogs grazed throughout much of the year.

New economic prosperity after the turn of the century accelerated the exploitation of Southern Appalachian forest and mineral wealth. Private companies accumulated large holdings of timberland. A 1908 report on the Southern Appalachians estimated that 50 percent of its timberland was owned by large companies. A 1901 report estimated that 75 percent of the region remained forested and that 10 percent was in virgin growth (Yarnell 1995). From 1900 to the 1920s, this forest cover would be substantially reduced by heavy cutting. Sawmills served by narrow-gauge logging railroads spread throughout the southern mountains, even to the spruce forests at the highest elevations. Overhead cables and yarding machines speeded the removal of trees in rough terrain, and new bandsaws speeded milling. With this logging came an increase in soil leaching, erosion, flooding, and forest fires. In 1908, the Secretary of State's report estimated that 86 percent of the acreage in the Southern Appalachians was cleared, in various stages of regrowth, or in young, secondary forests. According to the report, "practically all of it, whether cut or not, had been burned" (Yarnell 1995).

In addition to hastening deforestation, the economic upswing after 1900 tripled the production of coal in the Southern Appalachians. Eastern Kentucky and southern West Virginia were primary coal regions; secondary centers were in southwestern Virginia and eastern Tennessee. The population of the coal counties in southern West Virginia increased 400 percent from 1890 to 1920. Increased demand for coal during World War I promoted further expansion of the coal industry. Both the

number of mines and the rate of production per mine rose to meet the needs of wartime industry. Peak years of production were between 1915 and 1926.

Even today, the economy of the Southern Appalachians is greatly influenced by mineral and energy resources. Coal, oil, and natural gas provide most of the power for industrial, commercial, and personal activities, such as transportation, heating, artificial lighting, and refrigeration. Crushed stone and aggregate provide the base of and surfacing for most of the roads, railways, and airports. Limestone is used for purifying water, treating sewage, and conditioning soil for agriculture (Collins and others 1995). Many different minerals go into the manufacture of items ranging from chainsaws to china, from white-water rafts to recliners.

Coal accounts for about 45 percent of total mineral production in the region. Coal mining is centered in the extreme western counties of Virginia. In Buchanan, Lee, Tazewell, Dickenson, Russell, and Wise Counties, it accounts for up to 47 percent of the total number of jobs. Between 1960 and 1993, coal production rose from 26,694 tons to 40,096 tons. Because of mechanization, the total number of miners decreased by 40 percent over the past 20 years.

Miscellaneous nonmetallics form the next set of important minerals extracted in the region. These nonmetallics include barium, perlite, phosphate, feldspar, mica, olivine, gemstones, lead, and zinc ore. The bulk of these minerals are found in Tennessee and North Carolina, but they are mined across the region.

After 1900, extractive industries such as logging and coal mining competed with mountain farmers for the use of the woodlands. During the first three decades of this century, private companies acquired large tracts of mountain woodland. Entire valleys were given over to railroads, coal mines, and coal towns, while forested slopes were denuded to provide timber for underground mines and lumber for coal towns. By 1930, only 60 percent of the land in Appalachia was still owned by farm families (Eller 1978).

Losing their woodlands to extractive industries, mountain farmers turned from livestock grazing to growing corn. While they raised corn to feed their families, some also earned a living by selling corn whiskey or by taking part-time jobs in the timber and mining industries.

The rapid depletion of forest resources in

the Southern Appalachians led many to advocate better conservation practices. In 1902, the National Hardwood Lumber Association and the National Lumber Manufacturer's Association came out in support of a Southern Appalachian forest reserve. This idea was endorsed by many large corporations, as well as the American Forestry Association (AFA). The AFA led the efforts to establish national forests in the East (Yarnell 1995). Severe floods such as those on the Monongahela and Ohio rivers in 1907 heightened public concern for watershed protection. Proponents of eastern forest reserves linked the two issues, resulting in the passage of the Weeks Act in 1911.

The Weeks Act cleared the way for establishment of National Forests in the East. In 1911 and 1912, 11 national forest purchase units were designated in the Southern Appalachians, in portions of Georgia, North Carolina, South Carolina, Tennessee, and Virginia. Virgin timber covered 30 percent of the lands purchased in the first 5 years. The rest was partially or completely cut over and the proportion of purchased land that was cut over rose with time. Most of these areas had lost population and were out of the hands of local residents, but some were caught in a web of overlapping land titles. The National Forest Reservation Commission chose not to use condemnation to acquire land, fearing that it would cause ill will and undermine public support for conservation. Most of the conflicts were resolved, but the Smoky Mountain Unit was abandoned due to title difficulties. In 1923, a movement began to have the area designated a national park instead.

Between 1911 and 1916, the Forest Service purchased much of the land that became the Pisgah, Nantahala, Chattahoochee, Cherokee, and Jefferson National Forests. The Vanderbilt estate provided the foundation of the first eastern National Forest, the Pisgah, in 1916. In 1918, northern Alabama received its first national forest, now known as the William B. Bankhead National Forest. Additions that followed included the Monongahela (West Virginia), Chattahoochee (Georgia), Sumter (South Carolina), Talladega (Alabama) and Cumberland (Kentucky), later to be renamed the Daniel Boone.

During the 1920s Congress passed additional legislation facilitating the expansion of National Forests in the East. The Clark-McNary

Act of 1924 allowed the purchase of land for growing timber. It also broadened the joint Federal-State work in fire protection and forestry. In 1930, the Knutson-Vandenberg Act provided funds for reforestation and timber stand improvement. (Allen and Sharpe 1960).

Through the 1920s, the renewed movement for a National Park in the Southern Appalachians gathered momentum. After the Organic Act of 1916 created the National Park Service, the Southern Appalachians was one of the first sites considered for a new park. The Secretary of the Interior formed the Southern Appalachian National Park Committee in 1924 to study the question. Over 20 sites were under consideration, including the Great Smokies, the Grandfather Mountain-Linville Gorge region, and the Skyland district of the Shenandoah. Finally, in 1926, Congress passed a bill authorizing the creation of two parks in the Southern Appalachians – Shenandoah National Park and Great Smoky Mountains National Park. A third eastern park was also included at Mammoth Cave in Kentucky (Yarnell 1995).

Three new federal entities for conservation joined the Forest Service and National Park Service in 1933: the Agricultural Adjustment Administration (AAA), the Tennessee Valley Authority (TVA) and the Civilian Conservation Corps (CCC). The AAA bought "submarginal" farmlands and resettled farm families on better farms elsewhere. This program was later shifted to the Farm Security Administration and finally dismantled due to insufficient funding.

The Tennessee Valley Authority (TVA) was created in 1933 by Franklin D. Roosevelt's New Deal administration. The area that it was named for, the Tennessee Valley, extends for 650 miles along the Tennessee River and its tributaries, which together form America's fifth largest river system (Van Fleet 1987). The Tennessee Valley includes parts of seven states: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Virginia, and, of course, Tennessee.

Along its crescent-shaped path, the Tennessee River flows through some of America's most beautiful mountains and forests and through some of the South's most prominent cities. But it also flows through many polluted, poverty-stricken areas. This economic and ecological diversity presented a challenge and an opportunity to proponents of regional planning in the 1930s. President Roosevelt intended for TVA to serve as the model for future regional

development across the country.

The TVA was designed to improve regional conditions – by enabling river navigation, controlling frequent flooding, and producing electricity – and to serve the nation as a testing ground for new ideas. From the beginning, the TVA was an experiment in regional planning and in government. When President Roosevelt signed the TVA Act in 1933, he created a unique organizational design: a federally owned corporation that was part government and part business. In a message to Congress supporting the TVA, Roosevelt charged it with “the broadest duty of planning for the proper use, conservation, and development of the natural resources of the Tennessee River (Valley) . . . for the general social and economic welfare of the nation” (Van Fleet 1987).

For more than 60 years, TVA's responsibilities have been as varied and diverse as the region it serves. For example, in its early years, the agency designed and built high-voltage lines to carry electricity to homes, schools, and factories throughout the Tennessee Valley. Today, it operates the country's largest electricity-producing system and maintains its role as an innovator in the utility industry.

The TVA has also developed techniques for measuring and reducing air pollution for coal-burning power plants, and many utility companies use these techniques today. The TVA's pioneering efforts have even extended to the research and development of new fertilizers and fertilizer production processes. Methods based on these processes today produce about three-fourths of all fertilizers in the world.

The CCC, the Federal Emergency Relief Administration, and the Works Progress Administration provided jobs to thousands of workers. The first beneficiary of this labor supply was the Forest Service, which was in charge of at least half of the CCC workers until the program ended in 1942. The first camp in the nation was located on the George Washington National Forest, and additional camps were located throughout the region. They were run by the Forest Service, TVA, the National Park Service, and the Soil Conservation Service. Workers planted trees; improved timber stands; built recreational facilities, trails and telephone lines; and worked as firefighters. They also did similar work in various state parks.

As mountain families abandoned their farms after World War II, the coal companies

expanded their landownership and introduced the new technique of strip mining. Companies found that bulldozers and power shovels removed the overburden covering coal seams at a fraction of the cost of underground mining. Unfortunately, strip mining removed soils and vegetation, as well as overburden, transforming mountain lands into barren slopes (Caudill 1963).

The introduction of strip mining, the expansion of federal forests, and the migration of marginal farmers contributed to the decline of agriculture in the Appalachians. For example, the area of harvested cropland in the Appalachian Mountains of Kentucky, West Virginia, and Tennessee plummeted from 600,000 acres in 1939 to 35,000 acres in 1974 (Otto 1983). In the contemporary mountains, agriculture is essentially confined to larger valleys, where level terrain permits intensive commercial agriculture for cash crops and livestock. The traditional practice of open-range grazing has vanished, and patch farming has survived only on a limited number of small farms.

The Appalachian Redevelopment Act, passed in March of 1965, established the Appalachian Regional Commission (ARC). The goal of the ARC is to provide a cooperative federal-state framework for planning coordinated social and economic development for the region. The Act was passed in response to the severe economic and social conditions that existed in large sections of Appalachia in the late 1950s and early 1960s.

In part, this distress sprang from the rapid mechanization of coal mining, the sharp decline in farm employment, and shifts in markets and technology for several other basic components of the Appalachian economy. For example, between 1950 and 1960, employment on railroads in Appalachia dropped by 40 percent as a result of the shift from trains to highway transportation and changing rail technology (Appalachian Regional Commission 1970).

Appalachia historically has possessed a highly specialized economy, heavily dependent upon the exploitation of the region's abundant supply of natural resources. Still half rural, the region is deficient in service and light manufacturing employment.

In 1945, 10 percent of Appalachia's labor force worked in coal mines. In the 1950s, however, new technologies made it possible to

mine more coal with far fewer workers. Moreover, other fuels, such as oil, gas, and nuclear power started to capture many of the markets once served by coal. In 1970, mining accounted for only about 3 percent of all the jobs in Appalachia, although in the central part of the region, over 20 percent of the labor

force was mining coal. Since Appalachia lacked alternative job opportunities to absorb those displaced from its traditional industries, about 2.2 million persons left the region during the 1950s (Appalachian Regional Commission 1970).

*Communities and Human Influences
in Southern Appalachian Ecosystems:*

The Human Dimensions

In all but the most remote and forbidding of the earth's terrestrial ecosystems, human influences range from slight to pervasive. Indeed, it is concern over the pervasiveness of human influences in the Southern Appalachian natural ecosystems that led to this assessment. But even as humans are influencing the ecosystems in which they live, they are in turn being influenced by and are closely tied to those ecosystems. In fact, it is more useful and accurate to define ecosystems to include human settlements and cultures as integral components.

This chapter examines the human dimensions of Southern Appalachian ecosystems. Topics range from overall social trends since 1970 to projected changes in population into the 21st century. At all times, the concern is both with the way people are affected by the area's natural resources and with the way people are influencing the ecosystem.

While other portions of this assessment also address various aspects of human dimensions, it is the intention of this chapter to treat human beings as parts of Southern Appalachian ecosystems. The interactions between humans and the ecosystems around them are too complex to be examined exhaustively in an assessment like the one described here. Instead, the Human Dimensions Subteam, which authored this chapter, designed its analyses around seven questions. The first four of these questions resulted from concerns expressed at three public meetings held across the region in the summer of 1994. The other three questions emerged from needs and concerns expressed by the assessment collaborators in the Southern Appalachian Man and the Biosphere Program, which is the overall sponsor of this effort.

The seven questions addressed in the analysis are:

1. **How has the social pattern of Southern Appalachian communities changed over the past two decades?**
2. **How has the changing social pattern of the Southern Appalachians affected management of natural resources in the region, and what future effects of social trends can we predict?**
3. **How might management of natural resources impact the economic and social status of local communities in the region, particularly communities near major tracts of public land?**
4. **To what extent have interests or publics outside of the Southern Appalachians affected the status and management of the region's ecosystems and public land?**
5. **What are the important attitudes and values that Southern Appalachian residents hold toward natural resources and ecosystem management?**
6. **With particular emphasis on tourism and extractive and other resource-dependent industries, what are the important economic trends in the Southern Appalachians?**

7. What are the status of and the priorities for management of land by nonindustrial private landowners in the region?

To set the context for addressing these questions, the people and development of the Southern Appalachians are broadly described. Then each of the seven questions is addressed.

Most of the data used in this assessment are secondary data obtained from previous work of other organizations. One of the major limitations faced in attempting to address the questions was that none of the available data and information was specifically gathered for the needed analysis. Data describing the human population came from the Bureau of the Census' Census of Population and Housing for 1970, 1980, and 1990-91 and from that agency's TIGER (Topologically Integrated Geographic Encoding and Referencing) system files, which provide geographic resolution down to block group and census tract levels. Economic data came mostly from the U.S. Department of Commerce's County Business Patterns, from the U.S. Department of Labor, and from the U.S. Department of Agriculture's Economic Research Service. Several local sources were used to describe schools, highways, and other social characteristics. Specific sources of data are cited where the information is presented.

In two instances, major questions could not be answered with existing data and original data had to be developed. To adequately estimate the impacts of natural resource management on local populations, focus groups were assembled and studied in five communities near public land in the region. To ascertain the overall knowledge and values that Southern Appalachian residents have about ecosystem issues, a special phone survey was conducted. These special efforts provided essential insights into the importance of natural resources as sources of raw materials, as aesthetic backdrops, and as a way of life for Southern Appalachian people.

The professionals who developed this chapter represent a cross section of sciences ranging from sociology, social psychology, and resource economics to computer and forest sciences. This diversity of background and expertise is a strength of this chapter as the diversity of the people and settings in the Southern Appalachians is a strength of the region.

An Overview of the Southern Appalachian People

This overview is based on a variety of data sources, especially on U.S. census data for 1970, 1980, and 1990-91. Most of the information presented is 1990-91 summary data describing the current situation in the Southern Appalachians. Journal articles and technical reports written by various authors are also used to provide general information about the region.

Trends and Spatial Patterns

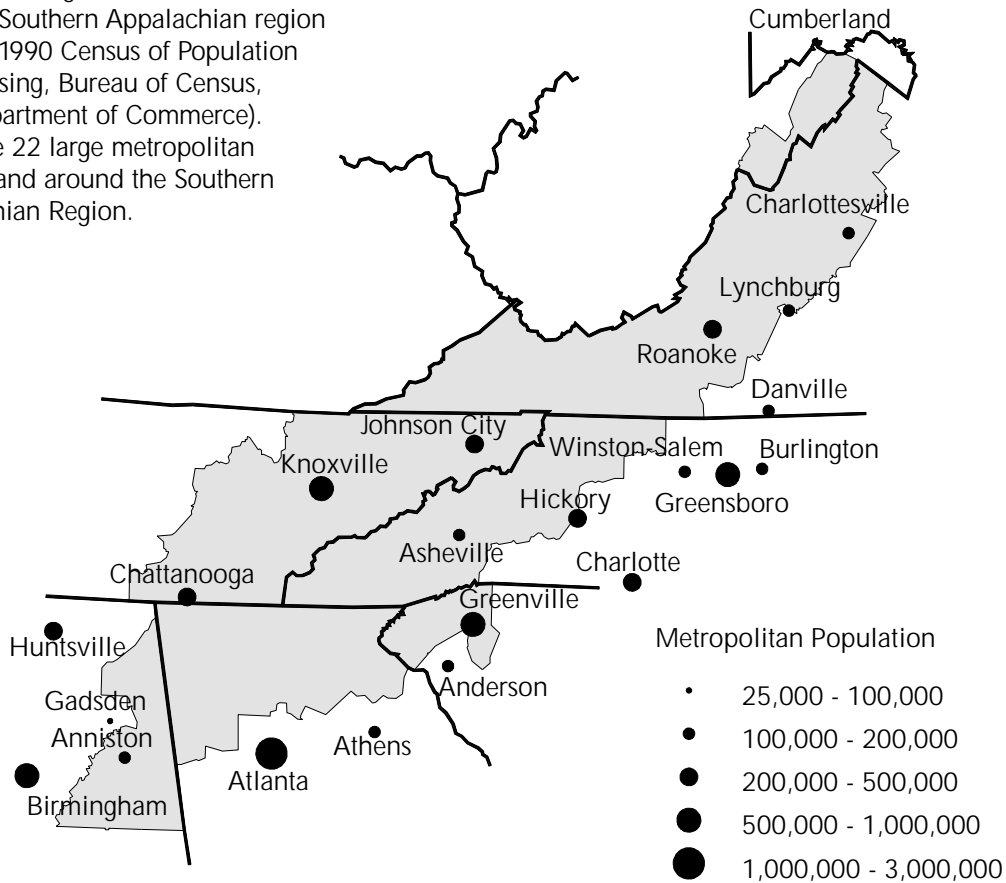
Largest Cities In or Near the Southern Appalachian Region

There are 22 cities with populations greater than 25,000 in or within 50 miles of the region (fig. 2.1). The largest city, Atlanta, GA, is located just south of the region. Other large cities in the area include Chattanooga and Knoxville, TN; Greenville, SC; and Roanoke, VA. Each of these cities has a population greater than 200,000. Of the 22 cities in the vicinity, 10 actually fall inside the regional boundary.

Interstates and Other Transportation Corridors

Some 15 interstate highways cross the Southern Appalachian region (fig. 2.2). Each is a major transportation corridor. Interstate 81 is the aorta for the system. It stretches from the most northern Appalachian areas in New York through the center of the Appalachians into Tennessee, where it merges with Interstate 75. Interstate 75 stretches on southward into Georgia while Interstate 59 feeds into Alabama. Other interstate highways cross this central transportation aorta. Most of these crossing interstates connect with major metropolitan areas. For example, Interstate 75 feeds into the Appalachian region from Atlanta, GA; Interstate 59 comes from Birmingham, AL; and Interstates 24 and 40 come from Nashville, TN. Interstate 64 comes from Charleston, WV, to the west and Richmond, VA, to the east; Interstate 70 provides access from the Washington, DC area; and Interstates 77 and 40 provide entry into the mountains from Winston-Salem and Charlotte, NC. All of these major interstates provide access

Figure 2.1 Largest cities within or near the Southern Appalachian region (Source: 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce). There are 22 large metropolitan areas in and around the Southern Appalachian Region.



HD313

not only for distant urban residents, but also for people living in the Appalachian region.

Although their importance has declined, railroads also are vital to the transportation system. Many of the railroads follow the same general routes as the interstate system, but they also provide additional access to some rural areas in the region. As can be noted from figure 2.3, most rail systems are on the western side of the mountains. Rail lines also run north and south through the center and the western side of the Appalachian region. The rail lines on the eastern side of the Southern Appalachians connect metropolitan areas there with lines that run the length of the mountain chain.

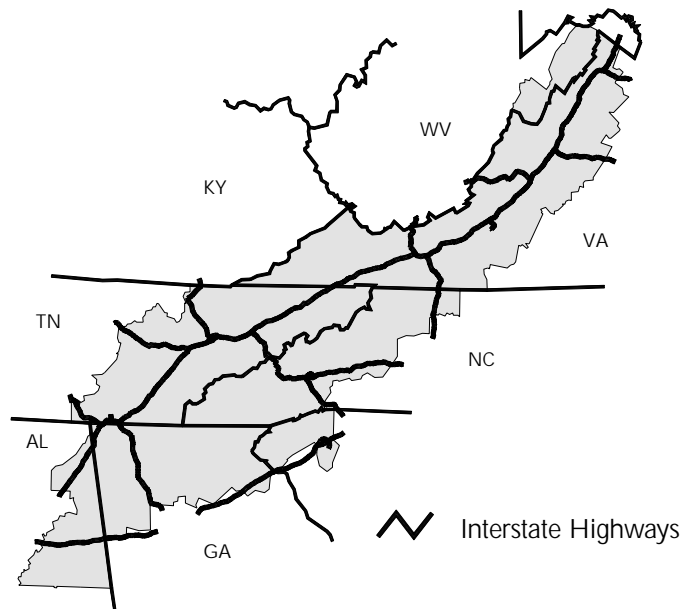
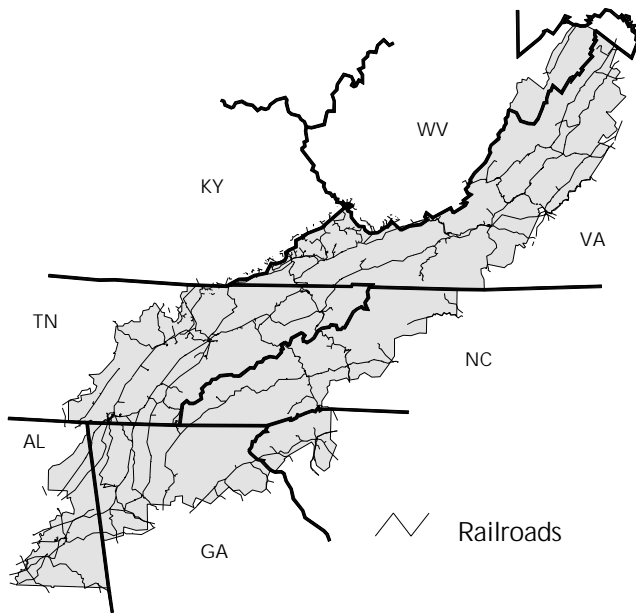


Figure 2.2 Interstates in the Southern Appalachians (Source: U.S. Geological Survey). There are some 15 interstate systems in the Southern Appalachians. Each of these systems serves as a major transportation corridor through the region from larger metropolitan areas that are not within the region.

HD307



HD308

Figure 2.3 Railroads in the Southern Appalachians (Source: U.S. Geological Survey). The railroad systems in the Southern Appalachians tend to congregate toward the western part of the region in the southern and central areas, while they are more to the eastern part of the region in the northern areas. These railroads serve more for the purpose of freight distribution than personal transportation.

Population

The population of the Southern Appalachians increased by over 1.2 million between 1970 and 1990 (table 2.1). Two-thirds of this growth took place between 1970 and 1980. Prior to the 1970s, the region's population had been decreasing due to a lack of employment opportunities for young people and a lack of accommodations for the elderly. Since the 1970s, however, all of the counties in this region have had high population growth percentages, except those containing metropolitan areas, which had high population bases in 1970.

Population Distribution

The population of the Southern Appalachians is unevenly distributed. The most rugged portions of the mountains, where much of the public land is, are sparsely settled. The more level areas have more dense populations than the national average. Although the number and size of urban areas have grown, almost 57 percent of the Southern Appalachian population still resides in rural areas.

Population densities of Southern Appalachian counties vary from 6.3 people per square mile (ppsm) to 4,034 ppsm (fig. 2.4). The average for the region is 262 ppsm. There are only two counties in Tennessee that have densities of over 500 ppsm, Hamilton and Knox. Hamilton County is just north of the Georgia-Tennessee border and includes Chattanooga. Knox County includes Knoxville. Other counties with

Table 2.1 Population of the Southern Appalachian region, by state, 1970, 1980, 1990.

	1970	1980	1990	Percent Change 1970–1990
Alabama	267,922	312,378	310,198	15.7
Georgia	610,361	755,293	923,174	51.2
North Carolina	677,090	796,134	846,356	25.0
South Carolina	340,230	415,816	471,555	38.6
Tennessee	1,474,707	1,757,565	1,822,643	23.6
Virginia	1,195,536	1,404,127	1,459,239	22.1
West Virginia	27,596	32,807	35,529	28.7
Regional Total	4,593,442	5,471,120	5,868,694	27.8

(Source: 1970, 1980, and 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce)

population densities over 500 ppsm are those that include cities in Virginia. Two counties in the Southern Appalachians have fewer than 10 ppsm, Bath and Highland Counties in Virginia.

Employment

In the early 1970s, manufacturing accounted for approximately half of total employment in Southern Appalachia. By 1990, this proportion had decreased to approximately 27 percent. Employment in retail and wholesale trade and in professional and related services each comprised approximately 20 percent of total employment in Southern Appalachia in 1990 (fig. 2.5). Together, manufacturing, retail and wholesale trade, and professional and related services comprise over 67 percent of all employment in Southern Appalachia. Agriculture (mainly farming), forestry, fishing, mining, and the entertainment and recreation industries together comprise less than 8 percent of total employment in this region. Although there are currently only three major economic sectors in the Southern Appalachian region – retail, manufacturing, and professional – the economy is much more diversified than it was 20 years ago.

Figure 2.4 Population density of the Southern Appalachians, 1990 (Source: 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce). The population densities of counties in the Southern Appalachians vary from 6.3 to over 500 people per square mile. Densities in most of the region range between 50 and 150 people per square mile.

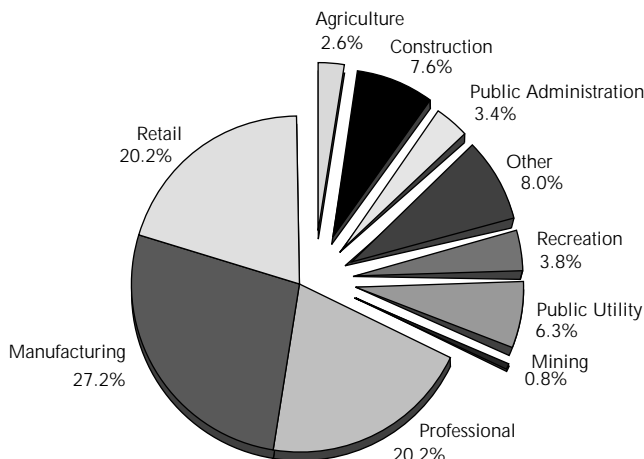
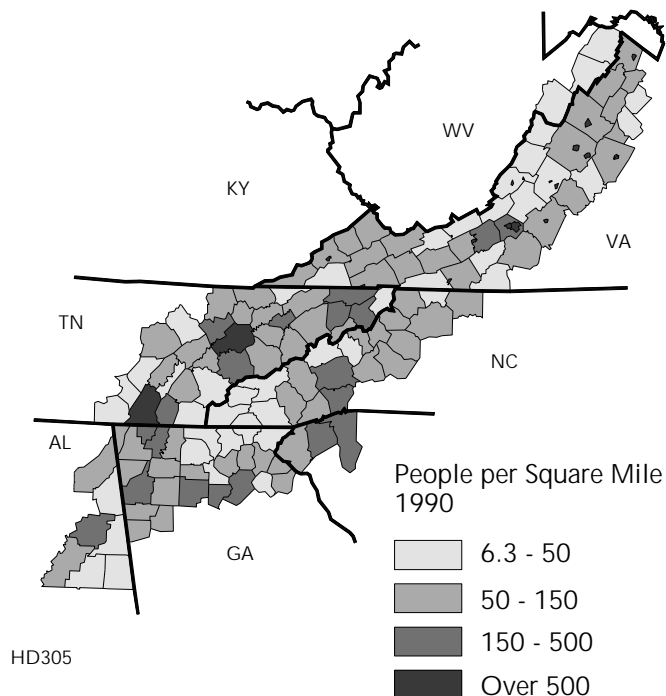


Figure 2.5 Southern Appalachian region employment, 1990. (Source: USA Counties 1994, Bureau of Census, U.S. Department of Commerce)

Race

In 1990, almost 92 percent of the 5.87 million people in the Southern Appalachians were white. A little over 7 percent were black, and 1.1 percent were of some other race. Since 1970, the percentage of the Southern Appalachian population that is black has increased and the place of residence of blacks has changed somewhat. Increasingly, blacks live in urban areas, and while most were once in Alabama and Tennessee, many now live further north and east in the Appalachian portions of North Carolina and Virginia.

Urban/Rural Mix

Although a majority still lives in rural areas, the population of the region, as in all regions of the U.S., is becoming more urban. Currently, 43 percent of the region's residents are urban. Urban areas in the Southern Appalachians provide more jobs for the young and better health care for the elderly. Some of the region's smaller cities are considered outstanding retirement communities.

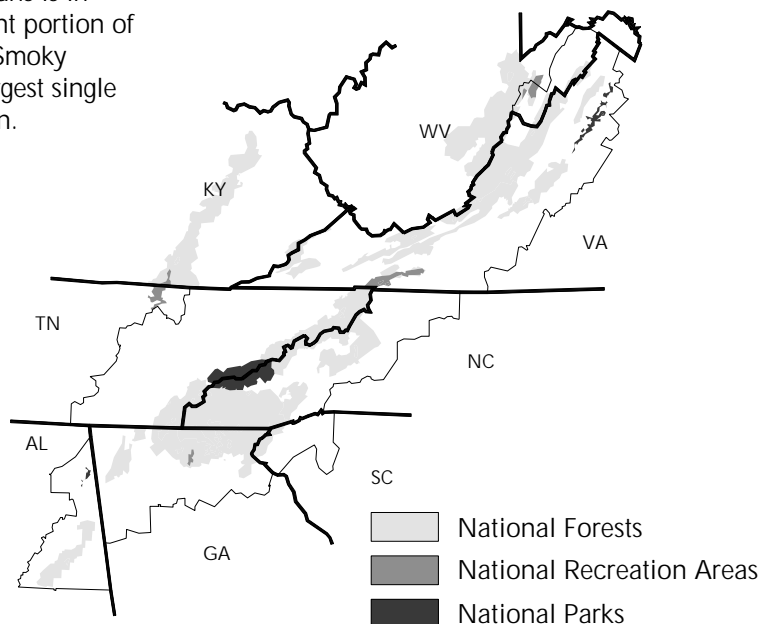
Location of Public Land

Tracts of public land are prominent components of the landscape. The region has 10 national forests, 2 national parks, and 5 national recreation areas (fig. 2.6). The largest concentration of federal land is in northern Georgia, southeastern Tennessee, and western North Carolina. In this area are the Chattahoochee, Nantahala, and Cherokee national forests, as well as the southern portion of the Blue Ridge Parkway and the Great Smoky Mountains National Park, the largest national park in the eastern United States. Another large concentration of federal land is in Virginia and West Virginia. This area contains the George Washington and Monongahela national forests as well as the Shenandoah National Park and the northern portion of the Blue Ridge Parkway.

Priorities of the Appalachian Regional Commission

The Appalachian Regional Commission (ARC), established in 1965, has a mission of promoting Appalachia's future economic and

Figure 2.6 Public Land in the Southern Appalachians, 1990 (Source: U.S. Geological Survey). The majority of public land in the Southern Appalachians is in national forest land. A significant portion of the public land is in the Great Smoky Mountain National Park, the largest single tract of public land in the region.



social development through a phased series of public investments to improve education, health, transportation, housing, community development, and conservation of natural resources (Appalachian Regional Commission 1970). The main priorities through 1970 were highway development, establishment of new health facilities, vocational technical centers, and assistance for construction of new housing. In 1975, the ARC was still concentrating on highway development, education, health, and housing, but child development and environmental and natural resource conservation were added. In 1980, funding priority for the ARC was concentrated in four areas: infant mortality, basic education skills, energy, and housing (Appalachian Regional Commission 1980). By 1985, the ARC had completed or nearly completed many of its initial projects. It turned its attention to new economic development needs, retraining and education of workers, reducing the high school dropout rate, and establishing new markets for the region's wood and coal industries. Since 1990, the ARC has focused on completing the Appalachian Development Highway System, creating jobs and retraining workers, supporting growth of small- to mid-sized businesses, and providing special help to the region's poorest counties (Appalachian Regional Commission 1991).

In the sections that follow, the seven questions listed earlier are addressed. Each question is addressed by first presenting key findings and observations from the analysis. Next, data and methods of analysis are briefly described. Finally, the more detailed results of the analysis are presented with accompanying maps, graphics, and tables.

The Seven Assessment Questions and Key Findings

Question 1:

How has the social pattern (demographics, occupations, lifestyles, cultures, backgrounds, etc.) of Southern Appalachian communities changed over the past two decades?

Key Findings

The population of the Southern Appalachians increased by almost 28 percent between 1970 and 1990. This increase was about the same as the almost 29 percent increase for the seven states in which the region is located. Population density in the study area remains below the average for the seven-state area. The greatest increases in population density occurred in areas near major metropolitan centers. These included northern Georgia, northwestern South Carolina, and portions of Tennessee, North Carolina, and Virginia.

The Southern Appalachian economy has improved greatly over the last 20 years. It has become less dependent on manufacturing and more dependent on the wholesale/retail and service industries. Growth of sales and service industries and maintenance of a manufacturing base have helped stabilize the economy.

Employment in manufacturing in the 1990s is a smaller share of total employment than it was in 1970. The trade and service industries have larger shares than in 1970. The trade sector employs 22 percent of Southern Appalachian workers, and the service sector employs 27 percent.

Poverty has declined significantly over the past 20 years. Twenty percent of families were below the poverty level in 1970; less than 11 percent were below it in 1990. The poverty rate in 1990 was slightly lower in the study region than that in the contiguous seven-state area. A lower poverty rate is the result of increasing real wages (inflation adjusted), particularly during the 1970s. Smaller increases in the 1980s were consistent with the national trend in real wages. Average real wage in 1990 was \$10,100 in the region, about \$2,500 per person below the average in the surrounding states.

Unemployment rates in the study area were relatively low in 1970, but they turned upward in the 1980s and 1990s in response to overall national recessions. The 6.5 percent unemployment rate for the region in 1990 was about the same as for the surrounding seven-state area.

Farming, a long-standing means of livelihood in the region, decreased 31 percent between 1969 and 1987. The percentage of the region's area in farms also decreased during this period, from 34 percent in 1969 to 25 percent in 1987. Perhaps helping to push the decrease in farmland, average inflation-adjusted market

value of farms rose over 100 percent throughout the region during the 1970s. Following a national trend, real farm values decreased 12 percent between 1978 and 1987 in the study region, but this decline was much less than the 33 percent decrease in the contiguous seven states.

A high percentage of households in the region own their homes. The average age of houses is about the same in the study area as in the surrounding states. The median year of construction is 1969. Market values for these homes average about \$10,000 less in the Southern Appalachians than in the surrounding seven-state area. However, housing quality has improved greatly since 1970. Housing with incomplete plumbing has been almost eliminated. The number of people per household decreased between 1970 and 1990; the average in 1990 was about 2.5 per household.

Overall, the social changes that have occurred in the Southern Appalachians have been growth oriented. Rural character is starting to give way to a more trade- and service-oriented urban character.

Observations

Rapid population growth, economic growth and diversification, better employment and wages, declining farming, and better housing translate into rising pressures on the natural resources of the Southern Appalachian region for the foreseeable future. For resource managers and planners the message is clear. Human communities, particularly those that are fastest growing, will be an increasingly dominating force in the balance between the biological, physical, and human dimensions of the region's ecosystems.

Rural lifestyles with close attachments to the land and water of the region are fast giving way to trade and employment attachments to industries and interests that have little direct contact with the natural systems of the southern highlands. Emerging social changes in the region will strongly influence planning and management of national forests, operation and maintenance of national and state parks, and the use of private land.

New highways connecting highland communities with major metropolitan centers, such as Atlanta, GA, Greenville, SC, and Knoxville, TN, are forever changing the commuting pat-

terns and makeup of the people who live in the region. Some towns and cities in the Southern Appalachians are now almost unrecognizable to people who have not seen them for 20 years.

As ecoregional assessments, such as this one, are developed for other regions, the process will be improved. The list of social factors analyzed needs to be expanded to include additional dimensions such as health, commuting patterns, leisure patterns associated with natural resources, cultural shifts, and political influences. Time and resources limited the coverage of this assessment to existing and easily obtainable data sources.

Data and Methods of Analysis

To address changes in population and housing in the region, census data from 1970, 1980, and 1990-91 were geographically analyzed. Other data sources included the Census of Agriculture for the last three decades and USDA Economic Research Service data.

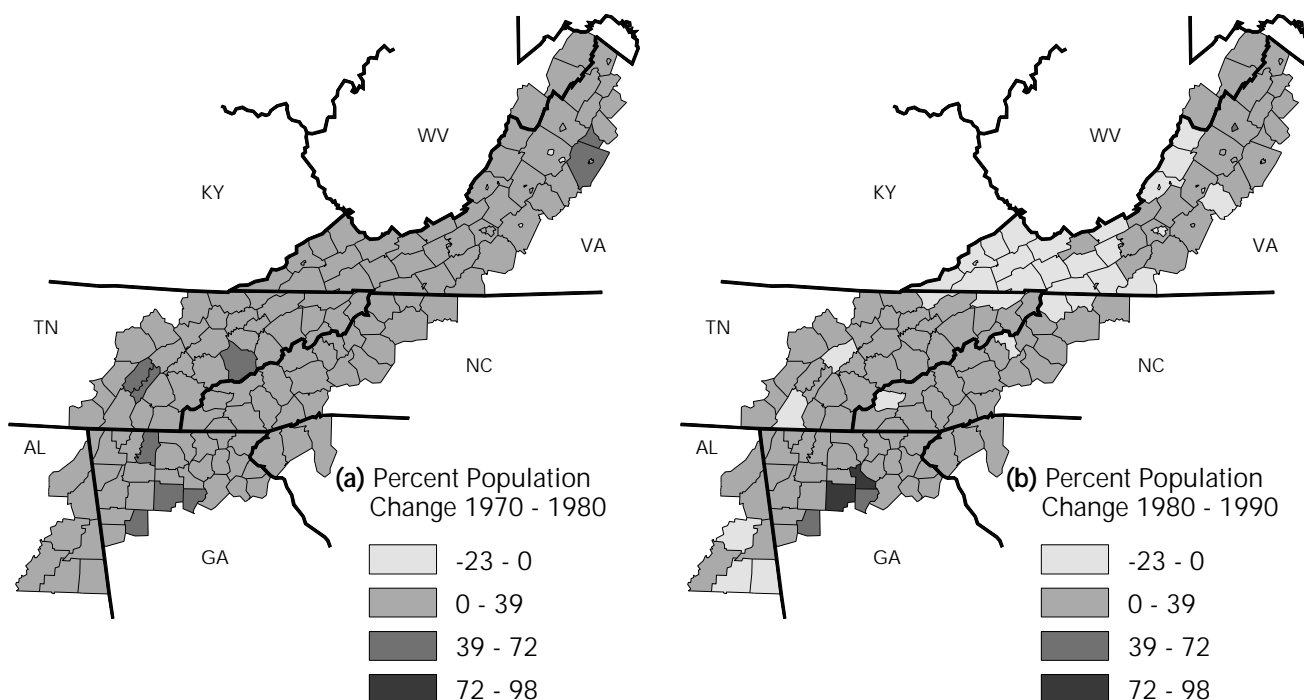
To place changes in the study area in perspective, they were compared with changes across the seven entire states in which the Southern Appalachians are located: North Carolina, Virginia, West Virginia, Tennessee, Georgia, South Carolina, and Alabama.

Maps were developed with ARCVIEW Version 2.1, a Geographical Information System (GIS) mapping system to display data geographically. For most maps, the averages for the counties in the study area were compared to averages for the seven states in which the Southern Appalachian counties reside. Only a few of the key maps are presented here. Others from the assessment database can be obtained separately in the Internet and can be accessed through SAMAB's Home Page and through the Forest Service Home Page.

When dollars were a unit of measure, real dollars were used. Real dollars reflect adjustments for inflation over periods across which trends were analyzed.

Economic and Social Trends Detailed Results of the Analysis

Many factors contribute to the social status of an area. We analyzed population, housing,



HD016

Figure 2.7 Percent population change in Southern Appalachia, by county, 1970-1990; (a) 1970-1980; (b) 1980-1990; (Source: U.S. Census). **(a)** In the 1970s, population increases were high in counties of northern Georgia, eastern Tennessee, and western Virginia. The average population increase for the region in the 1970s was 19.1 percent compared with the average total increase for the seven-states area of 16.2 percent. **(b)** In the 1980s there was substantial growth in northern Georgia and Virginia even though the average population increase was lower than that of the 1970s at 7.3 percent.

income, employment, and farming as key indicators of social change in the Southern Appalachian region.

Population

The population of the Southern Appalachian region increased by 19 percent between 1970 and 1980 (fig. 2.7). The population of the seven states encompassing the assessment area increased by 16 percent during this same decade. The population of all of the counties in the study area increased in the 1970s. Increases were particularly large in northern Georgia, eastern Tennessee, and western Virginia.

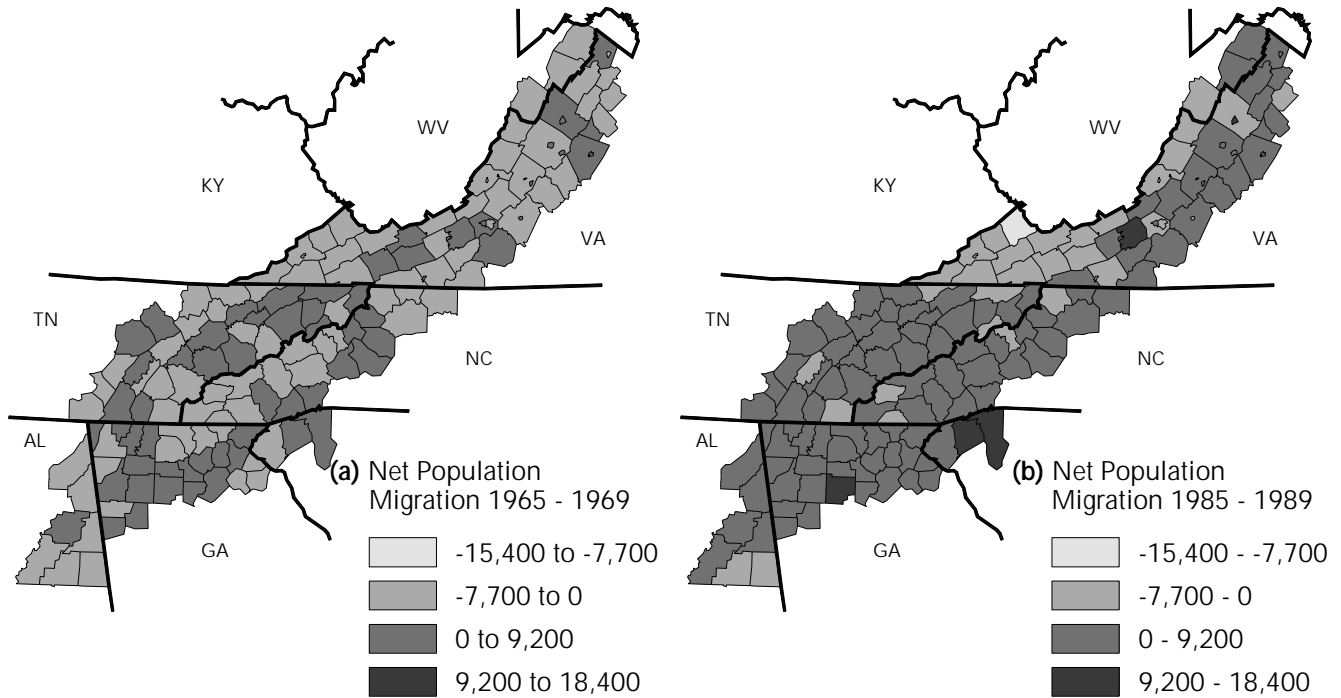
In the study area as a whole, population increases were far lower in the 1980s than in the 1970s. During the 1980s, the rate of increase was 7 percent in the Southern Appalachian region, whereas it was almost 11 percent for the seven-state area. Some notable exceptions to this lower growth rate

were rapid increases in northern Georgia and portions of Virginia.

The population density of the study area increased markedly from 1970 to 1990. In 1970, the area had an average of almost 80 ppsm, while the seven surrounding states averaged about 90 ppsm. In 1990, the region had increased to a density of 102 ppsm while the seven-state area had increased to 115 ppsm (fig. 2.4). The most dramatic changes in population density occurred in northern Georgia, northeastern South Carolina, and in isolated sections of Tennessee, North Carolina, and Virginia. These increases in population density occurred primarily in areas near major metropolitan centers.

Total net migration into the Southern Appalachian region has increased tremendously over the past 25 years. The area experienced population losses through out-migration in most of its counties from 1965 to 1969

Figure 2.8 Net population migration into Southern Appalachian counties, (a) 1965-1969 and (b) 1985-1989 (Source: U.S. Census). **(a)** Between 1965 and 1969, the total net migration into the region was 14,816, compared with the seven-states total of 264,627. The higher rates of net migration occurred in and around larger metropolitan centers. **(b)** The total net migration between 1985 and 1989 was 250,694 for the region and 1,014,368 for the seven-states area. During this time period, the population of the region increased as a result of net migration.



HD022

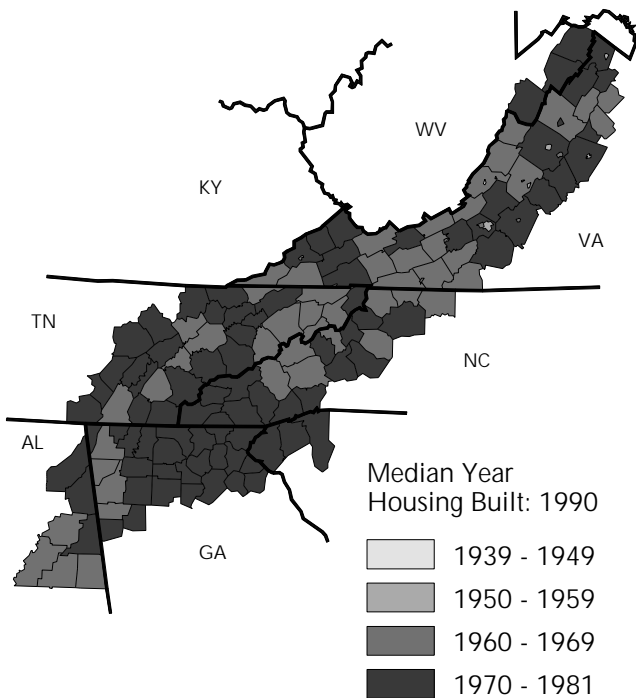
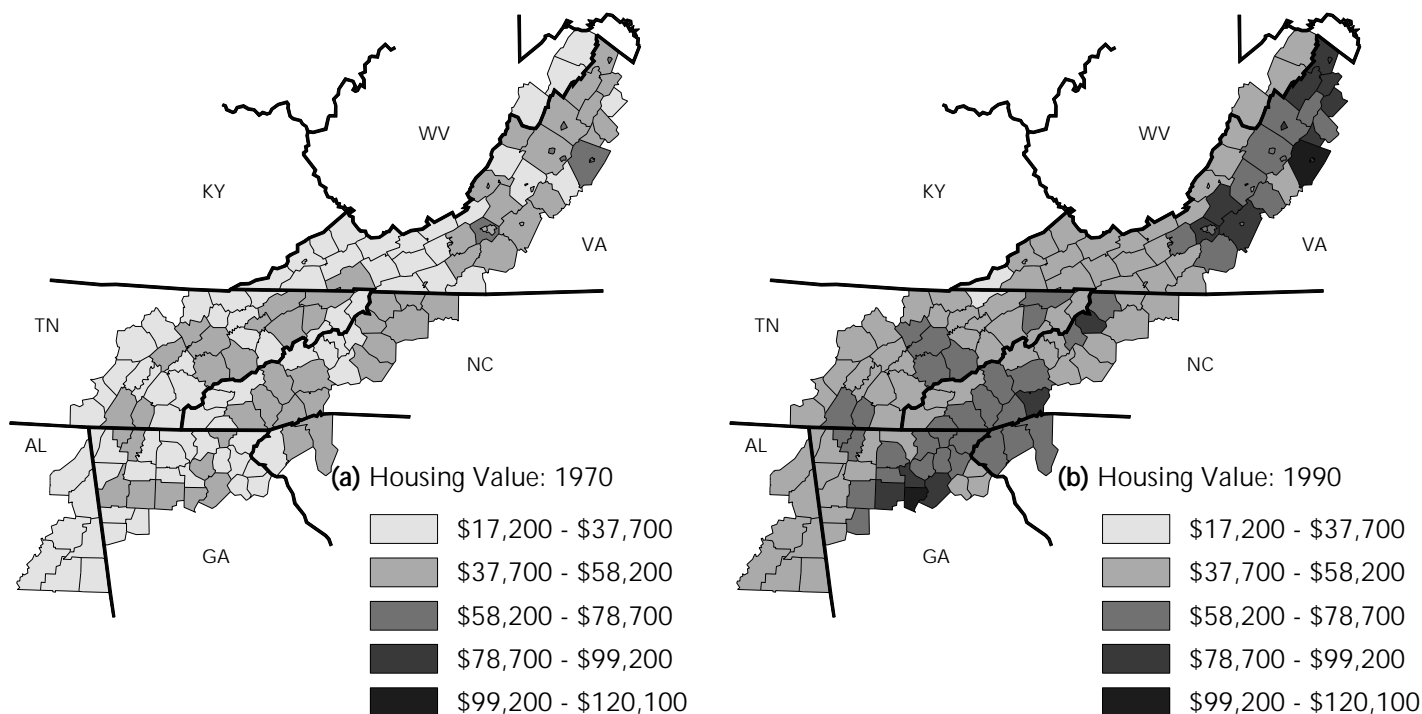


Figure 2.9 Median year of home construction in Southern Appalachian counties (Source: U.S. Census). The median age of houses in the region was 21 years as of 1990. Thus, the median year that houses were built was 1969. This can be compared with the seven-states median year for construction of 1970.

Figure 2.10 Housing values in Southern Appalachian counties (in 1990 Dollars) (a) 1970; (b) 1990; (Source: U.S. Census). **(a)** The average housing value for the region in 1970 was \$38,200 compared to the seven-states value of \$48,100. The areas with the higher housing values tend to be in western Virginia. **(b)** In 1990, the average housing value for the region was \$59,700, which remained approximately \$10,000 below the seven-states average. Again the higher values were in western Virginia, but there were also higher values in southwestern North Carolina and northern Georgia.



HD043

(fig. 2.8a). However, this trend was reversed from 1975 to 1979 and from 1985 to 1989, as population gains were fairly evenly distributed throughout the region (fig. 2.8b). There was one exception: a block of counties in southwestern Virginia experienced population losses from 1985 to 1989.

Housing

A high proportion of a region's population owning their homes is an indicator of social and economic stability. In the Southern Appalachians, this proportion has always been around two-thirds and has changed little in recent years. In the seven contiguous states, 61 percent of households owned their homes in 1990.

The median year of home construction is also an indicator of social status (fig. 2.9). More modern housing usually is associated with economic growth and transition. In 1990, the

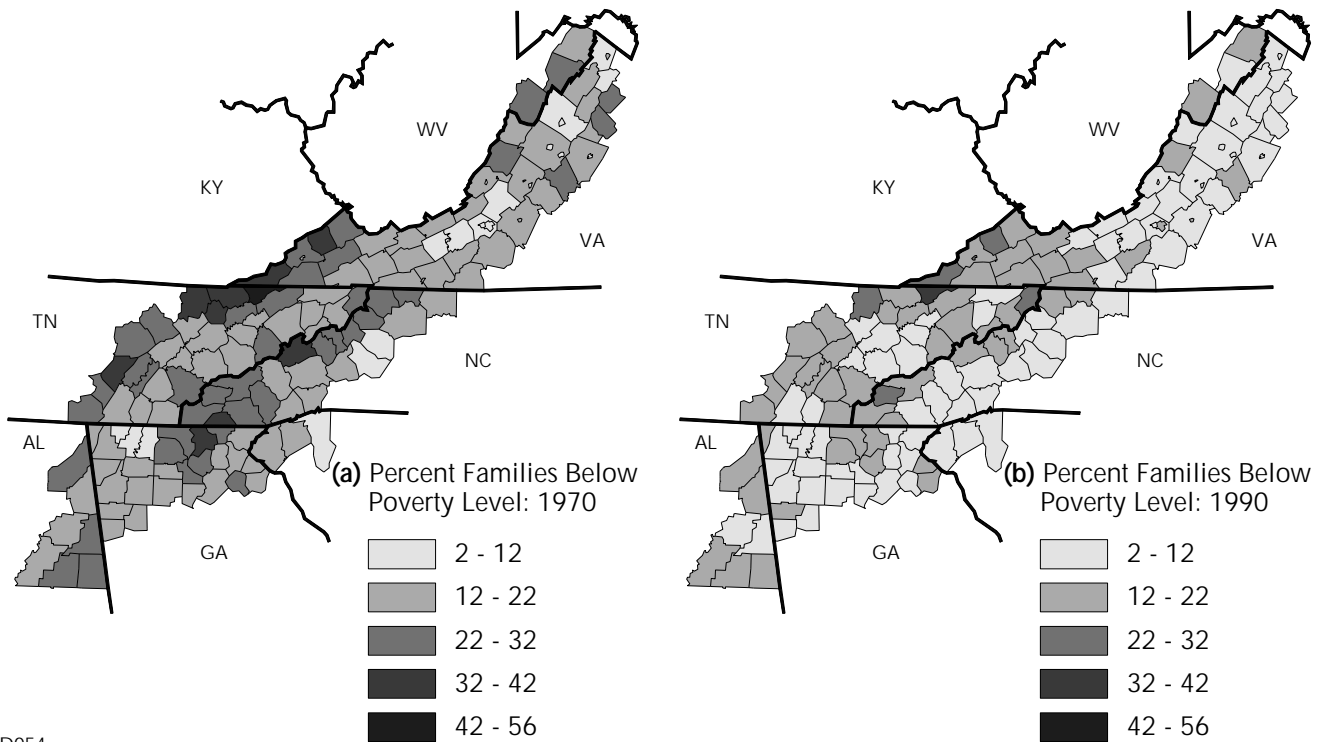
median year of home construction in the Southern Appalachians was 1969; the median year of construction for the seven surrounding states was 1970.

A decrease in the proportion of homes that lack complete plumbing facilities is also an indicator of social progress. In the Southern Appalachians, the proportion lacking complete facilities decreased from 15.4 percent in 1970 to 1.7 percent in 1990. In the seven surrounding states, the average dropped from 13.6 to 1.4 percent over this same period.

Expressed in 1990 dollars, the value of houses in the study area rose from \$38,000 in 1970 to \$59,700 in 1990 (fig. 2.10). Comparable values for the surrounding seven states were \$48,000 in 1970 and \$70,000 in 1990.

The average number of people per household in the region decreased from 3.2 in 1970 to 2.6 in 1990. This trend is similar to the one for the seven-state area. Farm families often are

Figure 2.11 Percentage of families in the Southern Appalachians below the poverty level, (a) 1970 and (b) 1990; (Source: U.S. Census). **(a)** About 20 percent of families in the region were below the poverty level in 1970, compared with 17.4 percent for the seven-states region. The majority of these families are in northern Georgia, western North Carolina, and eastern Tennessee. **(b)** By 1990, the percentage of families below the poverty level in the region dropped below the percentage for the seven-states area. The average percent below the poverty level in 1990 for the Southern Appalachians was 10.7 percent.



HD054

larger than average. The largest averages in the study area were in northern Georgia and northern Virginia.

Increases in female heads of household can sometimes indicate increasing social disunity and poverty. They also are a reflection of the divorce rate, which has risen across the nation. The proportion of Southern Appalachian households headed by females increased from 8.9 percent in 1970 to 10.5 percent in 1990. This proportion increased from 10.1 to 12.6 in the seven-state area.

Income

In 1970, 20 percent of Southern Appalachian families had incomes below the

poverty level (fig. 2.11). This proportion was 3 percentage points higher than in the seven-state area. By 1990, the proportion of families living below the poverty level had dropped to 10.7 percent. In that year, 11.2 percent of families in the surrounding states had incomes below the poverty level, indicating slightly better gains in the Southern Appalachians.

Over the same period, however, real (inflation-adjusted) increases in per-capita income were somewhat lower in the Southern Appalachians than in the surrounding seven states (fig. 2.12). In the region, per-capita incomes were \$7,000 in 1970, \$10,000 in 1980, and \$11,000 in 1990. Incomes in the seven-state area were \$8,800 in 1970, \$12,500 in 1980, and \$13,700 in 1990.

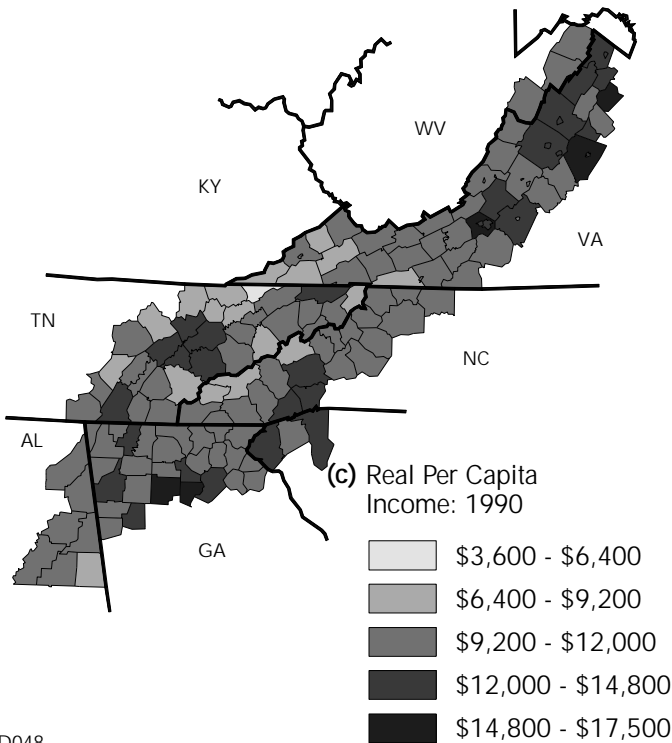
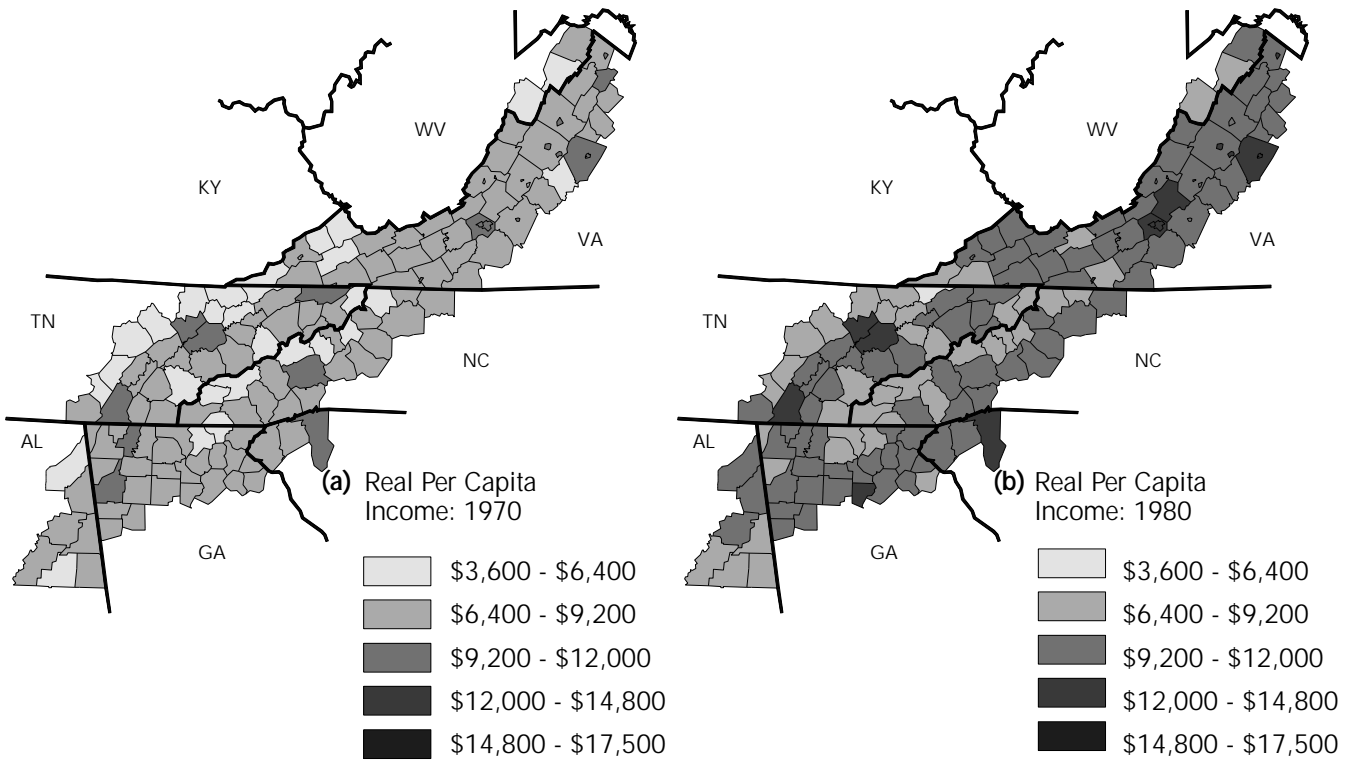
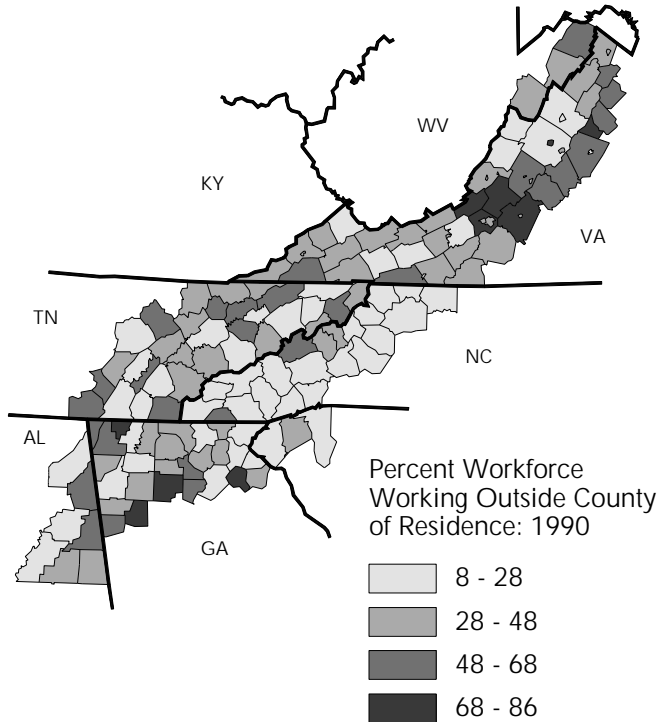


Figure 2.12 1970, 1980, 1990 real per capita income in Southern Appalachia (1990 dollars), (a) 1970; (b) 1980; (c) 1990; (Source: U.S. Census). **(a)** The average real per capita income in 1970 for the region was \$7,618 and \$8,814 for the seven-states area. The counties with the higher income are located near metropolitan areas. **(b)** The average real per capita income increased from 1970 to 1980 to \$10,138 for the region. This average, although increasing, is still below the seven-states average of \$12,466. There was only a slight increase in real per capita income for both the region and the seven-states area in 1990. The new region average was \$10,950 while the seven-states average was \$13,738.

Figure 2.13 Percentage of workforce working outside county of residence in Southern Appalachia, 1990 (Source: U.S. Census). Approximately 30 percent of the workforce in Southern Appalachia work in counties outside their county of residence. The largest percentages of these workers are found in western Virginia.



HD058

In 1970, unemployment was 3.7 percent in the region and in the seven contiguous states. By 1980, the rate had increased to 6.5 percent in the region, but fell again about 1 percent by 1990.

In addition to salary, factors defining the employment situation include distance and time to commute to place of employment. In 1990, 30 percent of the Southern Appalachian workers were employed outside their county of residence (fig. 2.13). In some counties, over two-thirds of resident workers commuted to another county to work. Average travel time to work was 21 minutes in the Southern Appalachian region, 1 minute less than in the surrounding seven-state area.

Retired people are becoming important contributors to the regional economy. In 1987, counties with 30 percent or more of land area in federal ownership were concentrated in western North Carolina, northern Georgia, and western Virginia. Most federal land is in

national forests and parks, which make the areas near them attractive as retirement destinations. In the 1980s, these destinations were concentrated in northern Georgia and western North Carolina. To classify as a retirement destination, the number of people 60 or more years old in a county had to increase by over 15 percent between 1980 and 1990.

Employment by Economic Sector

The relative shares of total employment in various sectors of the economy changed considerably between 1980 and 1990. Agricultural industries dropped from a 3.2 percent share of total employment in 1980 to 2.8 percent in 1990. Over this same period, share of total employment in agriculture decreased from 3.0 to 2.6 percent in the surrounding seven states. Only four counties had 20 percent or more of their work force engaged in farming in 1987 to 1989.

The mining industry's share of the work force in the Southern Appalachians declined from 1.6 to 0.9 percent between 1980 and 1990. Mining continues to be a major industry only in southeastern Virginia. Increased mechanization accounted for much of the decrease in mining employment. Southwestern Virginia had 15 percent or more of its work force employed in mining in the late 1980s, but mining makes up a relatively small portion of the entire region's economy.

Construction employment in the region rose from 7.4 percent of the total in 1980 to 8.1 percent in 1990. A similar increase occurred in the seven surrounding states. Construction's share of total employment in 1990 was highest in northern Virginia, northern Georgia near Atlanta, and western North Carolina.

Manufacturing's share of total employment decreased from 35 percent in 1980 to 29 percent in 1990 (fig. 2.14). Transportation's share of total employment also decreased slightly in both the Southern Appalachians and the seven-state area. The proportion in 1990 was 6.8 percent in the region and 7.9 percent in the seven surrounding states. Government's share of employment also decreased.

In contrast, Southern Appalachian employment in the wholesale and retail trade sectors rose from 19 to 22 percent between 1980 and 1990. An even larger increase occurred in the service sector (fig. 2.15). This sector's share of

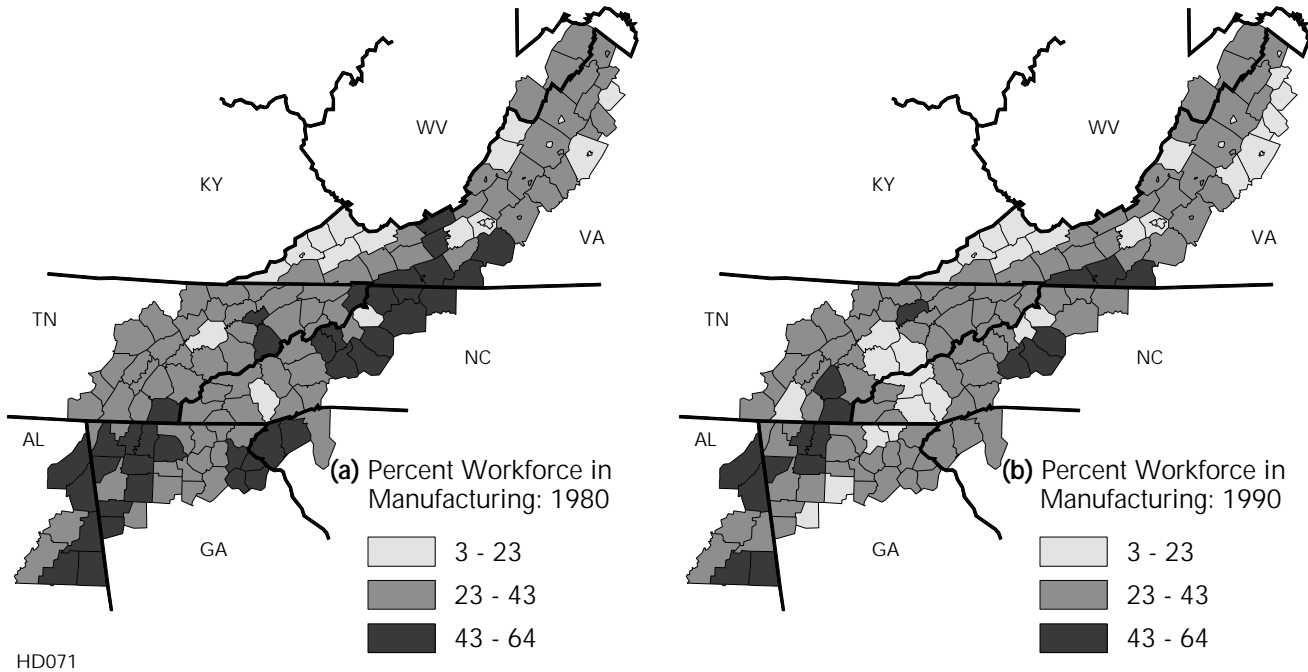


Figure 2.14 Percentage of workforce in manufacturing in Southern Appalachia, (a) 1980 and (b) 1990, (Source: U.S. Census). **(a)** In 1980, the average percentage of the workforce that is in the manufacturing industry in the region is 34.6 percent. This is comparably greater than the average percentage for the seven-states area of 28.5 percent. **(b)** By 1990, the average percentage of the region's workforce in the manufacturing industry had decreased by 5 percent. The majority of high percentage areas are in northeastern Alabama, northwestern Georgia, western North Carolina and southwestern Virginia.

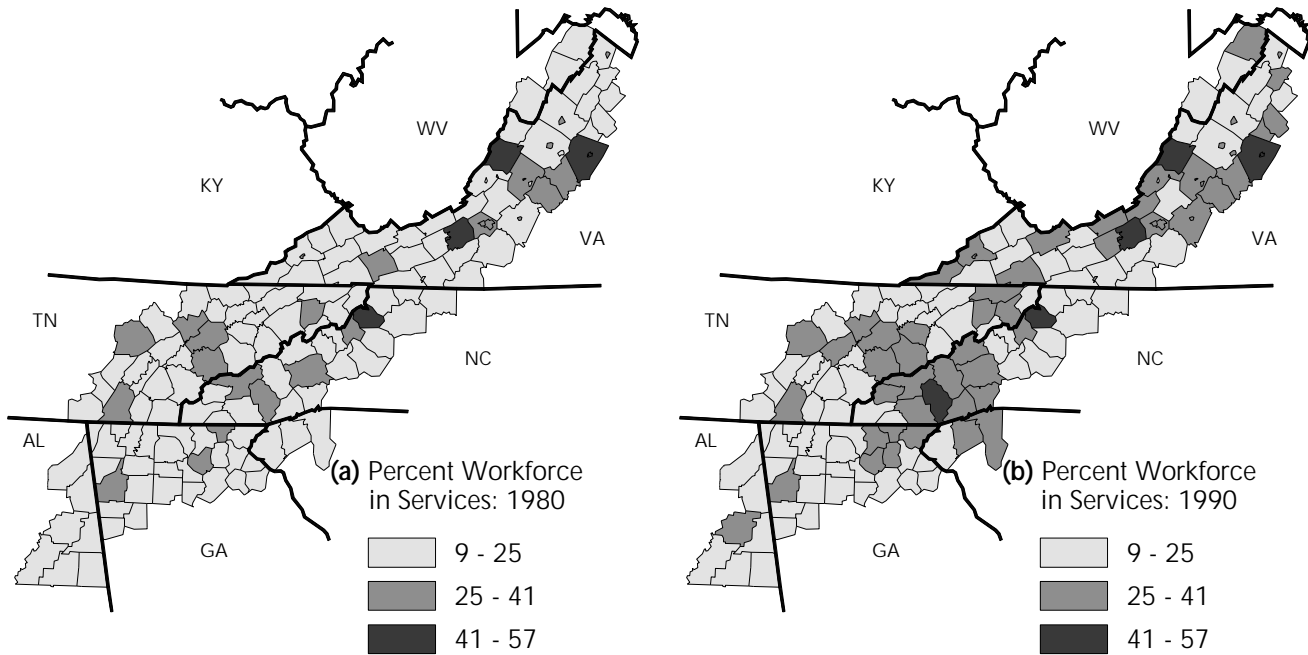
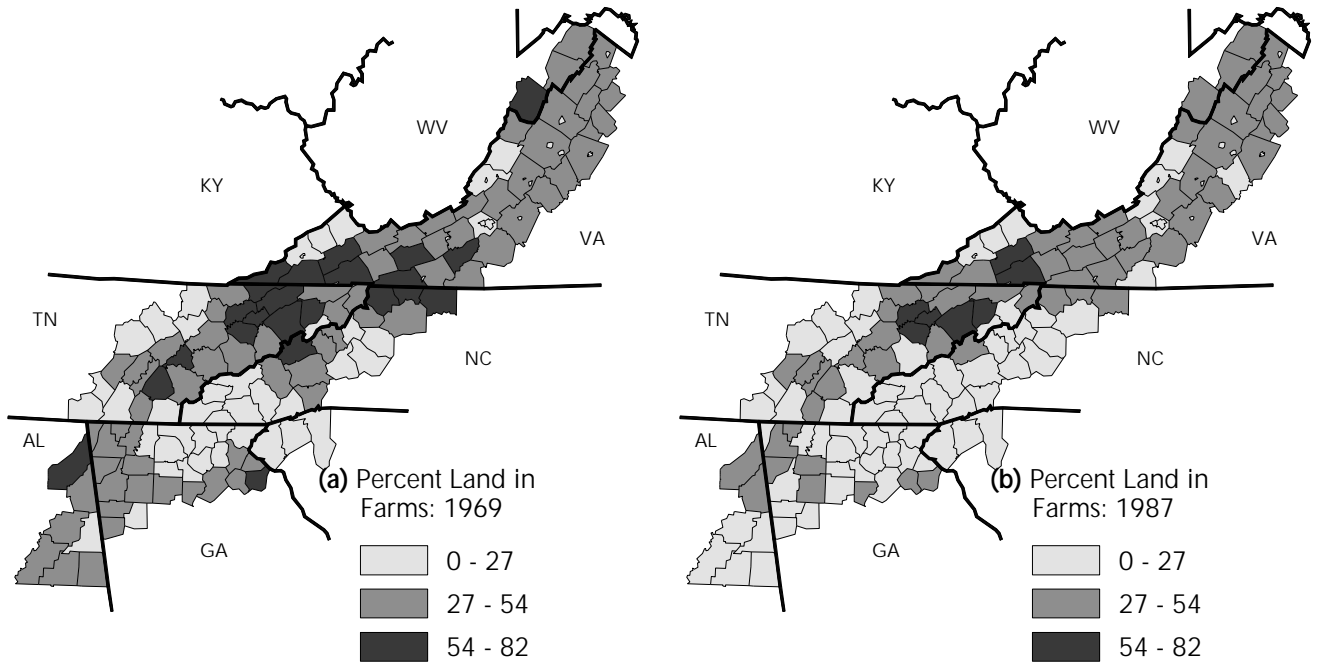


Figure 2.15 Percentage of Southern Appalachian workforce in the service industry, (a) 1980 and (b) 1990, (Source: U.S. Census). **(a)** In 1980, the percentage of the region's workforce that was in the service industry was 23.4 percent compared with 25 percent of the seven-states total. The distribution of counties with more than 25 percent of their workforce in the service industry is rather sporadic. **(b)** By 1990, the percentage of the region's workforce in the service industry had increased to 26.8 percent. Not only did the overall percentage grow, the number of counties with over 25 percent of their workforce in the service industry grew.

Figure 2.16 Percentage of land in farms in Southern Appalachia, (a) 1969 and (b) 1987, (Source: U.S. Census). **(a)** In 1969, the average percentage of land farms in each county of Southern Appalachia is 34.1 percent. This was well below the seven-states average of 41.2 percent. The counties with the highest percentages were mostly located in eastern Tennessee and southwestern Virginia. **(b)** By 1987, there was a substantial decline in the percentage of land in farms. The decrease of about nine percent, left the 1987 average at 25.5 percent. The majority of this percentage decrease is evident in the more southern counties of the region.



HD081

total employment rose from 23 percent in 1980 to 27 percent in 1990. Similar increases occurred in the seven states and across the nation as a whole.

Farming

Data from the Census of Agriculture for 1969, 1978, and 1987 documented a decline in farming activity in the Southern Appalachians (U.S. Department of Commerce, Bureau of Census 1969, 1978, 1987). The average number of farms per county decreased from 837 in 1968 to 577 in 1987. This decrease did not seem to result from consolidation of operations. The percentage of land area in the

Southern Appalachians in agricultural uses decreased from 34 percent in 1969 to 25 percent in 1987 (fig. 2.16). Decreases in the seven-state area were even larger.

The average value of farms more than doubled between 1969 and 1978 in both the Southern Appalachians and in the seven contiguous states (fig. 2.17), but farm values dropped in both areas between 1978 and 1987. In the study area, average value was \$103,000 in 1969, \$216,000 in 1978, and \$191,000 in 1987. The decline in farm values through the 1980s was part of a national trend. Over that period, values dropped an average of almost 12 percent in the study region, and 33 percent in the surrounding states.

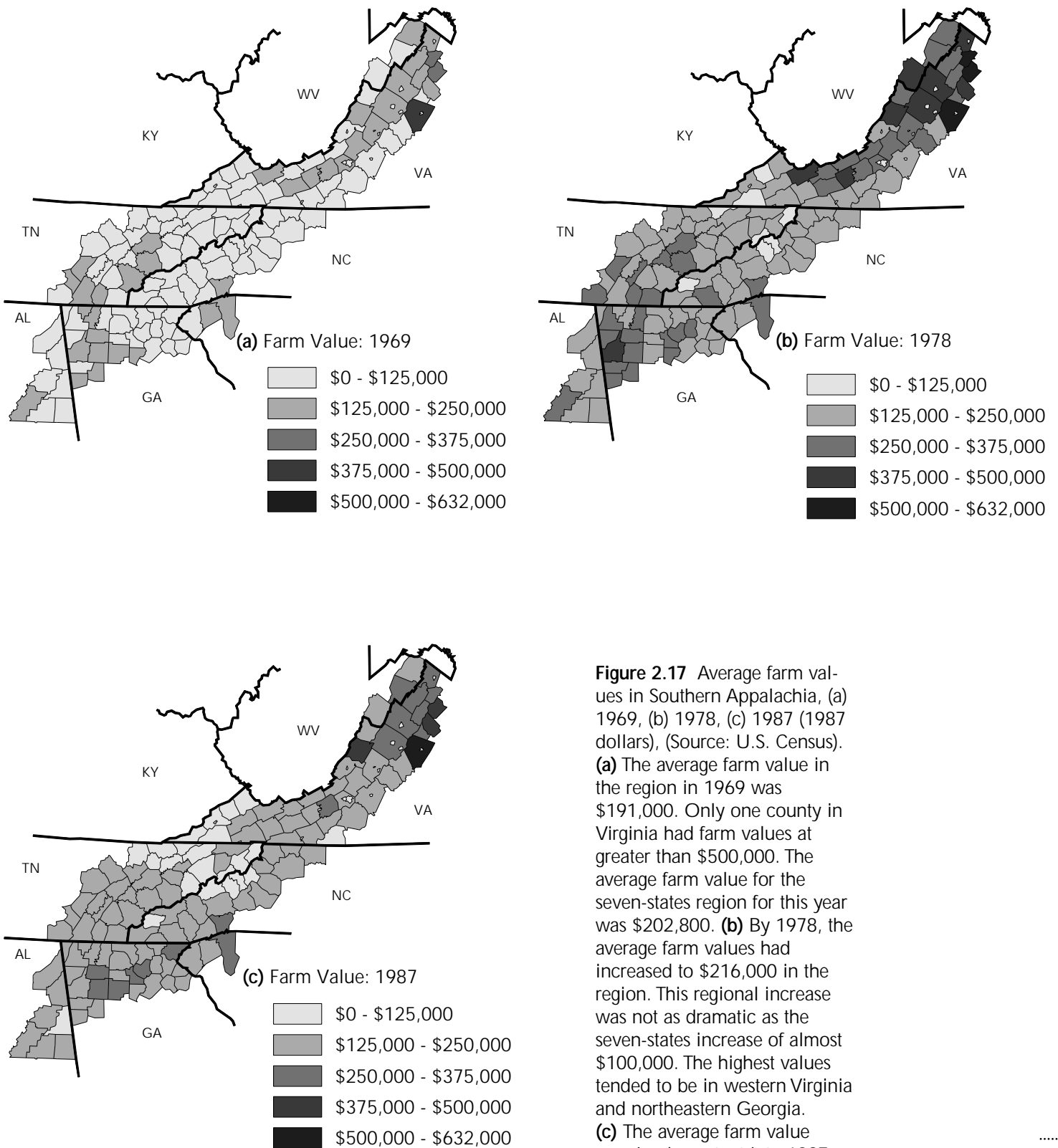


Figure 2.17 Average farm values in Southern Appalachia, (a) 1969, (b) 1978, (c) 1987 (1987 dollars), (Source: U.S. Census). **(a)** The average farm value in the region in 1969 was \$191,000. Only one county in Virginia had farm values at greater than \$500,000. The average farm value for the seven-states region for this year was \$202,800. **(b)** By 1978, the average farm values had increased to \$216,000 in the region. This regional increase was not as dramatic as the seven-states increase of almost \$100,000. The highest values tended to be in western Virginia and northeastern Georgia. **(c)** The average farm value remained constant into 1987 although the distribution of farms with higher values became less concentrated. By 1987, the seven-states farm value had decreased.

Question 2:

How has the changing social pattern of the Southern Appalachians affected management of natural resources in the region, and what future effects of social trends can we predict?

Key Findings

Population Growth is Creating Pressures

The most pronounced change in the social pattern of the Southern Appalachians since 1970 has been population growth. Urban, road, and housing development in association with increased population is particularly significant. While relatively little forest land has been lost, growth and development have taken farmland, pastures, and open space generally, and they have affected management of natural resources. Resource managers are accommodating the needs and desires of people new to the Southern Appalachians. Many of these new people are recent retirees. In some areas, such as north of the Atlanta metropolitan area, many in the current workforce live in the highlands, but commute to jobs in the city.

New Residents Have Moved Into the Region

In addition to retirees, many new people have migrated to the Southern Appalachians to live and work at jobs in the growing service and trade sectors. More jobs are now related to recreation and tourism than in previous decades. Service employment has grown faster than traditional employment in manufacturing, agriculture, and the resource-extraction industries, particularly timber.

Newcomers have greatly and irreversibly changed the social climate in which resource management takes place. For example, retirees who have recently come to the region seem to feel differently about natural resource preservation than long-time residents, many of whose incomes have depended on extraction and

manufacturing from natural resources. Such differences in preferences cause conflicts over resource management, often with the resource manager caught in the middle. For example, clearcutting usually is protested, especially when it occurs in sight of roads. Managers of natural resources have had to respond to new sets of values and preferences, particularly increased demand for land and water resources for scenery, recreation, and tourism.

Population Growth is Projected to Continue

The population of the Southern Appalachians is projected to grow 12.3 percent by 2010, somewhat less than the 13.1 percent for the United States as a whole. But 12.3 percent represents a large number of additional people in the region in a little under 15 years. Most of that growth is expected to be in northern Georgia, western North Carolina, portions of eastern Tennessee, and northwest Virginia. Growth in population density is perhaps the best indicator of potential human impact. Of counties having more than 25 percent of area in public ownership, Blount, Sevier, and Carter in Tennessee and Habersham in Georgia are expected to grow the most. White, Murray, and Lumpkin counties in Georgia; Smyth in Virginia; and Transylvania in North Carolina will grow the next most rapidly in density. Some counties with large areas of commercial forest land and with large mileages of streams may also be impacted by population growth.

Observations

Rapid growth of population in the region, similar to most other parts of the country, is the single social change most impacting the status of natural resources of Southern Appalachian ecosystems. Population growth, new residents with preferences different from long-term residents, and a general "spilling out" of people onto the countryside are changing forever the character of the landscape of the region.

Increased population density across all counties and development of former farms, forests, and pastures removes habitat for most species of wildlife and fish. Of particular

concern recently have been declines of populations and habitat for neotropical songbirds, fox, trout, and many other species. Continuing development pushed by human population growth and greater affluence will, in all likelihood, result in even greater losses of habitat and thus impact even more animal populations in the region.

More people and the resulting greater amounts of land conversions also impact water quantity, quality, and use. As cities expand, as residential developments are created, and as isolated homes and industries are newly developed, streams of all sizes and qualities are impacted. Development near and along streams, particularly attractive to retirees and tourists, effectively removes or alters riparian vegetation and soils. More roads means more flooding, siltation and introduction of pollutants. Greater numbers of people lead to greater water use and treatment costs and greater interruption of natural cycles. Human development and habitation often occur at higher elevations, resulting in downstream impacts. Some impacts are occurring on public land, and even on designated wilderness.

Development at higher elevations also impacts the visual qualities of the region. Some developments can be seen from 50 or more miles away. Scenery in the Southern Appalachians has always been one of the most precious resources of the region. Since the late 1900s, tourists and seasonal residents have used the region as a playground and retirement destination. Urban sprawl, strip industrial and business development, and roading have tremendously changed the scenic character of the area. In unmeasured ways, the tourism potential and economic growth of the region have been impacted.

Along with development and changing of ownership patterns from long timers to newcomers, is loss of access to land and water for recreation and general aesthetic purposes. Generally, as an area is developed and urban

pressures become more of a dominating force, private lands are posted and public lands become more crowded. The trend in the Southern Appalachians and more generally across the country is to greater restrictions of access to private land. Greater private land restrictions lead to greater pressures on public land, including designated wilderness and parks.

Public use and enjoyment of national forests, national parks, and public reservoirs has steadily grown since World War II. More recreation pressures from residents and from visitors to the region make the work of the resource manager more difficult. Ecosystem management and planning generally entail establishment of desired ecosystem conditions. Management then is designed to sustain those conditions while providing both commodity and noncommodity uses. Instituting ecosystem management in the face of urban growth, rural development, and rising public recreational pressures will be a major challenge for resource managers in the Southern Appalachians.

Data and Methods of Analysis

The data used and cited in this section were analyzed by simple descriptive statistical methods. Data sources include the Census of Housing and Population, the Agricultural Census, USDA Forest Service Forest Inventory and Analysis (FIA) units, the National Resources Inventory, and files from the U.S. Bureau of Mines. Projections for the section on future human impacts are from the Bureau of Economic Analysis (BEA) (1990) and are based on the 1990 census. In Virginia, independent cities are described separately from the counties in which they are embedded. To obtain the data needed for entire counties, some information for Virginia's independent cities was combined with data for areas outside the cities. This practice is followed by BEA.

Human Impact Trends – Detailed Results of the Analysis

Current Human Impacts

Figure 2.18 shows the counties where increases in population density have been greatest. Nearly all counties experienced some increase in density, but the increases were largest north of the Atlanta metropolitan area and in a few counties in Virginia. Population density in some counties doubled in just 20 years. The only counties where population density decreased over the last two decades are in southwestern Virginia.

Data from the Bureau of Mines show that the seven states in which the Southern Appalachians are located contributed only slightly to the total production of fuel and non-fuel minerals in the United States in 1980. In 1992, the Southeast produced about 42 percent of the lumber in the United States, up from around 31 percent in 1970. The majority of this lumber was softwood, mostly southern pine.

Almost 80 percent of the forest land in the

Southern Appalachians is privately owned. In only a few counties is there more public than private land. These counties include Rabun, Towns, and Union in Georgia; Clay, Graham, and Macon in North Carolina; Carter, Polk, and Unicoi in Tennessee; and Alleghany, Augusta, Bath, and Craig in Virginia. By 1992, 694,200 acres, about 2.4 percent of the total private forest land in the region, had been developed. The percentage of area developed, however, does not adequately capture the impact of spreading human habitation and development. Question 7 addresses in more detail and breadth the status of private land in the region.

The slight loss of forest land was mainly the result of the growing population in the Southern Appalachians. To accommodate population increases, significant areas were developed for shopping malls, housing, and roads.

Potential Future Human Impact

The United States population from the 1990 census was 248.7 million. By 2010, that total is projected to rise to 281.4 million an increase of 13.1 percent. The projected rise in the Southern Appalachians of 12.3 percent, therefore, is

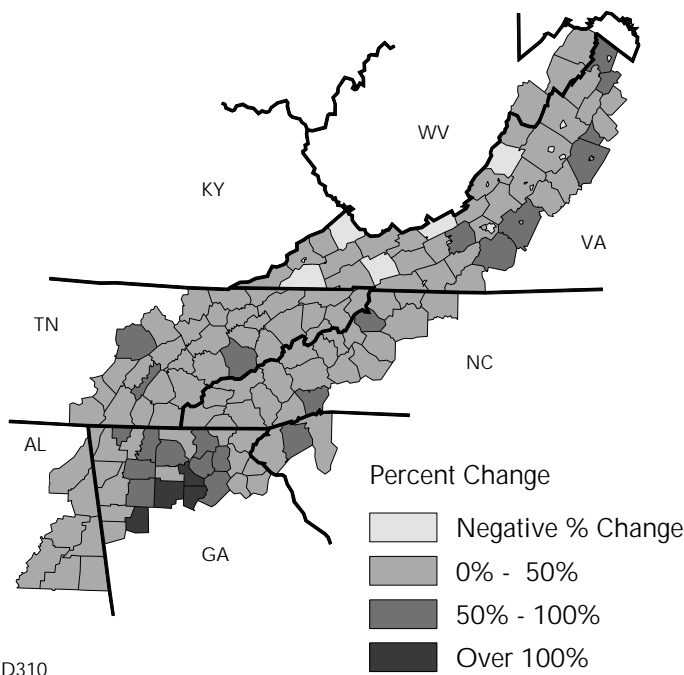


Figure 2.18 Percentage change in population density in the Southern Appalachians counties, 1970-1990 (Source: 1970, 1980, and 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce). Between 1970 and 1990, the population densities throughout most of the Southern Appalachians increased. Some counties experienced greater than 100 percent growth, most of which were located in north Georgia, in close proximity to Atlanta.

slightly below the national average. The rate of growth is expected to range from 0 to 27.7 percent among counties.

Projected percentage increases by 2010 in populations for the states in which the Southern Appalachian region is located are: Alabama, 5.2; Georgia, 17.5; North Carolina, 12.2; South Carolina, 9.5; Tennessee, 14.2; Virginia, 20.1; and West Virginia, 1.9. Projected increases for West Virginia, Alabama, and South Carolina are small relative to those for North Carolina and Tennessee, which are close to the national average. Projections for Georgia and Virginia are well above the national average. Especially in Georgia and Virginia, the high projected rates of population growth are likely to place unusually high pressures on the natural resources there.

The present and projected populations of the individual counties in the study area indicate the distribution of future population pressures, where resource management may be most challenging. These estimates are shown in figure 2.19.

All seven of the counties in Alabama have projected rates well below the national and regional averages. In contrast, Georgia has only

a few counties with below-average projected rates of growth, many have above-average projected rates. The highest is Dawson County with a projected rate of increase of 27.7 percent. Projected growth rates among North Carolina counties in the study area range from 4.2 percent in Graham to 16.6 percent in Macon. All three of South Carolina's mountain counties have projected growth rates below the national average. Similarly, the three West Virginia counties have projected growth rates somewhat below the national average. The state as a whole has a very low projected growth rate.

In Tennessee, projected rates of population growth in Southern Appalachian counties range from 0 for Hancock County to 21.4 percent for Sevier County. Virginia's expected rate of population increase is the highest of any state connected with the region (20.1 percent). Projected rates are lower than the statewide average in all but three of the counties in the region. There is little doubt, however, that the rapid projected growth of population in Virginia overall will put great pressure on Appalachian counties in that state and across the entire region. Similarly, population growth in Georgia will put pressure on the region's resources.

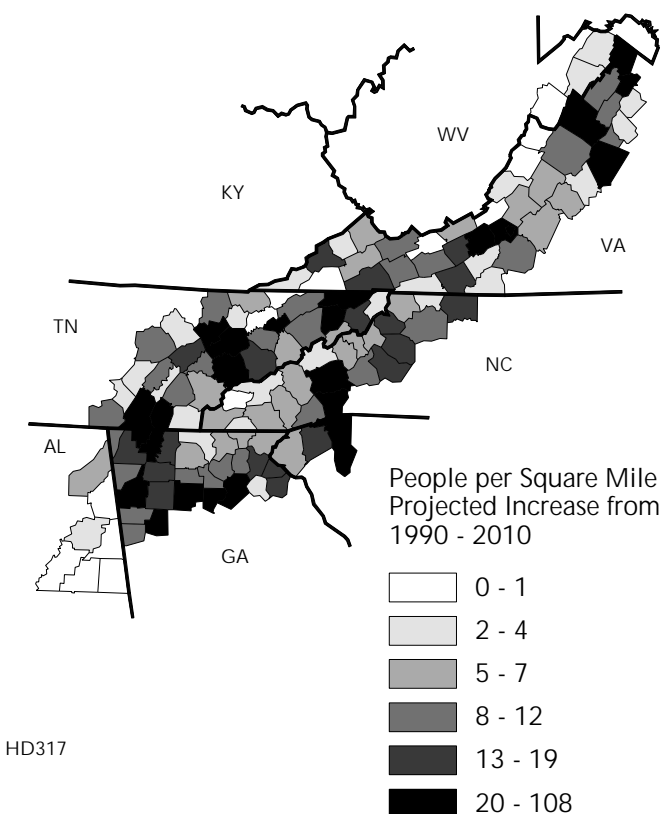


Figure 2.19 Projected increase in population per square mile, 1990 to 2010. (Source: County Projections to 2040, 1992 Bureau of Economic Analysis, U.S. Department of Commerce). Significant increases in population per square mile are projected for the year 2010 for many counties in the Southern Appalachian region.

Table 2.2 Projected increase in persons per square mile (ppsm) through 2010 in Southern Appalachian region counties with 25 percent or more of total area in public ownership.

County	Population Increase (ppsm)	Public Ownership (%)
Swain, NC	2	69.6
Rabun, GA	8	62.3
Graham, NC	1	58.7
Polk, TN	4	55.7
Craig, VA	0	55.0
Towns, GA	8	53.9
Bath, VA	1	50.9
Macon, NC	8	47.2
Union, GA	5	47.0
Unicoi, TN	6	46.8
Clay, NC	5	46.6
Fanning, GA	4	42.5
Haywood, NC	7	40.5
Carter, TN	15	38.0
Transylvania, NC	10	36.4
Monroe, TN	7	35.8
Sevier, TN	19	35.7
Smyth, VA	13	34.6
Page, VA	6	32.2
Lumpkin, GA	10	32.1
Bland, VA	1	31.7
Cherokee, NC	7	31.2
Blount, TN	24	30.4
Murray, GA	15	29.6
Pendleton, WV	1	29.4
Stephens, GA	20	29.0
Cleburn, AL	0	27.9
White, GA	11	27.5
Giles, VA	5	27.0
Highland, VA	0	26.6
McDowell, NC	8	26.1
Botetourt, VA	3	26.0
Johnson, TN	2	25.8
Habersham, GA	18	25.2

(Source: County Projections to 2040, 1992 Bureau of Economic Analysis, U.S. Department of Commerce)

Projected growth in persons per square mile was also examined separately in counties with large public holdings. Thirty-four counties have more than 25 percent of total land area in public ownership. Among these counties, Blount County, TN, is particularly noticeable with a projected increase of 24 ppsm and a public ownership of 30.4 percent. All 34 of the counties with 25 percent or more of total area in

public ownership are listed in table 2.2.

Projected growth in population density was examined for counties with the greatest area of commercial forest. Results suggest some potentially significant pressures on commercial forest management (table 2.3).

Growth in population density also was examined in counties with the greatest area of streams. The National Resources Inventory

Table 2.3 Projected growth in population density for Southern Appalachian region counties that have the greatest amount of commercial forest land, 2010.

County	Population Density (ppsm)	Commercial Forest Area (1,000 acres)
Buncombe, NC	30	22.4
Paulding, GA	25	10.3
Dawson, GA	12	10.1
Murray, GA	15	8.2
Botetourt, VA	3	6.9
Haywood, NC	7	6.7
Campbell, TN	8	5.8
Cumberland, TN	8	5.8
Hawkins, TN	8	5.7
Rhea, TN	9	5.5
Sullivan, TN	34	4.8
Patrick, VA	16	4.3
Hall, GA	36	2.9
Mitchell, NC	7	2.8
Pulaski, VA	12	2.4
Jackson, NC	6	1.9
Wythe, VA	14	1.9
Cherokee, NC	7	1.6
Greenville, SC	40	1.6
Burke, NC	19	1.5
Macon, NC	8	1.4
Whitfield, GA	54	1.2
Transylvania, NC	10	1.1
Amherst, VA	5	1.1
Wilkes, NC	10	1
Oconee, SC	7	0.9
Caldwell, NC	15	0.8
Pickens, SC	17	0.8
Surry, NC	14	0.7
Swain, NC	2	0.7
Warren, VA	19	0.7
Stephens, GA	20	0.5
Franklin, VA	12	0.5
Cherokee, GA	55	0.4
Floyd, GA	22	0.4
Haralson, GA	9	0.4
Madison, NC	2	0.4
Giles, VA	5	0.4
Bartow, GA	19	0.3
Polk, GA	8	0.3
Grayson, VA	3	0.3
Russell, VA	11	0.3
Shenand, VA	14	0.3
Smyth, VA	13	0.3
Forsythe, GA	43	0.2
Buchanan, VA	5	0.2
Madison, VA	2	0.2
Page, VA	6	0.2
Scott, VA	2	0.2
Tazewell, VA	12	0.2
Banks, GA	5	0.1
Catoosa, GA	58	0.1
Dade, GA	9	0.1

ppsm = persons per square mile

(Source: County Projections to 2040, 1992 Bureau of Economic Analysis, U.S. Department of Commerce)

Table 2.4 Total stream area and projected increase in population density for the 50 percent of Southern Appalachian region counties having the greatest stream area, 2010.

County	Stream Area (1000 acres)	Population Density Increase (ppsm)
Pulaski, VA	8.5	12
Buncombe, NC	4.1	30
Franklin, VA	3.8	12
Grayson, VA	3.6	3
Greenville, SC	3.5	40
Washington, TN	3.4	42
Loudon, TN	3.3	10
Hampshie, WV	3	3
Hardy, WV	2.9	3
Ashe, NC	2.8	5
Wilkes, NC	2.6	10
Knox, TN	2.6	108
Sevier, TN	2.5	19
Cherokee, AL	2.4	1
Greene, TN	2.3	10
Page, VA	2.3	6
Pendleton, WV	2.3	1
Burke, NC	2.2	19
Dickenson, VA	2.2	4
Russell, VA	2.2	11
Haywood, NC	2.1	7
Cocke, TN	2.1	7
Hawkins, TN	2.1	8
Nelson, VA	2	4
De Kalb, AL	1.9	6
Caldwell, NC	1.9	15
Pickens, SC	1.9	17
Cumberland, TN	1.9	8
Warren, VA	1.9	19
Cherokee, GA	1.8	55
Hamilton, TN	1.8	85
Monroe, TN	1.8	7
Bath, VA	1.8	1
Shenand, VA	1.8	14
Talladega, AL	1.7	0
Transylvania, NC	1.7	10
Marion, TN	1.7	8
Madison, VA	1.7	2
Patrick, VA	1.7	16
Calhoun, AL	1.6	4
Hendersn, NC	1.6	28
Madison, NC	1.6	2
Clay, AL	1.5	1
Randolph, AL	1.5	2
Bartow, GA	1.5	19
Yancey, NC	1.5	7
Oconee, SC	1.5	7
Carter, TN	1.5	15
Sullivan, TN	1.5	34
Botetourt, VA	1.5	3
Gordon, GA	1.4	18
Cherokee, NC	1.4	7
Surry, NC	1.4	14
Wattage, NC	1.4	18
Morgan, TN	1.4	3
Wythe, VA	1.4	14
Hall, GA	1.3	36
Jackson, NC	1.3	6
Swain, NC	1.3	2

ppsm= persons per square mile

(Source: County Projections to 2040, 1992 Bureau of Economic Analysis, U.S. Department of Commerce)

separates streams into categories based on width and then lists area in acres. Counties with high stream concentrations and large increases in human density are Buncombe County, NC; Greenville County, SC; and Washington and Knox Counties, TN (table 2.4).

Question 3:

How might management of natural resources impact the economic and social status of local communities in the region, particularly communities near major tracts of public land?

Key Findings

Differing Social Mix in Communities Near Public Lands

Between 1970 and 1990, the quality of education improved significantly in rural areas of the Southern Appalachians, especially in counties with much public land. The distribution of whites and African Americans has become more distinct. Whites are more likely to live in rural areas and near public land, while blacks are more likely to live in urban areas. The distribution of age groups has become less distinct. More young people are likely to live in rural areas, while working-age people are more likely to live in urban areas. Retirement-age people more frequently live near public land.

Rural communities close to public land have changed much less than urban communities. Families seem more stable with more marriages, fewer divorces, and longer tenure at the same address. Although per-capita incomes are slightly lower and poverty rates slightly higher in rural areas, differences have lessened greatly from 1970 to 1990.

Counties with high proportions of public land tend to have fewer rental houses, more vacant and seasonal houses, and homes of lower median value. People in rural counties, especially in counties with more public land, have slightly lower mortality rates than people in urban counties. Finally, people in these rural counties are considerably more likely to participate in civic activities, such as elections.

The social and demographic characteristics of Southern Appalachian communities vary

widely. Management policies applied regionally, therefore, can have significantly different effects in different communities. Makers of public policy, therefore, should carefully consider the needs and vulnerabilities of individual communities.

Natural-Resource-Based Industries Important, But Not Dominant

Natural-resource-based industries make up about 12 percent of the region's output and 10 percent of its employment. In six counties primary wood-products manufacturing has a 10 percent or greater share of total output. Secondary wood-products manufacturing accounts for more than 10 percent of total output in 18 counties. Mining is important only in southwestern Virginia. Outdoor recreation-based tourism contributes almost \$6 billion to business sales in the region and stimulates employment of over 100,000 regional workers.

Local Community Residents Seek Recognition

Focus groups of people living near national forests call for a better balance of input from local and regional special interests. To them, recreation, tourism, and resource protection are important, but so are timber and other commodities. They believe potential effects on local communities of forest management options need to be taken carefully into account when land management plans are being formulated.

Community residents do not feel that the Forest Service informs or involves them adequately, or that they are truly heard. They support scientific management, and seemingly ecosystem management, as an overall philosophy, but they fear that outside interests may push it too far and hurt local communities. In particular, they do not want to lose their access to public land. They seek balanced management with utilization and preservation responsibly undertaken. To them, a key to better community relations is a good educational program to help people living near national forests better understand what ecosystem management is and how it might affect them.

Sensitivity to effects on communities from resource management should be heightened. Findings supporting this conclusion are that rural and urban areas differ in social makeup,

that counties with more public land also differ in social makeup from other counties, that the Southern Appalachian economy is still very much natural resource dependent, that residents of communities near public land are sensitive to land management choices and that environmental justice (or injustice) is inconclusive as an issue. The region's communities are still in lower economic status than surrounding state populations and their economy is more dependent on natural resources. While these communities are transitioning to become more like areas in the rest of the states in which the Southern Appalachian region is located, land management agencies and collaborative planning efforts must be tuned in to the more localized circumstances and needs of regional communities.

Communities near public land sense the pressures from outside interests that have a stake in the national resources represented by national forests and parks. They seek more of a voice in the direction of management of these public lands. But local communities near public land differ substantially among themselves in social and economic makeup. Planners and policy staff of public agencies will be challenged to account for these differences and be aware of the potentials for inequitable effects of resource management choices, particularly negative ones, among local communities. Of particular concern is the need to balance local interests among retirement, logging, and tourism communities. An effective and affordable system is needed for monitoring the effects of management among diverse interests, local and nonlocal. Especially needed are more direct measures of effects than were available for this assessment.

Data and Methods of Analysis

Social status data were obtained from the 1970, 1980, and 1990 Censuses of Population and Housing as well as from the Department of Commerce's County Business Patterns. To determine whether communities near public land differ from other communities correlations were computed between the percentages of total county area that are privately or publicly owned and selected community social conditions. To determine whether social makeup differed between rural and urban counties,

correlations between percent of area that is urban or rural were computed to measure association with the same selected social attributes. Correlations are statistical measures of the association between percentages of land area and prevalence of the selected social attributes.

To address natural resource dependency, industries were grouped by 2-digit Standard Industrial Classification (SIC) codes into the 10 most prominent sectors for the region as a whole, for the four sub-regional economies, and for each county. In addition, several special sectors were examined, including forest products, wood-products manufacturing, mining, energy, tourism, wholesale and retail trade, transportation, government, education, housing construction, and agriculture. Data on employment, employee compensation, total industrial output, and imports and exports also were examined.

The primary data source for economic dependency was the Forest Service IMPLAN input-output system. Data in this model are from County Business Patterns, the Bureau of Labor Statistics, the Bureau of Economic Analysis, Regional Information System, and various U.S. Census surveys.

To examine community diversity, communities near five national forest ranger districts were selected. The social makeups of people living in these communities were compared.

To examine community residents' perceptions of potential impact, focus groups were convened near the five districts which represent four national forests: the Chattahoochee in Georgia, the Nantahala in North Carolina, the Cherokee in Tennessee, and the Jefferson in Virginia. Participants were selected through purposeful sampling, including typical case and snowball sampling (Patton 1990). Interviewees included new residents in the communities, people who were born in the communities, and people who were second- and third-generation community residents. The sample at each site included males and females, people in age groups ranging from their middle 20s through their 70s, and a variety of occupations.

Researchers generated a list of questions to guide the focus groups:

1. Tell me about the _____ National Forest and how living near it affects you.
2. Share with us how you feel the _____ National Forest is important to people in your community and how it impacts your community.
3. Describe ways you feel your community and other communities are impacting the _____ National Forest.
4. What do you and your neighbors see as the future for the _____ National Forest?
5. How will the future you envision for this national forest impact you and other people who live in nearby communities?
6. Describe how natural resources in the _____ National Forest are managed.
7. Professionals in the Forest Service talk about applying “ecosystem management” in national forest lands like the _____ National Forest. How do people in your community feel about “ecosystem management”?

To investigate the environmental justice issue in Southern Appalachia, total releases from the EPA toxic release inventory were tallied at the county and neighborhood levels and compared to community demographic characteristics. The EPA data set summarizes annual release reports filed by firms under Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986.

Potential Impacts on Communities: Detailed Results of the Analysis

Status of Communities Near Public Lands

With respect to race, greater percentages of whites are positively associated with greater percentage of county area in public ownership. Blacks tend to live in communities more removed from public lands. Age distributions also differ by county area in public ownership. People under 18 years are more likely to live in counties having more private ownership. People between 18 and 64 are also less likely

to live in counties with greater public land area. People 65 and over tend to be more prevalent in counties with more public land area.

In counties that are more rural in character and with more private land, family size tends to be somewhat larger. This, of course, influences age structure in these counties by making the average age somewhat younger. Marital status is also correlated, strongly in this case, with existence of public land. The percentage of persons married is higher and the divorce and separation rates are lower in counties with more public ownership. This relationship is further demonstrated by a positive association between percentage of two-parent households, versus single parent, female headed households.

Per-capita income level, median family income, and percentage of families below the poverty level were moderately positively correlated with percentage of county area in public ownership. This is a change from the 1970s when there were more lower economic status households living in rural communities with substantial public ownership. There is no correlation between unemployment and the presence of more or less public land.

Most of the correlations computed with housing indices as one of the argument variables showed weak associations with the public ownership character of Southern Appalachian counties. Both percentages of owner and renter occupied housing were weakly negatively correlated with greater proportions of area in public ownership. Median market value of housing was weakly negatively correlated with public land. In voting behavior, percentages of the population that voted in the 1976, 1984, and 1992 elections were positively correlated with presence of public land.

Status of Rural Versus Urban Counties

Race is strongly correlated with urbanization in the Southern Appalachians: this correlation strengthened between 1970 and 1990. Whites are more likely to live in rural areas, while blacks are more likely to live in urban areas.

There are notable distinctions in the distribution of the three age categories used in this analysis. People under 18 years of age are more likely to live in the more rural counties, while

distribution of people between 18 and 64 years of age is moderately but positively correlated with urban counties.

Family structure is strongly correlated with residence in the more urban portions of the Southern Appalachians. These correlations indicate that young people are more likely to live in mostly privately owned, rural counties; working-age people are more likely to live in more highly urban counties (where there are more jobs); retirement-age people are only slightly more likely to live in urban counties, and families are typically larger in rural counties.

The marriage rate is lower in counties with more urban area. Likewise, the rate of separations and the divorce rate are positively correlated with the proportion of urban area. Presence of widows is higher in urban areas, and there are proportionately more female heads of household in counties with proportionately more urban area. These correlations indicate that greater percentages of the population in rural areas, while divorce and separation percentages are higher in urban areas.

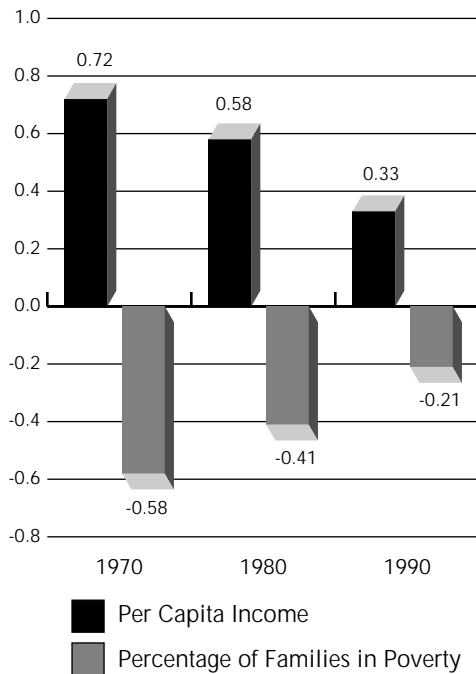


Figure 2.20 Correlation of percent of families in poverty and level of per capita income with nearness to public lands for local communities, 1970, 1980, and 1990. (Source: 1970, 1980, and 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce)

Per-capita income, median family income, and percent of families below the poverty level are moderately correlated with rural character of counties. This is a dramatic change from 1970 when there were very strong correlations between lower economic status and living in rural counties with more public land (fig. 2.20).

The distribution of the labor force follows that of the population in general. Most of the population is in urban areas, where jobs are more plentiful. This pattern is reflected in the moderately negative correlation between level of unemployment and urban character in counties.

Most correlations between the percentages of labor force employed in various economic sectors and rural character are what one might expect. Agriculture, forestry, and mining are obviously more prominent in rural counties. Somewhat unexpected is the strong positive correlation between percent of jobs in construction and rural character. Manufacturing is also positively associated with rural counties, while transportation, communications, and public utilities have no correlation with either rural or urban character.

As expected, wholesale and retail trade are more prevalent in urban counties. Entertainment and recreation jobs are weakly correlated, and professional and related service jobs are strongly correlated with urban areas in counties. Public administration jobs are weakly correlated with urban areas, an unexpected relationship.

Most of the indices relating to housing are more strongly correlated with urban to rural character than with the public ownership character of counties. Renter-occupied housing is very strongly correlated with urban counties, while owner-occupied housing is associated more with rural counties. Vacant and seasonal housing are more common in rural than in urban counties.

People over 25 years of age with a college degree are more likely to live in an urban area, but this correlation has weakened slightly since 1970. The negative correlation between people over 25 with a high school diploma and urban residence has significantly decreased between 1970 and 1990.

The total number of students reflects the distribution of the youngest category of the population and is, therefore, strongly correlated with urban residence. The student-to-teacher ratio is

Table 2.5 Employment, employee compensation, and industrial output of the Southern Appalachian region by sector, 1991.

Sector of Economy	Employment		Employee Compensation		Industrial Output	
	Total (number)	Share of Total (%)	Total (million \$)	Share of Total (%)	Total (million \$)	Share of Total (%)
Agriculture, forestry, fisheries	114,138	3.6	374.4	0.6	6,817.8	3.3
Mining	18,451	0.6	648.2	1.1	5,941.2	2.9
Construction	236,030	7.4	3,930.1	6.6	18,767.3	9.2
Manufacturing	719,802	22.6	18,190.6	30.4	81,480.7	39.8
Transportation, communication and utilities	119,640	3.8	3,125.9	5.2	11,819.9	5.8
Wholesale/retail trade	650,709	20.4	9,073.6	15.2	19,650.7	9.6
Finance, insurance, real estate	165,988	5.2	2,721.7	4.6	18,045.5	8.8
Services	688,293	21.6	11,388.3	19.1	27,430.3	13.3
Government	443,413	13.8	10,098.9	16.9	14,280.4	7.0
Total	3,187,740	100.0	59,744.1	100.0	204,802.7	100.0

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

higher in urban counties, reflecting larger class sizes in urban schools. Related to this, expenditures per student are negatively correlated with urban area. These correlations indicate that education in rural areas of the Southern Appalachians has improved considerably between 1970 to 1990. Where high illiteracy rates were once associated mostly with rural areas in the region, they are now more likely to occur in urban areas, where there are more students per teacher and less money is spent per student for education.

The mortality rate is moderately correlated with urban residence ($r=0.39$). Percentage of the population that voted is moderately correlated with rural areas. This correlation has strengthened since 1970. These correlations indicate that people in rural areas, especially in counties with more public land, have a lower mortality rate and are more likely to vote and participate in civic activities.

Economic Dependence on Natural Resources

Manufacturing industries contribute about 40 percent of the value of the Southern Appalachian's total production (table 2.5). In contrast, manufacturing comprises roughly 19

percent of total national production. Manufacturing in the region also accounts for 30 percent of wages and slightly more than 22 percent of employment. Other major sectors in the economy include services, wholesale and retail trade, and government. The Southern Appalachian economy generates output of almost \$64 million per 1,000 regional residents. Of this output, the manufacturing sector is highest with output per 1,000 citizens of \$25.6 million.

Six specific sectors were examined for their importance to the overall regional economy assessment (table 2.6). The combined natural resources sector shown provides nearly 10 percent of the region's employment, 7 percent of wages, and 12 percent of industry output (table 2.6). Natural resource industries include wood-products manufacturing, forestry, mining, and tourism. Only retail trade has a greater percentage of employment and wages than the natural resources sector among the six special industry groupings. However, natural resource output is a larger percentage of regional output than any of the other sectors.

Table 2.7 shows the importance of exports to the regional economy. The total regional economy imports 27 percent of its consumable

Table 2.6 Employment, employee compensation, and total output of the Southern Appalachian region among six specially identified sectors, 1991.

Sector of Economy	Employment		Employee Compensation		Industrial Output	
	Total	Share of Total	Total	Share of Total	Total	Share of Total
	(number)	(%)	(million \$)	(%)	(million \$)	(%)
Transportation	75,563	2.4	1,788.0	3.0	5,548.0	2.7
Energy	10,296	0.3	381.6	0.6	2,486.3	1.2
Education	152,905	4.8	2,206.8	3.7	2,567.5	1.3
Retail trade	530,888	16.6	5,976.6	10.0	14,046.3	6.9
New housing construction	66,637	2.1	824.3	1.4	5,927.8	2.9
Natural resources	301,795	9.5	4,113.3	6.9	24,785.0	12.1

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

goods and services, while it exports about 35 percent of its total output.

This analysis indicates that the Southern Appalachian region is a very open economy, with about 35 percent of its total production exported. It also imports more than 25 percent of materials for input into manufacturing and for final consumer demand. Major export industries include mining, manufactured wood products, manufacturing in general, and forest products.

The Southern Appalachian region has long

been considered one of the major tourist destinations in the United States. Table 2.8 indicates that a total of over 100 million outdoor recreation-based trips were taken to and within the region annually as of 1995. Almost 80 percent of these trips were exported, i.e., taken to the region by people living outside of the region. The largest single category of activities was developed site recreation, including camping, picnicking, sightseeing, and similar activities in developed areas. The next most frequent type of recreational pursuit was dispersed recreation,

Table 2.7 Total value and percent of total output imported and exported, by sector of the economy, in constant 1991 dollars.

Sector of economy	Imports		Exports	
	Total	Share of Total Output	Total	Share of Total Output
	(million \$)	(%)	(million \$)	(%)
Forest products	227.3	53.1	290.3	67.8
Total agriculture	3,130.4	45.9	3,681.9	54.0
Mining	1,825.0	30.7	4,912.9	82.7
Construction	7,569.3	40.3	906.7	4.8
Primary wood manufacturing	1,092.3	37.7	2,044.6	70.6
Secondary wood manufacturing	2,327.0	31.1	4,774.0	63.8
Total manufacturing	29,597.9	36.3	54,206.8	66.5
Transportation	1,313.2	23.7	821.3	14.8
Energy	719.5	28.9	318.5	12.8
Wholesale/retail trade	2,204.9	11.4	1,586.8	8.1
Education	165.4	6.4	174.0	6.8
Services	8,821.3	14.3	4,474.7	7.3
Natural resources	5,757.4	23.2	12,066.7	48.7
Regional share		27.0		34.7

(Source: Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

Table 2.8 Total number and percentage of trips for outdoor recreation exported from the Southern Appalachian region by type of activity, 1995.

Type of Activity	Total Trips (million)	Exported (%)
Developed sites	58.6	82.3
Dispersed	18.1	73.5
Developed water	7.7	78.3
Wilderness	1.1	74.1
Fishing	10.2	73.0
Hunting	2.3	78.0
Nonconsumptive wildlife	5.8	83.4
All activities	103.8	79.4

(Source: Public Area Recreation Visitor Study (PARVS), the Customer Use and Survey Techniques for Operations, Management, Evaluation, and Research (CUSTOMER), and the National Survey on Recreation and the Environment (NSRE) from the Outdoor Recreation and Wilderness Assessment Group, USDA Forest Service, Athens, GA)

i.e., recreation occurring away from developed sites and roads and dispersed into forests and other undeveloped areas of the region. Fishing and nonconsumptive wildlife activities provided the third and fourth most popular opportunities for recreationists visiting the region. Trip exports, like any other commodity or service exported, stimulate the regional economy with new income and jobs beyond those that occur from residents spending money already in the economy for recreation.

Table 2.9 shows total business sales (equivalent to value of total output), wage income, value added (worker and proprietor income plus tax revenues generated) and employment resulting from outdoor recreation on public and private land and developed sites in the region.

The value of total output from recreation-based tourism is nearly \$6 billion per year, almost as high as the combined value of outputs from agriculture, forestry and fisheries industries (table 2.5). Outdoor-recreation-based tourism does not include business or other travel to the region, nor does it consider much of tourism spending for entertainment, goods, accommodations, food and travel to areas such as Pigeon Forge in Sevier County, TN; Gatlinburg, TN; and Helen, GA. Estimates of the total magnitude of tourism sales and employment were not available for this assessment. Wilderness, fishing, hunting, and nonconsumptive wildlife (viewing, etc.) activities contribute significant numbers of jobs and income to the region.

Table 2.9 Total business sales, wage income, total value added, and employment by type of outdoor recreation based tourism in the Southern Appalachian region, 1995.

Type of Outdoor Recreation	Total Business Sales (million \$)	Total Wages (million \$)	Value Added (million \$)	Employment (thousands)
Developed sites	3,145.3	995.7	1,798.1	53.5
Dispersed	1,384.7	462.8	833.0	25.4
Developed water	673.6	215.0	386.1	11.8
Wilderness	64.1	18.5	31.7	0.9
Fishing	292.0	85.5	156.7	4.6
Hunting	37.2	10.5	19.8	0.6
Nonconsumptive wildlife	215.6	67.2	123.3	3.8
All activities	5,812.5	1,855.2	3,348.7	100.7

(Source: Greg Alward, Land Management Planning Systems, IMPLAN, Washington Office, USDA Forest Service and the Outdoor Recreation and Wilderness Assessment Group, Forest Service, Athens, GA)

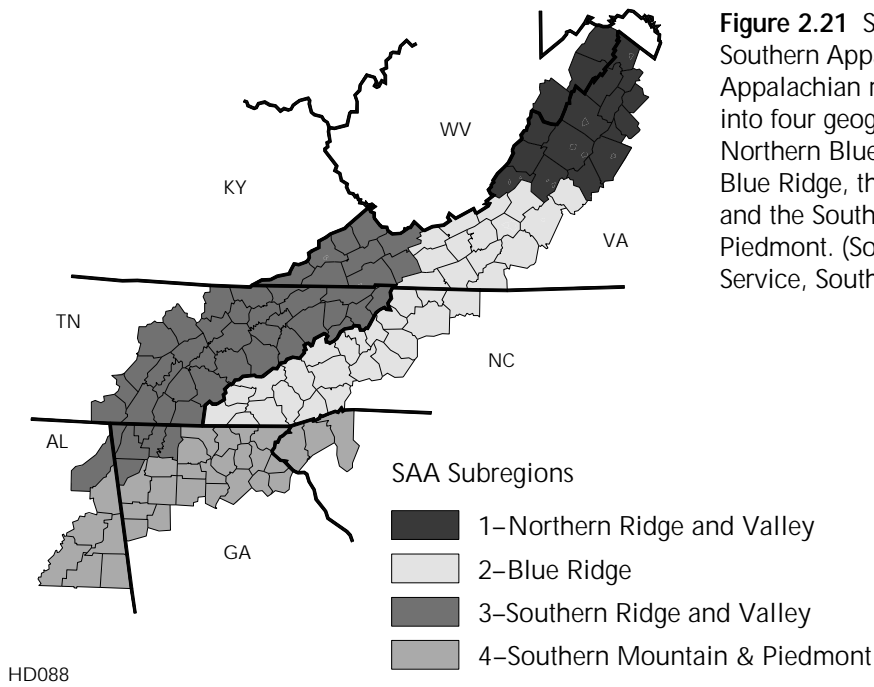


Figure 2.21 Subregions of the Southern Appalachians. The Southern Appalachian region has been divided into four geographic sub-regions: the Northern Blue Ridge, the Southern Blue Ridge, the Ridge and Valley, and the Southern Mountain and Piedmont. (Source: USDA Forest Service, Southern Research Station)

The SAA also examined four economic subregions (fig. 2.21). The Southern Ridge and Valley subregion has an \$85.6 billion economy, an output over four times that of the Northern Ridge and Valley, and almost twice that of the Blue Ridge and the Southern Mountain and Piedmont subregions. In all the subregions,

manufacturing is the most important single sector (fig. 2.22). However, government services employ a larger percentage of workers in the Northern Ridge and Valley and Southern Ridge and Valley subregions, than in the other two subregions. Forest products is a very small share of any of the subregions' economies.

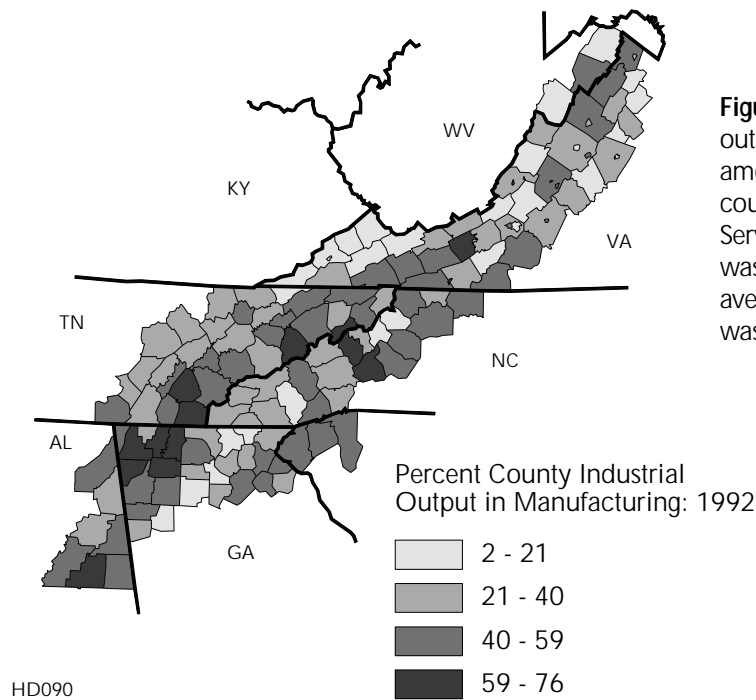


Figure 2.22 Percent of total industrial output in the manufacturing sector among Southern Appalachian counties, 1992 (Source: USDA Forest Service, IMPLAN). Industrial output was heavy throughout the region. The average percent of industrial output was 36.6 percent.

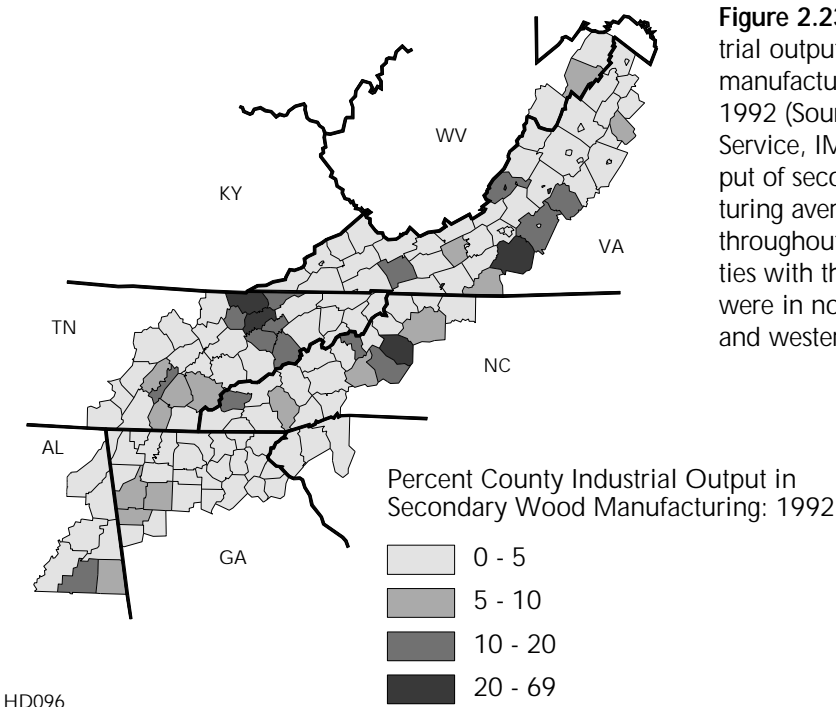


Figure 2.23 Percentage of industrial output in secondary wood manufacturing and in services, 1992 (Source: USDA Forest Service, IMPLAN). Industrial output of secondary wood manufacturing averaged about four percent throughout the region. The counties with the higher percentages were in northeastern Tennessee and western Virginia.

Wood-products manufacturing is particularly important in the Blue Ridge subregion, where it represents about 8 percent of total industrial output. In the other three subregions, wood products is only 4 to 5 percent of total output.

All four subregions export more goods and services than they import. The largest exporter is general manufacturing. Manufacturing imports range between 14 and 16.5 percent of total industrial output, while manufacturing exports range between 25 and 30 percent.

Economic importance of resource-dependent industries was examined at the county level. Manufacturing output was greatest in the central and southern counties of the Southern Appalachians (fig. 2.22). In only six counties was primary wood-products manufacturing more than 10 percent of total industrial output. Secondary wood-products manufacturing, on the other hand, was over 10 percent of industrial output in the central and eastern part of region (fig. 2.23).

Social Diversity of Communities Near Selected Public Lands

Two levels of analysis were undertaken to examine social diversity among communities (census block groups) within the region. The first was to briefly compare the social make-up of communities neighboring five national forest

ranger districts with surrounding state and regional social make-up. The second was to examine the degree of diversity among communities near the selected five districts.

The five districts chosen were Brasstown, Tallulah, Watauga, Tusquitee, and Deerfield. These were chosen because they are good examples of the ranger districts across the Southern Appalachians. Local communities around these districts were identified as all block groups having at least 20 percent of their area within 10 miles of the boundaries of the ranger districts.

Table 2.10 summarizes the diversity of the populations among the states containing the Southern Appalachians. These data provide a basis for comparisons with the local communities surrounding the five districts shown in table 2.11.

Local communities near districts have lower per-capita income, lower average education rates, higher average poverty levels, and lower average proportions of populations of working age (18 to 65) than the surrounding states. In fact, local people near the ranger districts live in several to many communities that differ considerably from one another. For example, looking at the Deerfield Ranger District (fig. 2.24), population and population density vary widely among the nearby communities. More dense population is found, as expected, near towns,

Table 2.10 Population and characteristics for states containing the Southern Appalachians and for the U.S., 1990.

	AL	GA	KY	MD	NC
Total Population	4,040,587	6,478,216	3,685,296	4,781,468	6,628,637
Population Density	77.08	108.99	91.19	385.37	123.16
Total Heads of Households	1,506,790	2,366,615	1,379,782	1,748,991	2,517,026
Per Capita Income	\$11,486	\$13,631	\$11,153	\$17,730	\$12,885
Median Family Income	\$28,688	\$33,529	\$27,028	\$45,034	\$31,548
% Population in Poverty	17.91	14.25	18.50	8.06	12.52
% Population <18 years old	26.20	26.66	25.89	24.31	24.23
% Population >65 years old	12.94	10.10	12.67	10.82	12.13
% White non-Hispanic	73.25	70.23	91.71	69.64	75.09
% Native American	0.41	0.21	0.16	0.27	1.21
% Population >18 No HS Diploma	23.76	21.03	25.07	16.15	21.88
% Population Agricultural	1.00	1.05	1.57	0.71	1.26
% Heads of Households at Address >5yrs	54.58	46.38	53.65	50.02	51.87

	SC	TN	VA	WV	US
Total Population	3,486,703	4,877,185	6,187,358	1,793,477	248,709,873
Population Density	108.94	115.72	144.67	74.01	65.67
Total Heads of Households	1,258,044	1,853,725	2,291,830	688,557	91,947,410
Per Capita Income	\$11,897	\$12,255	\$15,713	\$10,520	N/A
Median Family Income	\$30,797	\$29,546	\$38,213	\$25,602	N/A
% Population in Poverty	14.85	15.27	9.88	19.24	12.76
% Population <18 years old	26.39	24.94	24.32	24.73	25.57
% Population >65 years old	11.38	12.69	10.74	14.99	12.56
% White non-Hispanic	68.60	82.59	76.01	95.89	75.76
% Native American	0.24	0.21	0.25	0.14	0.79
% Population >18 No HS Diploma	22.47	23.95	18.28	24.68	18.30
% Population Agricultural	0.96	1.00	0.94	0.76	1.14
% Heads of Households at Address >5yrs	52.81	51.12	47.45	61.79	50.87

(Source: 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce)

but there are pockets of dense population and uneven distribution outside urban areas. Also, composition of population is very diverse among communities. Interestingly, young and old age groups seem to be negatively correlated with each other. Communities with higher percentage populations of young people (under 18 years of age) experience low percentages of older people (over 65 years of age) and vice versa. This may be the result of the community being populated with working-age people with children, as supported by earlier findings. Where population is most dense, there seem to be higher concentrations of people under the age of 18. Race seems to be fairly evenly distributed, except for greater concentrations of African Americans in urban communities.

Education levels are also diverse across communities. Communities with low education levels (26 to 30 percent with no high school diploma) can be found among communities having comparatively high education levels. The percent of people in personal poverty

varies across communities. No strong ties of poverty to agricultural employment or to urbanness appear to exist.

To summarize, communities around ranger districts appear very diverse, however homogeneous they may appear when viewed from a regional perspective. Population density, education level, income, marital status, family size, household and individual poverty rates, race, and age vary considerably from community to community.

Community Residents' Perceptions of Impact on Their Community

Residents in all of the communities near the five districts said that national forests are important to them and provide a barrier to overdevelopment in their area. Residents perceived that the local ranger district enhances the economy of their local community with jobs, timber harvesting, tourism, and recreation facilities. Residents said that while the forests

Table 2.11 Area and population characteristics of local communities near five ranger districts, Southern Appalachian region, 1990.

	Ranger Districts				
	Brasstown	Tallulah	Watauga	Tusquitee	Deerfield
Total Area in Square Miles	1,713	1,598	1,494	2,452	1,592
Total Population	58,861	53,659	150,626	87,250	56,637
Population Per Square Mile	34	34	101	36	36
Number of Households	23,423	21,575	58,968	34,390	21,346
Per Capita Income	\$10,541	\$11,937	\$9,922	\$9,639	\$12,572
Median Family Income	\$24,769	\$26,377	\$24,072	\$22,735	\$32,876
Percent of Individual Poverty	17	15	18	19	10
Percent of Population under 18 years old	21	22	22	22	22
Percent of Population over 65 years old	19	18	15	19	15
Percent of Population - White, non-Hispanic	98	96	98	98	92
Percent of Population - Native American	0.63	0.26	0.21	1.16	0.10
Percent of Population over 18 years old with No High School Diploma	30	27	30	32	24
Percent of Population employed in Farming, Forestry, or Fishing	2	2	1	2	3
Percent of Households at the Same Address for more than 5 Years	58	59	59	61	71

(Source: 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce)

take up much of the land in area, they also increase land values because proximity to a forest is desirable.

Certain needs were commonly perceived:

1. The need to balance forest uses among recreation, timber, tourism, and protection.
2. The need for the Forest Service to seek the perspectives of local residents, as well as outside special interests about issues and plans.
3. The need to educate adults and children in local communities about issues through Forest Service generated meetings and mailings which are friendly, interactive, informative (rather than problem-presenting), and present- and future-oriented. This need would emphasize Forest Service personnel and community residents sharing ideas equally.
4. The need to continue selective timber harvesting while making it a profitable endeavor.
5. The need to encourage tourism, but without degrading recreation opportunities for local residents.
6. The need to establish and maintain good

rapport and communication between local residents and regional and national Forest Service units, just as they already experience with local Forest Service districts and rangers.

7. The need to make more informed decisions to preserve wilderness for the future, but to still allow local residents access for recreational purposes.
8. The need for the Forest Service to more equally inform all residents about plans and emerging issues through a variety of communication strategies.

Balance clearly emerged as the core concept among residents' perceptions of needs. Residents said that the Forest Service should establish this balance by doing a better job of seeking local residents' perspectives and by taking account of those perspectives in decisions about forest use. Residents feel that forest use can be enhanced if regional- and national-level Forest Service units purposefully focus more on communication and collaboration with local residents. They feel that Forest Service personnel at all levels should spend more time in the communities and on the forests.

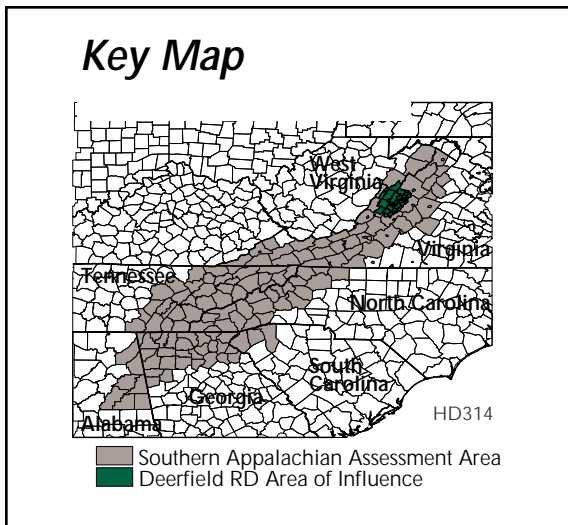
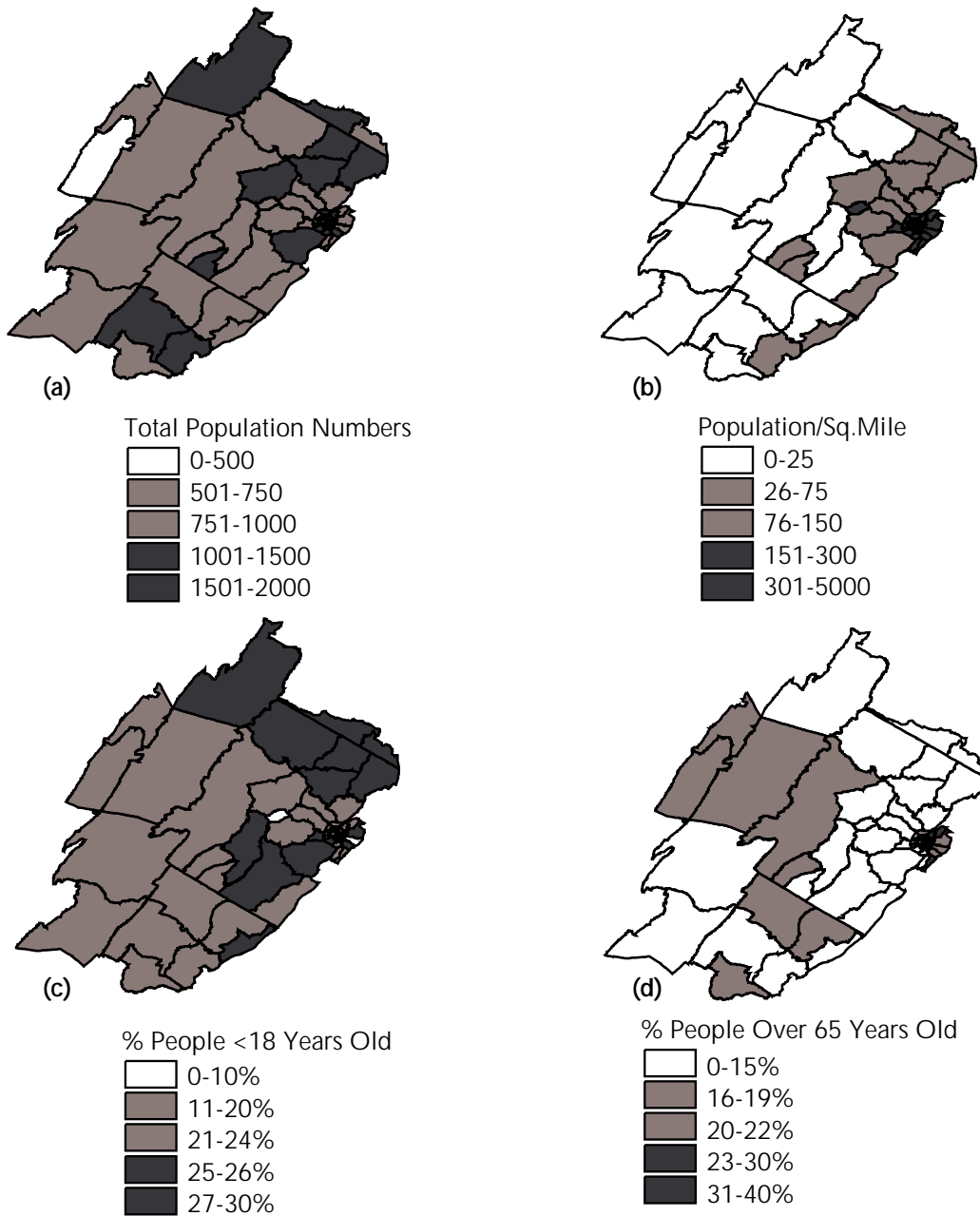


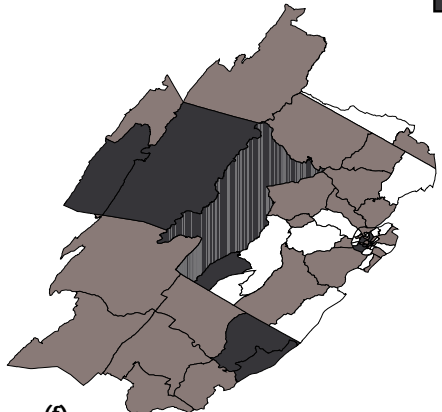
Figure 2.24 (a-i) Comparison of population and age characteristics of local communities of Deerfield Ranger District, Virginia (Source: 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce).





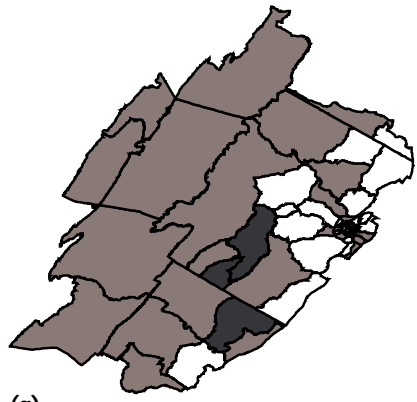
(e) % White, Non-Hispanic

0-75%
76-90%
91-93%
94-98%
99-100%



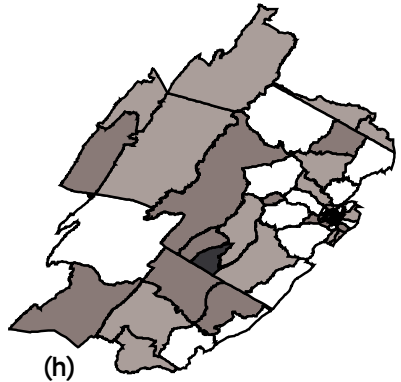
(f) % Personal Poverty

0-0.05
0.06-0.1
0.11-0.15
0.16-.25
0.26-0.50



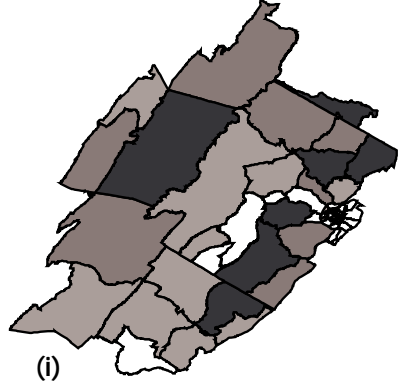
(g) % <9th Grade Education

0-10%
11-15%
16-20%
21-25%
26-30%



(h) % 9-12th Grade, No Diploma

0-10%
11-15%
16-20%
21-25%
26-30%



(i) % People in Farm/Fish/Forest Occupations

0-1%
2-4%
5-7%
8-10%
11-30%

One of the primary concerns of residents is that special interest groups, being larger, have a larger voice in forest management decision-making than local communities. One participant said, "Yes, it's theirs as much as ours, but those environmentalists get listened to more than us!" Another asserted that the "local people don't say enough, and the people not from around here don't have enough to do and don't know what they're talking about." Thus, residents feel that their long experience in the local area gives them better insights.

Residents feel that decisions are being made about timber, access to forest and wildlife areas, and recreation without their input. They want to be better informed of Forest Service meetings and specifically invited to them so that they can become aware of plans. One person said, "You have to have a balance... There needs to be some reasonable scientific management so that if there is an endangered species of plant or animal, we do our best to save them, and I think that's very important for the Forest Service to do. But, if extremists start making the rules, then they may take it a little too far."

One of the primary concerns of local residents is the Forest Service tendency to restrict use by closing roads or otherwise limiting access. They perceive wilderness areas as important for preserving trees and natural habitats, but they also want access to these areas. One person said, "My objection to wilderness areas is that there is no road. I won't be able to walk back in there 15-20 miles much longer. What good is it if you can't get back there?" Other residents emphasized the ecological value of wilderness: "I'm more interested in what the forests, the trees, do to the kinds of life we are going to lead." Another resident emphasized the heritage value, "We need some wilderness. Now you can't take your grandchildren out and share what we saw." One participant said residents' positions could be summarized as: "No more clearcutting and no more wilderness, we have enough."

Residents perceive an alternative between the two extremes of clearcutting and wilderness. "Clearcutting tears up everything, but forests have been managed for years without that." "Selective cutting is what you are talking about. The clearcuts is what made people agree to wilderness." The balance for local residents would be efficient management of the forests

for recreation, timber harvests through selective cutting, and maintenance of small areas of wilderness throughout the forests, rather than large inaccessible areas of wilderness. Both tourism and timber bring money into local communities.

Participants noted three primary communication needs: (1) the Forest Service needs to better educate itself about the composition and perceptions of the various communities it serves, (2) all residents of all communities need ongoing communication to keep them informed of Forest Service plans, and (3) an interactive trusting relationship needs to be established. The perceived problem with many current meetings is that they are held after a problem has emerged. Not all citizens are informed about such meetings, and issues are presented in a manner that is often unintelligible to residents. One resident reflected, "They put out requests for comments and they hold meetings – and I've been on some of their mailing lists – but they don't use terms that are intelligible." One participant suggested that "it would be good if the Forest Service would plan a meeting, maybe at the courthouse, something in the newspaper, invite interested people to a meeting. Ask, 'hey folks, what do you think we need to do with our forest. Are we doing right; are we doing wrong?'" But there's never any communication unless the local citizens initiate it."

Participants discussed the lack of clarity in information distributed by the Forest Service. One participant stated that she/he had an advanced degree, and "I can't understand the material. Have a seminar and explain it to us instead of just sending 20 pages I can't understand. We want to help, but ask us."

Participants suggested that a good education program is necessary to help them understand ecosystem management. The Forest Service is beginning to "shift toward the schools and that involved the young children and that's wonderful." Another participant cautioned that the Woodsy Owl and Smokey Bear education efforts in schools are not in all local schools. Two participants ended the discussion about ecosystem management with the suggestions to "Make more of an effort to be in the community about decisions that affect the community before the decision is made. Achieve an understanding with them before there's a problem. Make more of an effort to get to know the

Table 2.12 Southern Appalachian region counties ranking in top 210 in the nation in toxic releases.

County	Toxic Release Inventory Ranking	African American Population	Family Poverty Rate (percent)	African American Poverty
Floyd, GA	123	13.6	10.9	31.6
Caldwell, NC	65	5.6	8.1	29.2
Haywood, NC	185	1.2	9.5	19.0
Carter, TN	113	0.8	14.5	21.2
Hamblen, TN	8	4.6	11.1	28.2
Hamilton, TN	109	19.0	10.2	31.2
Hawkens, TN	117	1.8	14.3	15.5
Louden, TN	187	1.2	10.7	28.3
Sullivan, TN	7	1.7	10.4	39.5
Allegheny, VA	70	2.7	7.0	17.4
Frederick, VA	75	1.7	4.8	4.7
Giles, VA	33	1.6	9.5	13.7
Southern Appalachian Regional Average		5.0	12.1	25.7

(Source: EPA 1993 Toxic Release Inventory (TRI) and 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce)

people in their districts.” Residents assert that the forests belong to everybody, and that all should have a voice in what is done with the land.

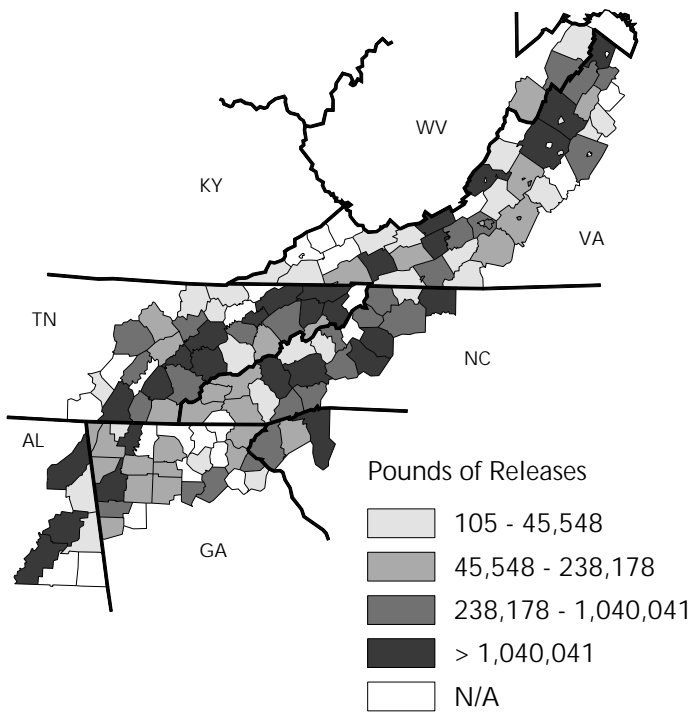
The Environmental Justice Issue

In 1982, the siting of a polychlorinated biphenyl (PCB) landfill in Warren County, NC, focused national attention on the issue of environmental justice (Mohai and Bryant 1992). The next year the General Accounting Office (GAO) completed a study of communities around four hazardous waste sites in the Southern United States and found that three of four sites were located in predominantly African-American communities. Fourteen of 15 subsequent research studies have shown pollution inequitably distributed by income and/or race (Mohai and Bryant 1992). In studies where race and income were both accounted for, four of five found race more strongly related to siting location than income. These findings and their implication for low income and minority communities have spurred today’s environmental justice concern.

In February 1994, Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” was issued by President Clinton. Agencies were advised to develop implementation strategies by February 1995. In

these strategies, as a minimum, agencies were to revise programs, policies, planning and public participation processes, enforcement, and/or rulemaking to: (1) promote enforcement of environmental and health statutes in areas with minority and low-income populations; (2) ensure greater public participation; (3) improve research and data collection relating to the health and environment of minority and low income populations; and, (4) identify differential patterns of subsistence use of natural resources among those populations.

In 1993, 12 out of 151, or 8 percent, of Southern Appalachian counties were among the 210 highest toxic polluters. Only 6.6 percent of U.S. counties were among the top 210. Table 2.12 shows the 12 counties and their ranking, racial, and income characteristics. Interpretation of these descriptive statistics does not suggest that siting decisions were based on race. The proportions of African-Americans in the populations there were generally lower than the regional average. An investigation of the income characteristics of these counties attests to their relative affluence. Only 3 of the 12 high-polluting counties had higher rates of poverty than the regional average. Half of the counties had lower than average rates of African-American poverty and half had higher rates of African-American poverty, suggesting there is little relationship between minority poverty and siting of pollution in the region.



HD311

Figure 2.25 Level of toxic release in Southern Appalachians counties, 1990 (Source: 1987-1992 Toxic Release Inventory, Office of Pollution, Prevention, and Toxics, U.S. Environmental Protection Agency). This shows the total level of toxic releases for each county.

Figure 2.25 shows all Southern Appalachian counties by level of toxic release. The income characteristics of these counties are shown in table 2.13. The counties with the highest levels of release (the upper quartile) are shaded. As a group, these counties had the highest median family incomes and the lowest poverty rates. The counties with the lowest amount of pollution had the lowest median family incomes and greater than average number of families living in poverty. The race-related statistics, however, show mixed results. In terms of population diversity, African-American populations in the

high-pollution counties were proportionately above the regional average while the African-American populations of the lowest polluting counties were below the regional average. The average African-American population across Southern Appalachian counties included in this analysis was 5 percent. These results suggest that siting may have occurred disproportionately in counties with higher proportions of blacks, but that income of both blacks and whites in these counties were higher than average.

Considering the low racial diversity in the Southern Appalachians, the county level of analysis may be too broad to detect environmental injustice. It is more desirable to look at relations between neighborhood racial and income characteristics and point-source pollution location. Kriesel and Centner (1995), for example, found differential impact at higher resolution (within 1 mile of census block group). Minority and low-income communities in Georgia were disproportionately located within 1 mile of a toxic release site. When controlling for income, the race effect persisted.

Due to time constraints for the SAA, we were not able to address the environmental justice issue at the block group level. Ranger district and area-of-influence maps presented in answer to Question 3 of this document illustrate block-group diversity that could fruitfully be analyzed in future studies. Important environmental justice indicators, such as race and income, vary considerably among block groups. These neighborhood-level patterns of diversity provide an important basis for future investigation. Environmental justice is an issue that can be more broadly defined than solely through analysis of racial and income characteristics and EPA toxic release data. Alternative strategies for analysis include looking at communities stratified by blue collar versus white collar status. This approach may be especially

Table 2.13 Category of toxic release by county and selected community characteristics.

Releases by Quartile	Median Family Income (dollars)	Family Poverty Rate	African American Poverty Rate (percent)	African American Population
1st	24,666	10.1	25.3	6.5
2nd	24,527	10.6	23.6	5.4
3rd	23,229	11.8	24.3	3.3
4th	22,132	13.6	25.2	4.1
Southern Appalachian Regional Average	23,149	12.07	25.7	5.0

(Source: EPA Toxic Release Inventory (TRI) 1990 and 1990 Census of Population and Housing, Bureau of Census, U.S. Department of Commerce)

valuable in the Southern Appalachians, where racial diversity is low. Additional environmental indicators could include air quality, stream turbidity and toxicity ratings, and average residential elevation to show whether groups are generally below or above most of the downhill water flow. Variables particularly related to forestry include forest cover, species abundance, and stream water quality. It is strongly recommended that the environmental justice issue be reanalyzed using more advanced methods.

Question 4:
.....

To what extent have interests or publics outside of the Southern Appalachians affected the status and management of the region's ecosystems and public land?

Key Findings

Outside Groups Are Active in the Region

A survey of a sample of 150 environmental groups reveals that the groups affect public land management in the region largely through technical assistance to management agencies (especially on plant and water-related issues) and through public outreach and environmental education activities (focusing particularly on fish and wildlife-related topics). Representatives of five federal land management agencies perceive that environmental groups influence management of public land in the region through input on planning proposals and environmental impact statements and through the creation of "community-led" organizations, such as the Oak Ridge Reservation Resource Management Organization.

Wildlife and Land Management Are Primary Concerns

Additional points revealed by the survey of environmental groups are: (1) Most environmental groups (69 percent) were formed after 1970. (2) Most organizations state that protection of natural resources, especially wildlife, is their greatest concern. (3) Urban

encroachment and poor management of forests, farms, and other natural resources were considered the greatest threat to natural resources. (4) The primary products or services associated with the various organizations were technical assistance (41 percent), environmental education and public communication (31 percent), and antidevelopment activities (17 percent).

It is clear that public land managers must work closely and skillfully with environmental groups. While keeping the needs and desires of local communities and businesses in mind, mandates for the national resources represented by federal lands in the region may in some instances push nonlocal interests ahead of local interests. Environmental and industry groups alike are much better informed and equipped to analyze and argue management options and the potential consequences of those options.

Interest groups have had a profound influence on the status of natural resources of the Southern Appalachian region. Large numbers of organized interests have involved themselves in planning and other decision making across an array of issues from local to regional in scale. In all likelihood, this interest and involvement will increase in the future. As the region grows as a tourism destination, pressures for environmentally and aesthetically sensitive management options also will grow.

Outside investment in the region was not covered in this analysis. For many years, resource extraction companies and tourism developers have invested in the region. That pattern also is likely to grow in the future. As transportation and communication improve inside the region and among regions, investment and development will continue to grow. Investment may become the dominant source of pressure on how public lands are managed.

Data and Methods of Analysis

This question was addressed by: (1) Compiling a list of environmental-related organizations around the region and mailing a questionnaire to a sample of these organizations requesting in-depth information about their role in natural resource policies and issues in the region. (2) Interviewing representatives of the major federal land management agencies in the region.

Compilation of Environmental-Related Organizations

A list of 1,942 organizations involved with, or affected by the management of, the region's ecosystems and public lands was compiled. Organizations were placed into one of the three categories: (1) "Internal" (located within the 135 county region); (2) "Adjacent" (located outside the region, but within one of the seven states of the study area – Alabama, Georgia, Kentucky, North Carolina, Tennessee, South Carolina, Virginia), and (3) "External" (major environmental organizations located in any of the remaining 43 states). In total, 718 internal groups, 794 adjacent groups, and 430 major external groups were identified. The list was generated from published conservation

directories (national, state, and local); nonprofit agency mailing lists (e.g., Sierra Club chapters, state United Way chapters); local and national television and radio listings; local newspapers and newsletters (e.g., Chattanooga Quarterly); federal, state, and local governmental agency mailing lists (e.g., departments of natural resources, state chambers of commerce, state institutes of environmental policy), and state universities.

Mail-back Questionnaire

In June 1995, a mail-back questionnaire was sent to a representative sample of organizations from the compiled list. A total of 150 organizations (52 internal, 69 adjacent, and 29 external) responded to six questions: (1) "Year

Table 2.14 Missions and natural resource values of sample organizations.

Category	Mission ¹ (percent of organizations reporting)	Values ²
Water resources		
Protection	5.4	8.0
Education and research	2.0	0
Quality	2.0	5.9
Wetlands	1.4	1.1
Fish and wildlife		
Habitat protection	3.4	6.4
Population protection	4.1	8.0
Education and research	1.4	0
Endangered species	1.4	0.5
Agriculture		
Sustainable practices	4.7	3.7
Economic development	.6	0
Forest Resources		
Protection	6.1	4.8
Timber production	9.5	5.9
Plants & Vegetation		
Protection	.6	3.7
Education and research	1.4	0
Area development		
Urban	1.4	0
Rural	2.0	0.5
Tourism	4.7	0.5
Social		
Historic and archeological	4.1	5.9
Recycling	5.4	0
Aesthetic and recreational	10.1	21.4
Natural resources (not specified)		
Protection	8.8	9.1
Education and research	12.2	0
Management and planning	4.7	0.5
Biodiversity	2.7	13.9

¹Number of respondents = 148; two organizations had missing data.

²Number of respondents = 187; total sums to more than 150 because of multiple values reported by some organizations.

(Source: Southern Appalachian Region Residents Survey, joint study between USDA Forest Service and University of Georgia, Athens, GA)

organization was formed," (2) "Number of members in organization," (3) "General mission or purpose of organization," (4) "Most important natural resource values in the Southern Appalachian region," (5) "Greatest threats to those natural resource values," and (6) "Outcomes of the major environmental projects conducted in the past 10-15 years."

Detailed Results of the Analysis

Most of the sample organizations (64 percent) were formed after 1970. Only 11 percent

were formed before 1920. Over one-third (38 percent) of the organizations had more than 500 members, 18 percent had 100 to 499 members, 11 percent had 50 to 99 members, 21 percent had 10 to 49 members, and 11 percent had less than 10 members. Two organizations did not supply all of the requested data.

Table 2.14 shows the missions and natural resource values of the sample organizations. Most reported that their general mission or purpose concerned the protection of natural resources, including water, fish and wildlife, land, or plants (28 percent). Other responses included education and public communication

Table 2.15 Major perceived threats to Southern Appalachian region natural resource values of sample organizations.

Category and Threat	Positive Response ¹ (percent of organizations reporting)
Water Resources	
Pollution	6.7
Dams and impoundments	.8
Fish and wildlife	
Loss of habitat	2.5
Loss of populations	.4
Pests	1.2
Agriculture	
Overgrazing	.4
Poor management practices	3.8
Forest resources	
Clearcutting	11.8
Wood products	2.5
Poor management practices	3.4
Plants and vegetation	
Loss of plants	.8
Area development	
Urban communities	17.2
Rural communities	2.9
Second homes	2.5
Tourism	.4
Government Interference	
Poor legislation	5.5
Social	
Loss of history	.4
Poor waste management	6.3
Recreation overuse	2.5
Social apathy	3.4
Radical environmental groups	2.1
Natural resources (not specified)	
Lack of education	7.1
Poor management practices	8.8
Mining	
Mineral extraction	2.9
Atmospheric	
Pollution and acid rain	2.9

¹Number of respondents = 238; total sums to more than 150 because of multiple values reported by some organizations.

(Source: Southern Appalachian Region Residents Survey, joint study between USDA Forest Service and University of Georgia, Athens, GA)

(21 percent), aesthetics or provision of recreation opportunities (10 percent), and timber production (10 percent).

When asked about which natural resource values they consider to be most important in the region, most organizations reported protection of natural resources, especially wildlife-related resources (40 percent). Other responses included aesthetics and recreation opportunities (21 percent), maintaining biodiversity (14 percent), wood production (6 percent), historical and archeological preservation (6 percent), and water quality (6 percent).

Table 2.15 shows the major perceived threats to natural resources values in the region. Primary threats included urban development (17 percent), poor resource management practices (16 percent), clearcutting and logging (12 percent), lack of environmental education (7 percent), ineffective waste management and recycling programs (6 percent), and improper environmental legislation (5 percent).

The major outcomes of environment-related projects that the sample organizations are involved with are shown in table 2.16. Primary outcomes include the provision of technical assistance, especially about plant and water issues, environmental education and public communication, antidevelopment initiatives, and land acquisition.

Interviews with Federal Agency Representatives

From April to August 1995, representatives (public affairs or liaison officers) of seven federal agencies in the region were contacted: The Blue Ridge Parkway, the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service, the Forest Service, the National Park Service (Great Smoky Mountains National Park), the Oak Ridge National Laboratory, and the Tennessee Valley Authority. Two questions were asked: (1) "Describe the

Table 2.16 Desired outcomes of sample organizations.

Category	Positive Responses ¹ (percent of organizations reporting)
Antidevelopment	
Wetlands	1.4
Water impoundments	5.0
Mining	.7
Forestry and timber	3.6
Tourism	.7
Nuclear energy	3.6
Road and home construction	2.1
Environmental education	
Historic	1.4
Forestry	5.0
Fish and wildlife	11.4
Plants	3.6
Atmospheric	.7
Natural resources (not specified)	8.6
Technical assistance	
Agriculture and land	2.9
Forestry	5.0
Water	9.3
Waste management	7.8
Fish and wildlife	.7
Plants	13.6
Other	
Legislation	2.1
Trails maintenance	2.9
Foundations	2.1
Land acquisition	6.4
Donations and grants	2.9

¹Number of respondents = 140; ten organizations had missing data.

(Source: Southern Appalachian Region Residents Survey, joint study between USDA Forest Service and University of Georgia, Athens, GA)

history of the agency's environmental planning process within the region since 1980" and (2) "Identify the major organizations and groups (located both within and outside of the region) who have affected those policy changes."

History of Environmental Planning in The Southern Appalachians Since 1980

(1) U.S. Fish and Wildlife Service (FWS): The FWS does not directly manage land or water resources in the region. Its primary responsibility in environmental planning is to provide technical assistance to other public agencies on the management and provision of wildlife and habitat, with particular emphasis on threatened and endangered species.

(2) National Park Service (NPS) – Great Smoky Mountains National Park (GSMNP): The following issues have been at the forefront of the GSMNP environmental planning since the early 1980s: (a) North Shore road settlement in North Carolina, (b) aircraft sightseeing overflights, (c) completion of the Foothills Parkway and (d) Class I Area air quality responsibilities.

(a) The issue of whether to build a remaining 21-mile section of North Shore Road along Fontana Reservoir has been long debated on economic and environmental grounds. In 1992, the estimated cost of the proposed road construction was \$125 million. The road is needed to provide access to area cemeteries, which the NPS has a responsibility to maintain. Primary environmental concerns include the effect on wildlife, the exposition of Anakeesta rock which produces acids and heavy metals that are leached by rainfall into streams and kill aquatic life, and possible faulting due to unstable rock formations. A related environmental issue is proposed wilderness designation that includes a portion of the proposed North Shore road. Wilderness designation would prohibit motorized use and have implications for cemetery access.

(b) The increase in low-altitude sightseeing flights in and around the GSMNP has resulted in impacts on visitor enjoyment and safety and on resource protection. Landings are prohibited within the GSMNP, but the NPS has no regulatory authority over overflights.

(c) To date only 22.5 miles of the 72-mile Foothills Parkway are completed and open to traffic. The NPS considers completion of the

Parkway necessary for providing scenic vistas of the northern portion of the Great Smoky Mountains.

(d) Monitoring and research conducted in the GSMNP have shown that airborne pollutants are significantly impacting Park resources and visitor enjoyment. Problems include ozone effects on vegetation, visibility impairment from regional haze, and effects of acid deposition on the aquatic and terrestrial resources.

(3) Oak Ridge National Laboratory (ORNL): The Oak Ridge Reservation was purchased by the wartime Manhattan Project. At the time, environmental planning was not a major consideration. Much of the land was not developed, but was left intact and used as a buffer around the facilities. Over the past 50 years, lack of disturbance has resulted in the establishment of several communities, such as cedar barrens, river bluffs, and wetlands, which are less common in surrounding areas. Today, the Oak Ridge Reservation has over 1,000 vascular plant species, of which 22 are state-listed and 4 are candidates for federal listing. It also has in excess of 300 wildlife species, an unknown number of which are state-listed. The Nature Conservancy reports 272 known occurrences of significant species and communities. Recently, the Oak Ridge area has been targeted for industrial and residential development.

(4) Tennessee Valley Authority (TVA): Since 1980, two of the most controversial environmental issues facing the TVA have concerned (a) forest management practices and (b) water management projects. The TVA employs a professional forestry staff that works cooperatively with the forest products industries and manages TVA land. Much of this work has involved limited timber sales and outreach activities with private landowners. The portable chip mill industry has been seeking water-use permits on or near TVA reservoirs and lakes. Water management, in the form of flood control, navigation, and generation of hydroelectric power, is a legislated mandate of the TVA. Recent planning issues are related to aquatic vegetation control, control of disease-bearing insects, nurturing of threatened and endangered species, and maintaining water quality and aesthetics for recreation use by managing lake levels and dam releases.

(5) The USDA Forest Service is the largest single land-management entity in the Southern Appalachians. The National Forest Management

Act of 1976 (NFMA) and its implementing regulations, which were written in 1979 and revised in 1982, called for detailed land management planning on all the national forests. Plans for the national forests in the Southern Appalachians were completed between 1984 and 1987.

In the planning process on each national forest, issues of concern to interested publics were identified at the outset in a formal public involvement process. These issues were tracked throughout the planning process, and their resolution was reported. The specific issues that were identified are too numerous to mention here.

The completed plans describe strategies, goals and objectives, standards and guidelines, areas where specified management activities will occur, and monitoring and evaluation schemes. The plans are permissive; that is, they allow certain activities to occur. They do not, however, contain the site-specific decisions needed to implement projects. Implementation decisions must be made separately for individual projects that are deemed to be consistent with the forest plan. In making implementation decisions and taking actions, the forest manager is bound by the National Environmental Policy Act (NEPA) to analyze and disclose to the public the effects of decisions and actions.

In 1995, all but the George Washington, Nantahala, and Pisgah National Forests began to revise their forest plans. The results of the SAA will be a valuable source of data and information for making these revisions. The George Washington National Forest completed revisions of its plan in 1993, and the Pisgah and Nantahala National Forests completed a significant amendment to their plan in 1994.

Influence of Environmental Organizations on Land Management in Southern Appalachians

(1) U.S. Fish and Wildlife Service: Public involvement in FWS environmental planning and management has focused primarily on issues concerning endangered species populations and habitats. The FWS gets public input through two primary means, "Listing Actions" and "Recovery Plans." Under Listing Actions, the FWS prepares a regulation for listing a species as endangered. Public input on the

proposal is solicited for 30 days before the listing can pass. In a separate effort, the FWS publishes a notice in the federal registry to solicit input from the public on a Recovery Plan. The Recovery Plan, however, has limited legal ramifications.

(2) National Park Service:

(a) North Shore Road settlement; interested publics and groups involved in the road-building/wilderness/cemetery issue include Congressional delegations from North Carolina and Tennessee, the TVA, Swain County Commissioners, Tennessee Great Smoky Mountains Park Commission, the Wilderness Society, the Sierra Club, the Wildlife Federation, the North Shore Historical (Cemetery) Association, the Non-partisan Citizens Against Wilderness in North Carolina, other environmental and recreational organizations (including anglers and other backcountry user-groups), and GSMNP neighbors. The NPS sought public input on the issue through its General Management Plan. The outcome has been a decision not to support the construction of the North Shore road of Fontana Lake, but to ensure cemetery access by maintaining existing nonpublic use roads and trails.

(b) Aircraft overflights; major interest groups include the National Parks and Conservation Association, park visitors (especially backcountry users seeking solitude), nearby communities, and tour operators. Several communities (Gatlinburg, Pigeon Forge, Sevierville, and Townsend) prohibit landings within city limits, and Pigeon Forge city ordinances have proposed eliminating tour operations. As of January 1995, the local issue is being considered in the Sevier County Circuit Court. On a national level, the issue of overflights in national parks is to be considered by Congress.

(c) Foothills Parkway construction; Leaders of neighboring Tennessee communities, the Tennessee Congressional delegation, and the Foothills Parkway Association support completion of the project. Some adjacent landowners are concerned over possible pollution of their wells and streams, as well as the increased traffic and the visual impact of the roadway on scenery. (d) Class I Area air quality responsibilities; the EPA, the Forest Service, and several environmental organizations, including the National Park Conservation Association, support the NPS position on air quality

emission standards. Tennessee Luttrell and other industries, along with some states, have opposed an adverse impact determination on grounds that it will limit economic growth. One of the outcomes of public input has been the creation in 1992 of the Southern Appalachian Mountains Initiative (SAMI), a voluntary, multi-organizational, state-driven initiative charged with preventing future adverse effects from human-induced air pollution on the region.

(3) Oak Ridge National Laboratory: In the early 1980s, the Oak Ridge Reservation Resource Management Organization was formed to solicit input on land-use impacts on the Reservation. Interested parties involved in its formation included groups and individuals representing utilities, security, site development, forestry, wetland preservation, and threatened and endangered species issues. More recently, an environmental evaluation, known as the "Common Ground Process," has been developed to solicit external stakeholder input about use of the Oak Ridge area in the future.

(4) Tennessee Valley Authority: Since 1980, the public has affected TVA management practices related to at least three environmental issues: (1) reservoir planning, (2) endangered species, and (3) chemical treatment in water bodies. In the late 1980s and early 1990s, a public planning review was conducted in association with an Environmental Impact Statement. Meetings and workshops were held at key locations near the approximately 40 reservoirs within the TVA jurisdiction. Stakeholder groups that were involved included, lake homeowners (and associations), recreation user groups (e.g., Bass Fisherman's Association) and individual users, power consumers, industrial organizations, and local, regional and national chapters of environmental organizations (such as the Sierra Club). The primary outcome of the review process was a Lake Improvement Plan that will improve dissolved oxygen levels and water quality in TVA reservoirs.

No new reservoir projects have been proposed since the Duck River in the early 1970s. While the controversies surrounding the snail darter have not resurfaced, mussels have become the single biggest endangered species issue related to water impoundments in the region. In general, the loss of mussel species, however, has not received tremendous public attention.

Recently, the use of chemicals in the treatment of aquatic vegetation has generated public concern. Not only has the use of chemical treatments led to conflicts among user groups (such as anglers versus boaters), the general public has been concerned about water quality levels. In the past 2 years, public involvement has resulted in a shift away from TVA use of chemicals to other types of vegetation control including natural manipulation, control of lake levels, and mechanical harvesters.

(5) USDA Forest Service: In its forest planning efforts in the Southern Appalachians, the Forest Service has attempted systematically to broaden the set of interest groups and agencies involved in its decision-making processes. Among those involved have been: (1) representatives of federal, state, local, and tribal governments; (2) local and national representatives of environmental groups; (3) local and national representatives of forest industry groups; (4) owners of small sawmills, timber buyers, and various proponents of specific industries; (5) owners of nonindustrial private forest land; (6) representatives of a wide range of professional organizations; (7) members of forest recreation user groups; (8) hunters and fishermen; and (9) nonconsuming users of wildlife such as bird watchers and wildlife photographers.

Question 5:

What are the important attitudes and values that Southern Appalachian residents hold toward natural resources and ecosystem management?

Key Findings

Environmental Protection Remains An Important National Concern

Environmental concern remains high in the United States in the 1990s, but most Americans feel that environmental protection and economic growth can be compatible. When people must choose one over the other, their first choice is the environment. Most also feel that environmental protection has not gone far enough.

Americans view environmental groups favorably, but feel they as individuals do not make a significant difference. Southern Appalachian residents, for the most part, have even indicated willingness to put more personal funds toward collective environmental protection. About one-half feel the environment has gotten worse.

Regional Knowledge About Natural Resource Issues is Low, But Preferences Are Clear

Southern Appalachian residents exhibited moderately positive attitudes and values toward the natural resources of the region, but lacked objective knowledge about related issues. Overall, respondents held slightly stronger environmental attitudes toward fish, wildlife, aquatic, and air issues than toward forest practices and social issues. In addition, respondents were against increasing controls over tourism development and were equally divided over restrictions of second-home development. In contrast, most respondents felt the Endangered Species, Clean Water, and Air Quality Acts had not gone too far in their actions. They agreed that critical plant and animal habitat should not be developed and that protecting habitat for nongame fish was as important as protecting trout habitat. They were, however, in favor of stocking fish in streams and lakes to increase sportfishing opportunities.

Southern Appalachian Residents Have Relatively High Environmental Values

Compared with respondents to similar national surveys, Southern Appalachian residents seem to have somewhat higher environmental values (as scored on the New Environmental Paradigm Scale). Consistent with recent national public opinion polls, crime was rated the most important issue in America. Interestingly, however, more people were concerned about protecting the environment than about reducing the national debt. Respondents also exhibited more environmentally responsible behaviors (such as recycling and contributing money to environmental organizations) than national averages. Almost 60 percent of respondents indicated that they would "make personal sacrifices to protect"

their local community and surrounding area, while only 25 percent indicated no attachment to the region.

Few significant and consistent differences in environmental attitudes, knowledge, values, and behaviors were found across the four subregions of the Southern Appalachians.

From the analysis to Question 3, we learned that local communities near public lands seek a voice and a balance in the management of natural resources. When considered in the larger context of all people living in the region, it becomes clearer why local communities are not just interested in their own economic welfare, but are also interested in protection and improvement of the resource. People living in the region, for the most part, lean toward having an improved environment and quality natural settings, rather than strict economic growth. While they do not have good knowledge of the specifics and technical aspects of environmental issues, it is clear that they support measures that will assure they and future generations will have a high quality environment to live and play in.

As agencies adjust management to better assure the health and sustainability of forest ecosystems, they are likely to have support from the people living in the region. As retirees, urban-based, and other new residents move into the region, concerns for the health and aesthetic appearance of the region's ecosystems are likely to strengthen.

Data and Methods of Analysis

Simple descriptive statistics from published sources were used to describe national attitudes toward environmental issues. Sources included national private and university polling firms, such as Roper, Times Mirror, Harris, Southern Focus polls, and the Carolina Poll index.

In addition, approximately 1,200 residents of the Southern Appalachian region were surveyed by telephone to assess their attitudes and values toward natural resource issues and management. Information about length of residence, sense of place, land ownership, environmental knowledge, environmental attitudes, environmental values, environmental behaviors, and socio-demographic background is reported.

Telephone interviews with residents of the region were conducted from August 11 to September 21, 1995, by the Human Dimensions Research Laboratory at the University of Tennessee. Individual respondents were selected from contacted households by asking for the individual in the household who had the most recent birthday. Telephone numbers for households were generated using the random-digit dialing method. A quota sampling procedure was used to generate equal sample sizes across two dimensions: subregion and residence. There were four subregions (as described earlier) and two levels of residence (urban and rural).

Approximately 150 responses were targeted for each cell (e.g., 150 rural residents and 150 urban residents) in the Northern Ridge and Valley subregion. Telephone call-backs were repeated until the targeted sample size per cell was reached. Telephone interviews took an average of about 15 minutes.

Frequencies, means, Chi-Square tests, and analyses of variance with a significance level of $p=0.05$ were used to examine differences between the subregions.

A total of 6,000 telephone numbers were generated during the data collection period. One-fifth were disconnected numbers and 9.7 percent were business or fax numbers. In total, 2,829 people were contacted. Of these 54.4 percent refused to participate in the survey and 1.8 percent terminated part-way through the interview. Final sample size was 1,220, and the response rate was 43.8 percent. Responses were distributed evenly across the four subregions, ranging from 304 to 306.

Detailed Results of the Analysis

Environmental Attitude Surveys in the United States

Environmentalism has become an important and seemingly enduring social phenomenon in America. A comprehensive review of national public opinion data reveals that environmental concerns peaked in 1990 (Dunlap 1992). In 1995, public concern for the environment remains high. A recent survey reports that only 2 percent of the American public reported being unsympathetic to the environmental

movement (Times Mirror 1994). Furthermore, many Americans (52 percent) think the 1990s is the last decade when humans will have a chance to save the earth from environmental catastrophe (Times Mirror 1994). Furthermore, in 1994, 29 percent of the American public claimed to be active environmentalists; between 52 and 56 percent were sympathetic, but not active.

There are several important themes of American environmentalism. First, most opinion polls show that the great majority of Americans are concerned with the environment, and many Americans think environmental protection and economic growth can go hand-in-hand. A full 90 percent in 1994 believed we could find a balance that allows both economic progress and environmental protection. When a compromise between economic growth and environmental protection cannot be made, however, the public sides with the environment. Between 1992 and 1994, from 59 to 64 percent of the public reported that environmental protection was more important than economic development when a compromise could not be found (Times Mirror 1994).

Second, Americans continue to believe in regulatory action to protect the environment. In 1992, 63 percent of respondents reported that environmental laws and regulations had not gone far enough. In 1994, 53 percent of the public responded in that manner (Times Mirror 1994). Both percentages are far higher than the 33 percent in a 1980 Roper survey who thought environmental laws had not gone far enough.

Third, environmental groups and organizations are highly respected by the American public. A remarkably high percentage of Americans have a favorable view of environmental groups, and large numbers give money to such groups. A 1990 survey by Environmental Opinion (Dunlap 1992) found that two-thirds of the public agreed that "threats to the environment are as serious as the environmental groups say they are" and only one quarter said that "environmental groups are exaggerating these threats in order to get the public to pay attention to them." Similarly, a 1989 Business Week/Harris poll gave respondents a list of six groups and for each asked, "do you think they do more good than harm or more harm than good?" Seventy-five percent indicated that environmental groups did more

good than harm. Likewise, the Times Mirror survey (1994) reports that 74 percent of the public feels favorable toward environmental groups. These results reflect a high level of public identification with the environmental movement and indicate the high degree of credibility and legitimacy that environmentalism has attained in our society (Dunlap 1992).

While most Americans report high levels of commitment to the environmental movement, fewer feel they can make a big difference through their personal actions. Most Americans (56 percent) feel that their personal effort can make only a small difference when they try to protect the environment. Slightly more than a third (34 percent) think their effort can make a large difference.

In addition to surveys at a national level, some polls have been conducted in parts of the Southern Appalachians. During April 1992, 81 percent of a random sample of adult South Carolina residents reported that it was more important to maintain an acceptable water quality, than to increase the number of jobs in the State (University of South Carolina 1992). In the fall of 1993, 64 percent of a random sample of North Carolina adults agreed with the statement: "Protection of the environment should be given priority, even at the risk of curbing economic growth." Only 26 percent agreed that "Economic growth should be given priority even if the environment suffers to some extent" (University of North Carolina 1993).

During the spring of 1994, North Carolina residents were asked to evaluate whether they thought that the Sierra Club had gone "too far," "not far enough," or "does things just right" to protect the environment. The largest group responded that the Sierra Club was doing "just right" (32 percent), the second largest group felt that the Sierra Club was "going too far" (23 percent), and the smallest group (13 percent) felt the Sierra Club was "not going far enough" (University of North Carolina 1994).

During April 1989, the Atlanta Journal-Constitution Poll (Morris 1989) asked a cross-section of southern census region adults if they would pay an additional \$100 each year if it would help to clean the environment. Exactly 50 percent responded "yes" they would pay an additional \$100 each year in taxes if it would help to clean the environment and 39 percent responded "no" they would not. The poll also asked if they would be willing to pay a higher

price for gasoline, if the money collected would be allocated solely to clean up the environment. Forty-seven percent indicated that they would pay the higher price, while 43 percent indicated that they would not be willing to pay the higher price (Morris 1989).

During October 1993, a cross-section of southern census region adults, as well as a cross-section of nonsouthern census region adults, were asked if they felt that the environment where they lived had become better, worse, or had stayed about the same in the last 10 years. Forty-eight percent of the southerners responded that they felt the environment had gotten worse in the last 10 years as opposed to 43 percent of nonsoutherners. Thirteen percent of southerners thought the environment in their area had gotten better, while 19 percent of the nonsouthern sample thought the environment in their area had gotten better (University of North Carolina 1993).

A review of national and regional environmental attitudes reveals that concern for environment is at an all time high, that a majority of Americans favor environmental protection over economic growth but feel both can be provided, that trust in environmental organization is high, and that most people believe in the value of environmental regulations.

Environmental Knowledge and Attitude Survey of Southern Appalachian Residents

Residence. Almost 96 percent of respondents were year-round residents of the region, and 61.3 percent had lived there all their lives (mean = 43.5 years). Of those who had lived in the region all their lives, their family (including ancestors) had been in the region for an average of 81.8 years. Of those who had not lived there all their lives, the mean length of living in the region was 16.9 years.

There were no significant differences across the four regions in terms of length of residence and ancestral residence. However, there were significantly fewer respondents who were year-round residents in the Southern Mountain and Piedmont subregion than in other subregions. Also, for nonnatives, length of residence in the region was significantly higher in region 3 than other regions.

Sense of Place. Public lands have both utilitarian and emotional values. Sense of place

refers to the emotional attachments people have with a place or landscape (Mitchell and others 1993). Understanding people's attachment to place, particularly in rural communities, is considered important because of the loss of culture or meaning often associated with economic change and development in these communities. Such change might include a shift from an extractive economy to a tourism economy (Mitchell and others 1993; Williams and others 1995). Using a place attachment scale developed by Williams and others (1992), respondents to this survey were asked a series of questions about ties to their local community. Local community was defined as "the surrounding area in which you now live." Since the Williams and others scale measured attachment to a single site (Mt. Rogers Recreation Area in Virginia) as opposed to attachment with unique communities, comparisons with results of this survey were not possible.

Most people (67.6 percent) felt "emotionally attached" to their local community: of these 58.1 percent had very strong ties to their community, indicating that they would be willing to "make personal sacrifices to protect this place." Over one-quarter of all respondents, 25.6 percent, had a negative attachment to their community indicating they "would rather live somewhere else", "have no particular love for this place," or "did not feel like they were from this place". Eight percent had neither a positive nor a negative attachment. There were no significant differences across the four subregions for place attachment.

Rural Land Ownership. Four questions were selected from the 1995 National Private Land Ownership Study (NPLOS) to measure rural land ownership in the region. Two hundred and forty-nine respondents (20.5 percent) owned tracts of rural land of 10 acres or more in the region (average size = 75.1 acres and mean number of years owned was 20.0). Most either intended to "improve the natural conditions of the land and not [use it] as a source of income" (48.3 percent) or "improve the natural condition of the land and use the land as a source of income" (39.9 percent). Only 11.8 percent intended to "use the land primarily as a source of income." Again, there were no significant differences across the four subregions in land ownership, total acreage, years owned, or intent of land use.

Environmental Knowledge. National surveys have shown the public has only low to moderate knowledge about environmental issues. For example, the National Science Board (1993) reported that when asked about acid rain issues, less than one-quarter of U.S. citizens correctly answered questions about location of the ozone hole or knew that car exhaust fumes contribute to acid rain. Supporting previous studies, respondents to the Southern Appalachian survey also demonstrated very low levels of knowledge about issues such as timber harvesting, fish and wildlife, water pollution, and wilderness.

When asked how well informed they thought they were about environmental issues in the region, most respondents (64.2 percent) reported they were at least "moderately informed." However, when asked to respond to 14 objective questions about specific environmental issues (on a "true," "false," "don't know" scale), they performed slightly poorer than someone who would simply have guessed the answers. The mean number of correct scores across all 14 knowledge items was 5.9 (a range of 0 to 14, standard deviation of 2.5). Simply guessing (i.e., providing a random response) to each question would have yielded a mean correct score of 7.0.

Table 2.17 shows the percent of correct and incorrect responses per question. Overall, more than half of the respondents knew that both plants and animals are listed on the Endangered Species list, that the region experiences air pollution, that tourism is a significant employer in the region, and that the Forest Service has reduced clearcutting in the region over the past few years. However, less than one-third knew that rainbow trout are not native to the region and that timber harvesting and motor vehicles are not permitted in federal wilderness.

Environmental Attitudes. Table 2.18 shows the percent of respondents who "agreed," "disagreed," or "neither agreed nor disagreed" with 16 attitude items. Overall, respondents exhibited slightly more of a positive (than negative) attitude toward environmental issues in the region.

Forest issues: Overall, respondents support harvesting dead and downed trees, but were against the use of fire as a management tool, a landscape of "brown and dead trees," and increasing timber harvesting on national forests. Slightly more respondents were against

Table 2.17 Percent of correct and incorrect responses to 15 environmental knowledge questions.

Knowledge Item	Correct Response			
	True	False	Don't Know	
After a forest fire it usually takes 10 to 15 years before the first signs of plants and animals are found.	False	26.1	49.1	24.8
Both plants and animals are included on the T&E Species List.	True	72.3	12.6	15.1
A threatened species is one that is near extinction.	False	69.5	16.6	13.9
In Southern Appalachia, more animals and fish are killed through hunting and fishing than removal of habitat.	False	37.5	38.9	23.7
In Southern Appalachia, more species of fish, crayfish and mussels are T&E than species such as bear and wolves.	True	43.7	21.8	34.5
Rainbow trout are native in Southern Appalachia.	False	51.6	18.6	29.8
The most common pollutant of water is carbon monoxide.	False	23.1	41.9	35.0
Southern Appalachia is one place in the U.S. that does not experience air pollution.	False	9.8	80.0	10.2
Tourism is one of the largest employment industries in Southern Appalachia.	True	59.3	22.4	18.3
Timber harvesting is permitted in federally designated wilderness areas in the Southern Appalachia.	False	50.8	17.6	31.6
Motor vehicles are permitted in federally designated wilderness areas in Southern Appalachia.	False	59.7	17.3	23.0
User fees are charged to hike and camp on National Forests in Southern Appalachia.	False	47.6	30.9	21.5
Timber harvesting is permitted on National Forests in Southern Appalachia.	True	45.4	28.4	26.2
Over the past few years, the Forest Service has reduced the amount of clearcutting on national forests.	True	52.0	14.3	33.8
Most old-growth timber is on private lands.	False	35.5	34.0	30.5

(Source: Southern Appalachian Region Residents Survey, joint study between USDA Forest Service and University of Georgia, Athens, GA)

(versus in favor of) increasing timber harvesting on private lands.

Terrestrial issues: Almost twice as many respondents disagreed with the statement that “the Endangered Species Act had gone too far” than agreed. They also supported not developing critical habitat. While more than one-half felt that it was as important to protect habitat for nongame fish as for trout, over 60 percent supported stocking fish in streams and lakes to increase sportfishing opportunities.

Aquatic and air issues: A large majority (83 percent) agreed that polluting industries should pay water clean-up costs, even if it means a loss of jobs or profit. Most felt that the Water Quality and Air Quality Acts should not be restricted.

Social issues: Respondents were evenly divided on whether there should be more

restrictions on second-home development. Slightly more people were against restricting tourism development (51 percent) than were in favor (38 percent). Over two-thirds supported charging a recreation user fee on national forests and increasing the amount of wilderness in the region.

Subregional analysis: Of the 16 attitude items, only 5 were significantly different among the subregions. Overall, respondents in the Southern Mountain and Piedmont subregion had less positive attitudes toward charging recreation user fees and increasing the amount of and using fire as a forest management tool. They had more positive attitudes about increasing the harvest of downed and dead trees, than respondents in other regions.

Table 2.18 Percent of respondents who “agreed,” “disagreed,” or “neither agreed or disagreed” with 16 environmental issues in the region.

Attitude Toward Issues in the Southern Appalachian Region	Agree	Neither	Disagree
Forest issues			
It is OK if parts of the landscape are brown and consist of dead trees.	25.2	6.2	68.5
There should be more harvesting of dead and downed trees.	70.0	7.3	22.8
Using fire as a management tool in National Forests is a good idea.	32.1	8.6	59.3
There should be more timber harvesting of private forests.	35.8	17.7	46.5
There should be more timber harvesting of National Forests.	17.6	10.3	72.1
Terrestrial issues			
Land that provides critical habitat for plants and animals should not be developed.	72.5	4.7	22.5
The Endangered Species Act has gone too far and should be restricted.	33.6	8.9	57.5
It is more important to protect habitat for trout than non-game species.	29.3	17.7	53.0
More fish should be stocked in streams and lakes to provide increased sportfishing.	62.8	12.8	24.4
Air and water quality issues			
Industries which pollute the water and air should pay for the clean-up even if it means the loss of jobs or profit.	83.5	6.9	9.6
The Water Quality Act has gone too far and needs restricting.	17.2	9.1	73.7
The Air Quality Act has gone too far and needs restricting.	15.2	6.7	88.1
Social issues			
There should be more restrictions on second-home development.	41.7	18.8	39.5
There should be more controls on tourism development.	38.3	11.1	50.6
More public land should be set aside as wilderness.	68.6	7.1	24.3
There should be a user fee to recreate on national forests.	67.6	5.0	27.4

(Source: Southern Appalachian Region Residents Survey, joint study between USDA Forest Service and University of Georgia, Athens, GA)

Environmental Values. Has the environment gotten better or worse? Respondents were evenly split in their perceptions of whether the environment has become worse (41.5 percent) or stayed about the same (43.4 percent) in the past 10 years. These results are similar to a 1993 Harris Survey of adults in the United States, which found that 44.5 percent and 41.6 percent, respectively, thought the environment had become worse or stayed the same. There were no significant differences across the four subregions.

The environment versus other social issues: A May 22, 1995, USA Today national poll of adults found crime to be the major social issue

facing America today. Southern Appalachian respondents were also more concerned about reducing crime (mean score = 3.0) than health care, the environment, and the national debt. However, people in the region were as concerned with protecting the natural environment (mean = 2.5) as with reforming national health care (mean = 2.6). They demonstrated less concern for reducing the national debt (mean = 2.2).

The new environmental paradigm: Over the past two decades, the New Environmental Paradigm Scale (NEP) (Dunlap and Van Liere 1978) has become popular for measuring public environmental values in the United States.

Table 2.19 Mean scores on dimensions of the New Environmental Paradigm (NEP) Scale by Southern Appalachian region, Washington state, and Kentucky residents.

NEP Dimensions	Mean Score ¹		
	Southern Appalachian Residents	Washington Residents	Kentucky Residents
Balance of nature	12.81	12.84	12.10
Limits to growth	11.60	12.00	10.60
Humans over nature ²	11.16	11.45	9.75

¹Scale of scores = 4 to 20

²Items in the "Humans over nature" dimension were reverse scored

(Source: Southern Appalachian Region Residents Survey, joint study between USDA Forest Service and University of Georgia, Athens, GA)

The NEP is a 12-item scale that purports to measure three dimensions of environmental values: limits to growth, balance of nature, and a nonanthropocentric view of nature (Miles and others 1993). Table 2.19 compares mean scores for each of the three dimensions from the regional survey with results of a recent study of Kentucky residents (Christianson and Arcury 1992) and a study of Washington State residents (Dunlap and Van Liere 1978). Findings show that Southern Appalachian respondents hold stronger environmental values than Kentucky residents, but weaker values than people in Washington. No significant differences were observed across the four subregions.

Environmental Behaviors. Overall, a high proportion of Southern Appalachian respondents indicated they participated in environmentally responsible behaviors (table 2.20). In the past couple of years, over 85 percent had recycled, taken into account the amount of packaging when purchasing goods, and/or

watched television shows and read books about the environment. In addition, over one-third had contributed money to an environmental organization, had participated in a clean-up drive, or had voted for a public official because of the candidate's pro-environmental stance. One of the most surprising findings was that over one-half (52.5 percent) had participated in a clean-up drive in the past couple of years.

Southern Appalachian respondents also report higher levels of environmental behaviors than the national average. A national sample of adults in 1990 by the Roper Organization (Schwartz and Miller 1991) showed only 46 percent recycled goods (compared with 59.7 percent who often recycled in our survey), only 8 percent contributed money to environmental organizations (compared with 40.2 percent in our survey), and only 4 percent had written to politicians (compared with 24.7 percent in our survey who had written or called a politician).

Table 2.20 Percent of respondents who had participated in environmental behaviors in the past couple of years.

Environmental Behaviors (past couple of years)	Yes	No
Recycled paper, plastics or glass	91.9	8.1
Taken into account the amount of packaging on goods bought	85.6	14.4
Switched products because of environmental reasons	77.1	22.9
Car pooled to work	32.7	67.3
Watched t.v. shows about the environment	94.6	5.4
Read books about the environment	91.1	8.9
Written or called a public official about an environmental issue	24.7	75.3
Subscribed to environmental publications	28.3	71.7
Attended meetings on environmental issues	24.0	76.0
Contributed money to an environmental group	40.2	59.8
Participated in a clean-up drive	52.5	47.5
Voted for a public official because of their proenvironmental stance	36.6	63.4

(Source: Southern Appalachian Region Residents Survey, joint study between USDA Forest Service and University of Georgia, Athens, GA)

Table 2.21 A comparison of socio-demographic background in the Southern Appalachian region survey with the 1990 Census.

Socio-demographic background	1990 Census	Southern Appalachian Survey
	(percent of respondents)	
Gender		
Male	48.3	39.3
Female	51.7	60.7
Residence		
A farm	2.1	8.9
A rural area	54.0	58.8
Suburb	15.9	18.4
City	27.8	14.1
Education levels		
Less than high school	25.8	12.4
High school graduate	23.2	28.4
Some college	13.4	26.2
College graduate	6.8	21.4
Post-graduate	3.3	11.6
Household income		
Under \$15,000	30.3	16.5
\$15,000 - \$24,999	20.2	18.2
\$25,000 - \$34,999	17.0	20.1
\$35,000 - \$44,999	12.3	14.0
\$45,000 - \$54,999	7.9	12.4
More than \$55,000	12.3	10.7

(Source: Southern Appalachian Region Residents Survey, joint study between USDA Forest Service and University of Georgia, Athens, GA)

Regional analysis: Of the 12 environmental behaviors, only 4 significantly differed between the four subregions. In all cases, Southern Mountain and Piedmont subregion respondents were most likely to watch tv shows about the environment, write or call a public official, subscribe to environmental publications, and (along with respondents of the Northern Ridge and Valley subregion) contribute money to environmental groups.

Socio-demographics. Table 2.21 compares socio-demographic variables from our survey with the 1990 census. Discrepancies between the sample data and the population data exist because of the quota-sampling procedure used in our survey. Respondents to our survey were more likely to be female and have higher education and income levels than the 1990 census.

Question 6:

With particular emphasis on tourism and extractive and other resource-dependent industries, what are the important economic trends in the Southern Appalachians?

Key Findings

The Southern Appalachian Economy During the 1980s

Between 1977 and 1991, the economy in the Southern Appalachians grew more slowly than the economy of the seven states that include the study region. Industrial output in the region grew 42 percent during those 15 years, while output in the seven-state area grew 54 percent. Employment grew 65 percent in the Southern Appalachians, but 76 percent in the seven-states. Slower growth in the region is probably a result of its predominately rural character.

Economic Gains to Individuals Were Significant

Real per-capita income in the study area increased by 1.9 percent per year between 1970 and 1980. The increase from 1980 to 1990 was less than 1 percent per year. Concomitantly, poverty declined dramatically during the 20 years since 1970. The proportion

of families below the poverty level decreased from 20 percent in 1970 to 11 percent in 1990. Unemployment in 1990 also was lower than in the 1980s. Having had a large share of its employment in manufacturing has seemed to make the region more vulnerable to general economic contractions in earlier decades. The unemployment rate by 1990 decreased to about 5.6 percent, a rate that today is considered "full employment."

The Region's Economy is Now More Diversified

Growth in real wages in the region was 25 percent over the 14 years between 1977 and 1991. Real wages in the surrounding seven-state area increased 27 percent over this period. Very slow growth in real wages plagued the entire national economy during the last decade.

The Southern Appalachian economy also became more diversified between 1972 and 1991 with manufacturing's share of industrial output decreasing from 52 to 40 percent. Still, manufacturing's share of the region's economy is relatively high. For the nation as a whole, manufacturing represents only about 19 percent of the total economy's output. The service and trade sectors grew significantly in the region, adding diversity and stability.

The increased diversity of the regional economy will make business recessions and related increases in unemployment less severe. Community cohesion could rise because shocks to the economy will be less traumatic. People generally will have more money for leisure activities.

Data and Methods of Analysis

Industries in the region were grouped by 2-digit SIC codes to create the 10 basic sectors of the region's economy. Particular attention was given to extractive and manufacturing industries directly linked to natural resources, such as mining, forest products and wood-products manufacturing, as well as to services and other indirectly linked industries. Significant timber- and mining-dependent areas were identified. Trends were tracked for employment, employee compensation, and industrial output data from 1977 to 1991. Relative shares of the economy were calculated and contrasted between time periods to establish trends. Data were obtained from the Forest Service IMPLAN input-output system.

Detailed Results of the Analysis: Economic Trends, 1970-1990

Between 1977 and 1991, the region's economy became less reliant on manufacturing and more dependent on services and trade. This increase in industry diversity should have helped to stabilize the region's economy. Such trends may at the same time have resulted in growth of low-wage jobs at a pace faster than is typical of manufacturing jobs.

The three economic variables chosen to measure trends in economic activity are: (1) employee compensation, (2) employment, and

Table 2.22 Percentage shares of employment, employee compensation and total industrial output across 10 sectors of the Southern Appalachian region economy, 1977 and 1991.

Major Sectors	Employment		Employee Compensation		Total Output	
	1977	1991	1977	1991	1977	1991
Agriculture, forestry & fisheries	1.8	3.6	0.8	0.6	3.0	3.3
Mining	1.4	0.6	3.6	1.1	3.4	2.9
Construction	7.6	7.4	8.8	6.6	8.0	9.2
Manufacturing	35.8	22.6	38.4	30.4	52.2	39.8
Transportation, communication, & utilities	3.7	3.8	5.4	5.2	5.3	5.8
Wholesale & retail trade	14.8	20.4	11.6	15.2	8.9	9.6
Finance, insurance, & real estate	3.0	5.2	3.3	4.6	8.4	8.8
Services	15.3	21.6	11.4	19.1	9.2	13.3
Government enterprises	14.7	13.8	16.2	16.9	1.5	7.0
Special industries	1.9	1.0	0.6	0.3	0.0	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

Table 2.23 Average annual wages by industrial sector for the Southern Appalachian region and the seven-state region, 1991.

Aggregated Sector	Average Annual Wage	
	Southern Appalachian Region	Seven Surrounding States
Agriculture, forestry & fisheries	\$10,700	\$13,400
Mining	41,000	44,700
Construction	21,100	22,400
Manufacturing	26,300	28,200
Transportation, communication, & utilities	28,900	33,100
Wholesale & retail trade	15,600	17,600
Finance, insurance, & real estate	16,000	17,600
Services	21,500	22,800
Government enterprises	22,800	25,100
Special industries	6,100	6,500
Overall Average	21,100	22,700

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

(3) value of total industrial output. All dollar values are in 1991 dollars. Table 2.22 contrasts the economy between 1977 and 1991 across 10 broad sectors and shows each sector's share of employment and output.

Mining and manufacturing's share of the economy decreased across all three measures of economic activity (employment, employee compensation, and total industrial output). In the agriculture, forestry, and fisheries sector, total output and employee compensation barely increased between 1977 and 1991. Employment in the agricultural sector is not comparable between 1977 and 1991 because 1977 data do not include self-employed persons. Percentages of the region's total output from construction, services, and government enterprises rose substantially from 1977 to 1991. Outputs from agriculture, transportation, communication, utilities, and finance remained relatively constant.

Manufacturing lost more of its share of the economy than any other sector. In absolute terms, its share decreased from 36 to 23 percent of total employment, from 38 to 30 percent of employee compensation, and from 52 to 40 percent of total output.

Services and wholesale and retail trade increased their shares of the economy significantly. Their shares of employment increased by 7 and 5 percent, respectively. Their shares of employee compensation increased by 8 and 3 percent, but their shares of total output increased by only 4 and less than 1 percent, respectively.

In addition to the percentage distribution of the economy across the 10 sectors, total dollar amounts of employee compensation and output between 1977 and 1991 were examined for the region and for the surrounding seven-state area.

Whereas overall industrial output increased 42 percent between 1977 and 1991 for the Southern Appalachian region, output in the surrounding seven states increased 54 percent. Employee compensation increased by 25 percent in the Southern Appalachians, but by 27 percent in the seven surrounding states. Similarly, employment increased 65 percent in the region compared with 76 percent in the seven-state area.

Among all sectors, the services, trade, finance, and transportation sectors grew the most. Although manufacturing grew moderately in employment and output, it actually decreased in real value of output after adjustment for inflation.

Table 2.23 shows 1991 average wages and salaries for employees and proprietors, both for the Southern Appalachians and for the seven surrounding states. The 1991 average income was \$21,000 for the Southern Appalachians and \$22,700 for the surrounding states. The mining sector had the highest average wage in the region at \$41,000. Transportation, communications, and utilities was the second highest, but much lower than mining, at \$28,900. Manufacturing was third at \$26,300. Data for calculating average sectoral wages for 1977 were not available.

Table 2.24 Shares of Southern Appalachian region employment, employee compensation, and total industrial output by wood products sectors, 1977 and 1991.

	Employment		Employee Compensation		Total Industrial Output	
	1977	1991	1977	1991	1977	1991
Wood Products Sector	(percent of economy)					
Primary wood products	0.9	0.7	0.9	1.1	1.5	1.4
Secondary wood products	3.4	2.7	3.2	3.1	3.7	3.8
Total	4.3	3.4	4.1	4.2	5.2	5.2

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

The Wood-Products Industry

Between 1977 and 1991, the shares of total Southern Appalachian economic output contributed by primary and secondary wood processing industries remained almost constant (table 2.24).

While their share of regional employee compensation increased, the employment share dropped from 1977 to 1991. Shares of employment dropped significantly because other sectors of the economy grew at faster rates during these years.

Even though regionwide shares largely remained constant or dropped, table 2.25 shows that all three measures of economic activity increased between 1977 and 1991 in the wood using industries. Although wood

manufacturing output grew faster in the secondary industries, employee compensation in primary industries increased almost twice as fast as the secondary industries. Employment grew at about the same rate for primary and secondary wood manufacturing.

Counties were identified as timber-significant if 80 percent or more of their total land area was in timberland or national forest (fig. 2.26). Table 2.26 compares employment, employee compensation, and industrial output from 1977 to 1991 for wood-products industries in the three timber-significant areas thus identified in the region. As in the whole region, wood-products manufacturing's shares of the economies of the three timber-significant areas declined between 1977 and 1991.

Table 2.25 Value of and change in economic activity in Southern Appalachian region wood manufacturing sectors, 1977-1991.

Industry Sector	1977 (million \$)	1991 (million \$)	Change (%)
Primary Wood Manufacturing:			
Employment	16,992	21,916	29
Total industrial output	2,106	2,898	38
Employee compensation	453	662	46
Secondary Wood Manufacturing:			
Employment	66,101	86,160	30
Total industrial output	5,340	7,696	44
Employee compensation	1,513	1,844	22

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

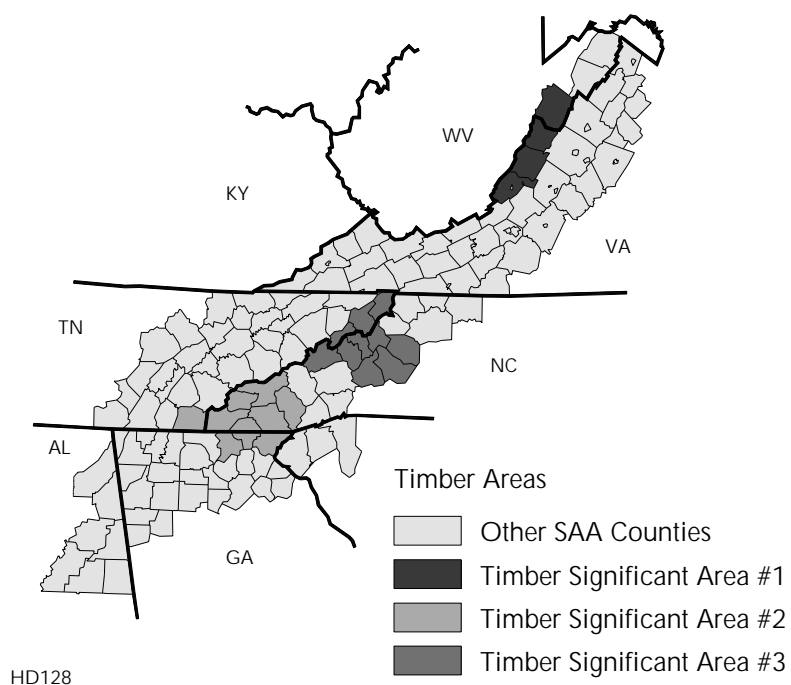


Figure 2.26 Timber Significant Areas in the Southern Appalachians (Source: USDA Forest Service, Southern Research Station). Three timber significant areas, those in which timberland comprised 80 percent or more of the land, were found in the region.

Table 2.26 Wood products as shares of the economies of the Southern Appalachian region as a whole of the three timber-significant areas, 1977 and 1991.

Wood Products Sectors and Timber-Significant Areas	Employment		Employee Compensation		Total Industrial Output	
	1977	1991	1977	1991	1977	1991
	(percent of economy)					
Primary Wood Products Manufacturing						
Area 1	2.5	1.9	2.3	1.6	3.5	3.2
Area 2	1.7	0.9	1.4	1.0	2.1	1.3
Area 3	1.1	0.7	0.8	0.6	1.0	0.7
Region	0.9	0.7	0.9	1.1	1.5	1.4
Secondary Wood Products Manufacturing						
Area 1	0.2	1.0	0.1	2.0	0.2	2.4
Area 2	4.3	2.0	4.6	2.5	4.3	3.4
Area 3	19.4	12.8	20.4	14.7	19.4	12.2
Region	3.4	2.7	3.2	3.1	3.7	3.8
Total Wood Products Manufacturing						
Area 1	2.7	2.9	2.4	3.6	3.7	5.6
Area 2	6.0	2.9	6.0	3.5	6.4	4.7
Area 3	20.5	13.5	21.2	15.3	20.4	12.9
Region	4.3	3.4	4.1	4.2	5.2	5.2

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

Table 2.27 Employment, employee compensation and output from wood manufacturing in three timber-significant areas and in the Southern Appalachian region, 1977-1991.

	Employment			Employee Compensation			Output		
	1977 (number)	1991	Change (%)	1977 (million \$)	1991	Change (%)	1977 (million \$)	1991	Change (%)
Primary Wood Manufacturing									
Area 1	123	235	91	2.3	3.3	43	10.8	22.9	112
Area 2	588	657	12	10.1	10.4	3	50.0	51.1	2
Area 3	913	1,098	20	13.7	17.0	24	62.9	75.6	20
Region	16,992	21,916	46	453.0	662.0	46	2106.0	2898.0	38
Secondary Wood Manufacturing									
Area 1	11	121	1100	.1	4.0	4000	0.6	17.7	2950
Area 2	1,485	1,401	-6	34.0	25.4	-25	104.3	130.1	25
Area 3	16,833	20,264	20	369.1	401.3	9	1189.7	1389.3	17
Region	66,101	86,160	30	1513.0	1844.0	22	5340.0	7696.0	44

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

Table 2.27 shows real economic changes from 1977 to 1991. Real growth in wood-products manufacturing was greater in the Southern Appalachians as a whole than in timber-significant areas 2 and 3. Area 1 had substantial growth, but values of output for both years were much smaller than for the other two areas. Between 1977 and 1991, employment and employee compensation declined in area 2.

Between 1977 and 1991, mining's share of the region's economy decreased (table 2.28). While mining's shares decreased for employment (from 2.0 to 1.1) and employee compensation (from 5.8 to 2.0), its share of output (5.6 percent) remained constant between 1977 and 1991.

A further analysis identified 23 counties in which mining provides a significant payroll. Even in the counties with significant mining activity, mining as a share of the economy was

small. Coal mining, the most significant of the mining industries, decreased in these counties as a percentage from 1977 to 1991. Coal mining output decreased by 50 percent.

Tourism is not a recognizable separate economic sector. Rather, it is a consumer activity that affects several industrial sectors. The following sectors were assumed to be tourism related: hotels, amusement services, air travel, bus and taxi services, retail trade, restaurants, gas stations, and services such as laundry and auto rental. Dr. Gordon McClung of West Virginia University has estimated the percentage of business stimulated by tourism within each of the above sectors. These percentages were used to estimate direct tourism effects for the region and are reported in table 2.29. The estimates do not capture the full effects of tourism throughout all sectors of the economy.

Table 2.28 Percent of regional total employment, industrial output, and employee compensation in mining, 1977 and 1991.

Economic Measure	Share of Regional Total	
	1977	1991
Variable:		
Employment	2.0	1.1
Total industrial output	5.6	5.6
Employee compensation	5.8	2.0

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

Table 2.29 Trends in direct employee compensation, employment, and total industrial output for tourism industries in the Southern Appalachian region, 1977 and 1991.

	Totals		Trend (%)	Percent of the Region's Economy	
	1977 (million \$ and jobs)	1991		1977 (%)	1991 (%)
Employee Compensation (wages)	710	631	-11	1.5	1.1
Total Industrial Output (dollars)	1,889	1,643	-13	1.3	0.8
Employment (jobs)	31,742	63,115	99	1.6	2.0

(Source: ES202 Data, 1993, Bureau of Labor Statistics, U.S. Department of Labor; County Business Patterns, 1993, Bureau of the Census, U.S. Department of Commerce; Regional Economic Information System (REIS), 1993, Bureau of Economic Analysis, U.S. Department of Commerce; Bureau of Economic Analysis (estimates) and other surveys, 1993, U.S. Department of Commerce)

Tourism's direct share of Southern Appalachian regional employee compensation and output decreased between 1977 and 1991 (table 2.29). Total employee compensation and industrial output decreased by 11 and 13 percent, respectively, in real dollars. Meanwhile, numbers of employees, many of them part-time or seasonal, doubled.

Question 7:

What are the status of and the priorities for management of private land by non-industrial owners in the region?

Key Findings

Forested and Cultivated Private Land Have Decreased Slightly

The Southern Appalachian region encompasses over 37 million acres, just under 75 percent of which is rural and privately owned. Of these 28 million private acres, almost 19 million are in forest. Forested private land in the region has declined by about 220,000 acres since 1982. Pasture and cropland have decreased. Developed acreage, on the other hand, has increased by more than 600,000 acres.

Agriculture, Forestry, and Recreation Are Major Reasons for Owning

More than three-fourths of private forest land is owned by individuals. Corporations, partnerships, clubs and associations own the remainder. As expected, agriculture and timber harvesting are the overwhelming primary

commodity uses of private undeveloped land. Recreation is the dominant noncommodity use. Raising livestock, recreation, enjoyment of a rural lifestyle, and having green space are most often listed as important reasons for owning land in the Southern Appalachians.

Earning Income is Not a High Priority on Private Lands

Income-earning potential of private, non-industrial forest land in the Southern Appalachians appears to be limited. More than half of owners reported either a net loss or no income from activities on their property. About 30 percent said they earned in excess of \$5,000. Many more owners place higher priority on the natural condition of their land than on making money from it. Generally, Southern Appalachian owners are environmentally oriented. Their attitudes are much like those of the general populace as reported in answer to Question 5.

Data and Methods of Analysis

Two primary and two secondary sources of data were analyzed to describe private owners and their holdings in the Southern Appalachians. The primary sources were two mail surveys of private landowners across the United States. The extensive questionnaires covered a variety of issues related to land ownership use and priorities. Responses returned from Southern Appalachian landowners were used from each study.

The first primary source was the 1995 National Private Land Ownership Study (NPLOS) developed in Athens, GA, by the Forest Service, Forestry Sciences Laboratory

and the University of Georgia. The NPLOS database includes information on a sample of private rural landowners in the Southern Appalachians. The second primary source was the 1994 National Private Forest Lands Study developed by the Forest Service at the Northeastern Forest Experiment Station at Radnor, PA. These data describe owners of private forest land and contain a sample of 520 owners in the region.

The secondary data sources included

the 1992 National Resources Inventory (NRI) developed by the Natural Resources Conservation Service, formerly the Soil Conservation Service. The NRI, conducted every 5 years, describes rural, nonfederal land and land uses. The Forest Service's FIA data describe the nation's forest lands. Data are updated periodically, one state at a time. County-level data were used from all of the above data sets.

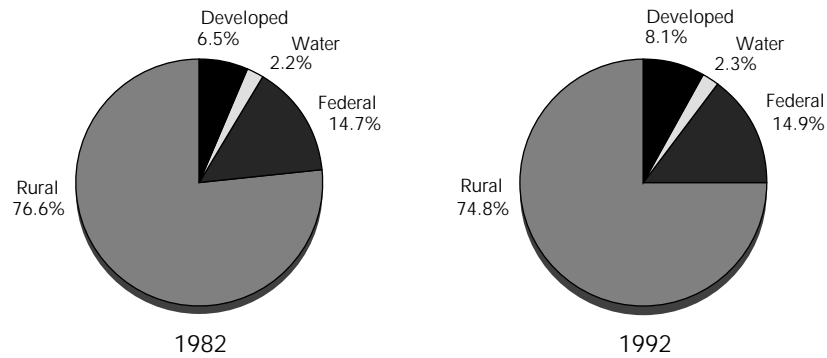


Figure 2.27 Percentage of land distribution in Southern Appalachian region, 1982 and 1992. (Source: 1992 National Resources Inventory, Natural Resources Conservation Service, USDA)

Table 2.30 Surface areas of nonfederal and federal land and water in the Southern Appalachian region, 1982, 1987, and 1992 (thousands of acres).

Year	Federal Land	Water Area	Nonfederal Land			Total Area
			Developed	Rural	Total	
1982	5,499.6	836.3	2,425.6	28,692.2	31,117.8	37,453.7
1987	5,522.0	840.6	2,726.5	28,364.6	31,091.1	37,453.7
1992	5,567.3	846.3	3,042.1	27,998.0	31,040.1	37,453.7

(Source: 1992 National Resources Inventory, Natural Resources Conservation Service, USDA)

Table 2.31 Current status and trends in Southern Appalachian region lands, 1992.

Region	Developed (million acres)	Change Since 1982 (%)	Rural, Nonfederal (million acres)	Change Since 1982 (%)	Total (million acres)
Blue Ridge	897.9	26.9	7,778.0	-2.9	10,864.8
Southern Ridge & Valley	1,142.4	24.8	10,140.3	-2.3	12,928.1
Southern Mountains & Piedmont	732.1	26.5	6,089.3	-2.7	8,134.6
Region Totals	3,042.1	25.4	27,998.0	-2.4	37,453.7

(Source: 1992 National Resources Inventory, Natural Resources Conservation Service, USDA).

Results of the Analysis

Current Status of Private Rural Land

The region's 135 counties contain over 37 million acres (58,521 square miles) an area roughly the size of Georgia. Rural, private land accounts for nearly three-fourths of that area (fig. 2.27). This proportion is down from almost 77 percent in 1982, a decrease of about 694,000 acres. Federal holdings increased slightly over that 10-year period, but the greatest gain was in urban and developed land. The NRI defines developed land as small to large urban and other built-up areas, including both urban and rural roads. Developed areas increased by about 617,000 acres, a 25-percent increase between 1982 and 1992 (table 2.30).

The growth of developed land and the concurrent decline in private rural acreage was most pronounced in the Blue Ridge subregion, followed closely by the Southern Mountain and

Piedmont subregion. Table 2.31 describes the status of private rural land across the four subregions in 1992.

Over two-thirds of the private rural acreage of the region is forested (fig. 2.28). The proportions of land in forest, crops, and pasture have changed little since 1982. However, total acreages in both rural forest and cropland declined during this period because of development (table 2.32). Cropland acreage dropped by almost 300,000 acres, more than the loss of just over 200,000 acres of forest land. The loss of cropland was 12.4 percent, while the loss of forest was 1.1 percent. The loss of cropland was particularly severe in the Blue Ridge and Southern Mountain and Piedmont subregions, where development pressures have been particularly high. Rates of change in those two subregions were more than double those of the other two subregions. The decline in forest land was also proportionally greater in these two subregions.

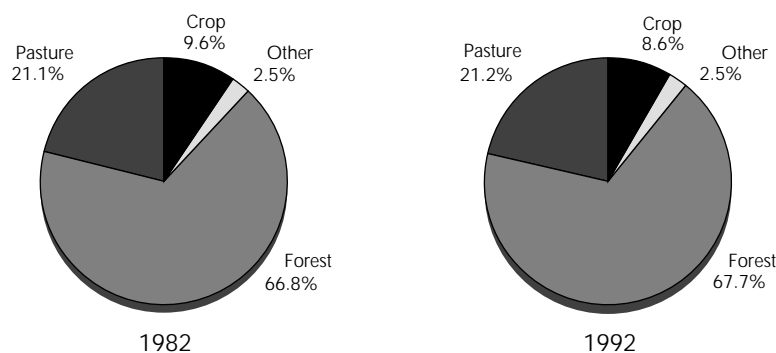


Figure 2.28 Percent of nonfederal rural land in the Southern Appalachian region by type of cover or use, 1982 and 1992. (Source: 1992 National Resources Inventory, Natural Resources Conservation Service, USDA)

Table 2.32 Current status and trends in cover and use of nonfederal rural land in Southern Appalachian subregion, 1990.

Subregion	Acreage by Type of Use						Total (million)
	Crop (million)	Change Since 1982 (%)	Pasture (million)	Change Since 1982 (%)	Forest (million)	Change Since 1982 (%)	
Northern Ridge & Valley	470.7	-7.2	925.1	-6.8	2,464.7	0.8	3,990.4
Blue Ridge	666.1	-18.0	1,537.8	-1.3	5,408.6	-1.7	7,778.0
Southern Ridge & Valley	880.1	-7.2	2,567.7	-0.4	6,439.4	-0.9	10,145.3
Southern Mountains & Piedmont	389.4	-18.6	914.5	-1.9	4,642.4	-1.9	6,089.3
Total	2,406.3	-12.4	5,945.1	-1.9	18,955.1	-1.1	28,003.0

(Source: 1992 National Resources Inventory, Natural Resources Conservation Service, USDA)

Table 2.33 Acreage and percentage of nonfederal rural land by type of use and primary and secondary designation, 1992.

Type of Land Use	Acreage in Primary Use		Acreage in Secondary Use	
	(million)	(% of total)	(million)	(% of total)
Agricultural	27,393.8	95.0	3,108.7	23.8
Recreation	471.7	1.6	9,844.7	75.2
Reserved, dedicated	399.6	1.4	12.4	0.1
Business/commercial	390.2	1.4	54.1	0.4
Transportation	122.2	0.4	25.4	0.2
Residential	57.0	0.2	36.1	0.3
Waste	9.8	0.0	6.1	0.0
Region total	28,844.3	100.0	13,087.5	100.0

(Source: 1992 National Resources Inventory, Natural Resources Conservation Service, USDA)

Both primary and secondary uses of rural private land are of interest (table 2.33). As expected, agriculture (including timber harvesting) is the overwhelming commodity use of private land in the Southern Appalachians. Owners list it as a use across 95 percent of ownerships. More than 75 percent reported recreation as an important use. Agricultural use of private land varies little across the four subregions. Recreational use, however, varies from a high of 83.5 percent in the Southern Mountain and Piedmont subregion to a low of 67.7 in the Northern Ridge and Valley.

The priorities for using and managing private tracts depend heavily on their size, which varies by subregion (table 2.34). Almost 60 percent of tracts in the region as a whole are between 20 and 100 acres, but the Northern Ridge and Valley and the Southern Mountain and Piedmont subregion have proportionally fewer of these smaller tracts and proportionately more tracts of 100-499 acres. Across the region, only about 7 percent of tracts are larger than 500 acres.

People have many reasons for owning land and an individual owner will typically have more than one reason. From the 1995 NPLOS,

the most popular reasons identified by sampled Southern Appalachian owners were raising livestock for sale (45 percent), personal recreation opportunities (41 percent), living in a rural environment (35 percent), enjoying my own green space (35 percent), and eventually selling all or part of the land at a profit (32 percent) (table 2.35). Least popular reasons were making money from leasing or charging fees for recreation, growing crops or hay for sale, and having a second home site. A seemingly important 25 percent listed "providing recreation opportunity for others" as important.

Significantly more owners in the Southern Ridge and Valley and Southern Mountain and Piedmont subregions, relative to the rest of the region, listed enjoying their own green space and living in a rural environment as important. Significantly more owners in the Northern Ridge and Valley and Blue Ridge subregions listed providing recreation for others, making an estate for heirs, and growing timber for sale as important reasons for ownership (table 2.35).

About as many owners have sold some of their land (20 percent) as have added acreage (19 percent) since their original purchase or inheritance. However, in the Blue Ridge

Table 2.34 Distribution of ownerships by size of tract in subregion of the Southern Appalachian region, 1985.

Subregion	Size of Tract (in acres)		
	<100	100-499	500+
	(percent)		
Northern Ridge & Valley	53.6	37.9	8.4
Blue Ridge	70.4	20.9	8.7
Southern Ridge & Valley	62.0	33.9	4.1
Southern Mountains & Piedmont	51.4	43.3	5.2
Regionwide	59.9	33.4	6.7

(Source: 1985 National Private Landowners Survey, USDA Forest Service, Outdoor Recreation and Wilderness Assessment Group, Athens, GA)

Table 2.35 Reasons given for owning land in the Southern Appalachian region, 1995.

Reasons for Owning ¹	Subregions		
	Entire Region	Northern Ridge and Valley and Blue Ridge	Ridge & Valley and Southern Mountain
	(percent of sample)		
Renting dwellings or mobile homes	15.8	17.2	15.0
Having a "second" home site	7.6	9.4	6.7
I inherited the land	9.2	9.4	9.2
Enjoying my own green space	34.8	28.1	38.3
Having a tax shelter	8.2	9.4	7.5
Personal recreation opportunities	40.8	43.8	39.2
Eventually selling all or part of my land at a profit	32.1	29.7	33.3
Providing recreation opportunities for others	25.0	32.8	20.8
Making money from leasing or otherwise charging fees for hunting, fishing, or other recreation	2.7	1.6	3.3
Providing a place for wildlife	20.7	20.3	20.8
Making an estate for heirs	25.0	34.4	20.0
Living in a rural environment	35.3	32.8	36.7
Growing crops or hay for sale	7.6	6.3	8.3
Raising livestock for sale	44.6	42.2	45.8
Growing landscaping shrubbery for sale	12.0	14.1	10.8
Growing nursery trees; Christmas trees for sale	9.8	14.1	7.5
Growing timber for sale	12.5	17.2	10.0

¹Respondents were instructed to circle as many choices as applied. For this reason, percentages do not sum to 100.

(Source: 1995 National Private Land Owner Survey Study, USDA Forest Service, Outdoor Recreation and Wilderness Assessment Group and the University of Georgia, Dept. of Agriculture & Applied Economics, Athens, GA)

subregion, significantly more have added acreage (27 percent) than have sold acreage (22 percent), and in the Ridge-Valley and Southern Mountain and Piedmont subregions more have sold acreage (20 percent) than have added acreage (15 percent).

Over one-third of owners (36 percent) post some or all of their land to inhibit trespass. More post in the Blue Ridge subregions (44 percent) than in the other two subregions (32 percent). However, significantly more owners in the two Blue Ridge subregions (18 percent),

relative to the other subregions (8 percent), allow others outside their family to use their land for recreation. Similarly, only 19 percent of owners in the Blue Ridge subregions completely close some or all of their land to public access, whereas 29 percent of Southern Ridge and Valley and Southern Mountain and Piedmont subregion owners completely close their land to access.

Across the region, more owners plan to decrease than to increase access in the future (8 versus 4 percent). Significantly more owners

Table 2.36 Percentage of owners in the Southern Appalachian region undertaking wetland conservation activities the last 12 months.

Type of Activity	Subregions		
	Total Region ¹	Blue Ridge ²	Ridge & Valley and Southern Mountains ³
Preserving wetlands, such as marshes, swamps, etc.	23.5	40.0	16.7
Restoring wetlands by closing drainage systems	7.7	0.0	9.1
Creating wetlands through dams or water diversions	21.4	33.3	18.2
Receiving state or federal assistance for protecting wetlands	13.3	0.0	18.2
I have not undertaken any wetland activities ⁴	96.6	94.7	97.5

¹number of respondents = 168

²number of respondents = 57

³number of respondents = 111

⁴These numbers reflect the total of each sample that did not partake in any wetland conservation activity. Numbers higher in the table, represent percentages for that group of people that did participate in wetland conservation activity.

(Source: 1995 National Private Land Owner Survey Study, USDA Forest Service, Outdoor Recreation and Wilderness Assessment Group and the University of Georgia, Dept. of Agriculture & Applied Economics, Athens, GA)

will allow more access in the Blue Ridge subregion (18 percent) in the Southern Ridge and Valley and Southern Mountain and Piedmont subregions (3 percent).

Some owners have undertaken wetland conservation activities (table 2.36). Twenty-four percent have taken steps to preserve natural wetlands, 8 percent have closed drainages, 21 percent have created wetlands with dams or diversions, and 13 percent have received government assistance for specific treatments. Large subregional differences exist. Blue Ridge owners are more active in protecting and creating wetlands.

Environmental attitudes have much to do with land use. Among the region's owners, many (82 percent) agree or strongly agree with the statement that, "The balance of nature is very delicate, so we must try to limit economic growth that exploits nature." Fewer (49 percent) agree that "People must rule over nature. Plants and animals are here for our use." In general, more owners in the Blue Ridge subregion strongly agree with limiting economic growth, than in the other subregions, and more Blue Ridge owners than other owners strongly disagree with ruling over nature.

Consistent with the above environmental positions, greater percentages of owners will emphasize the natural makeup of their land in the future (41 percent) than will emphasize making money from their land (19 percent). There are few subregional differences in future plans involving natural versus income outcomes.

Private Landowners

Over the entire region, 79 percent of owners have held title to their tract for more than 10 years, and 39 percent have owned for more than 30 years. On average, owners in Blue Ridge and Southern Appalachian subregions have owned their land for longer periods than those in Northern Ridge and Valley and the Southern Ridge and Valley subregions.

Personal characteristics of owners are revealing. Eighty three percent of sample respondents are male, 93 percent are Caucasian, average age is 61 years, average household size is 2.8 persons, and over three-fourths are married. Owners in the Northern and Blue Ridge subregions average 5 years older than owners in the other two subregions.

Forty-four percent have an annual household income of \$30,000 or more; 16 percent have an income of less than \$10,000 (in 1985 dollars). Nearly 23 percent of owners across the four subregions have not completed high school; 53 percent have completed at least some college. Only 3 percent have attempted any graduate college work in the Southern Mountain and Piedmont subregion. Over 26 percent have completed some graduate study in the Southern Ridge and Valley subregion. Almost one-half (49 percent) of owners across the entire region live on their land, but in the Northern and Blue Ridge subregions, only 42 percent live on their land.

Most owners earn very little income from production activities on their land. Only 15 percent of owners earn more than \$5,000 per year from their land (fig. 2.29). Over half either make no income or face a net loss. These

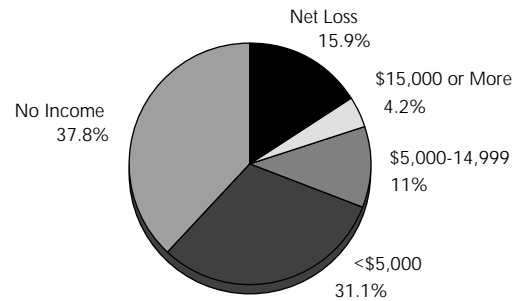


Figure 2.29 Income earning from private, non-industrial lands in the Southern Appalachian region. (Source: 1985 National Private Landowners Survey, Outdoor Recreation and Wilderness Assessment Group, USDA Forest Service, Athens, GA)

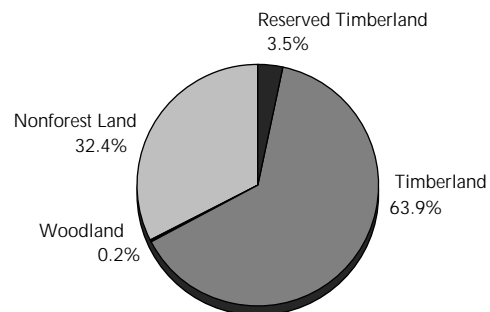


Figure 2.30 Percent distribution of land types in the Southern Appalachian region. (Source: Forest Inventory and Analysis, 1994, USDA Forest Service, Southern Research Station, Asheville, NC)

percentages vary substantially among the subregions. More owners in the northern and southernmost subregions earn over \$5,000 per year from their land. Interestingly, owners in these two subregions also more frequently report net losses.

Private Forest Land

Over two-thirds of the Southern Appalachian region's roughly 37 million acres are forested (fig. 2.30). The vast majority of this forest is classified as timberland, which includes land that is not legally reserved for a specific nontimber use (i.e., wilderness or national parks) and land that is capable of growing commercial timber crops. Woodland is forested land that is not sufficiently productive to grow commercial crops of timber. Only

3.5 percent of the region's land is held in reserve and just 0.2 percent is classified as woodland. The Southern Ridge and Valley subregion, and to a lesser extent the Northern Ridge and Valley, have lower proportions of forest land than the rest of the Southern Appalachian region. As one might expect, concentrations of forest land are located at higher elevations, where more national forest or public land is present.

The three major types of forest ownerships in the region are public, forest industry, and nonindustrial private. Of the 23.5 million acres of timberland in the Southern Appalachians, nearly three-quarters are in nonindustrial private ownership (fig. 2.31). Further, about four times as much forest land is in public ownership (20.8 percent) as is in forest industry ownership

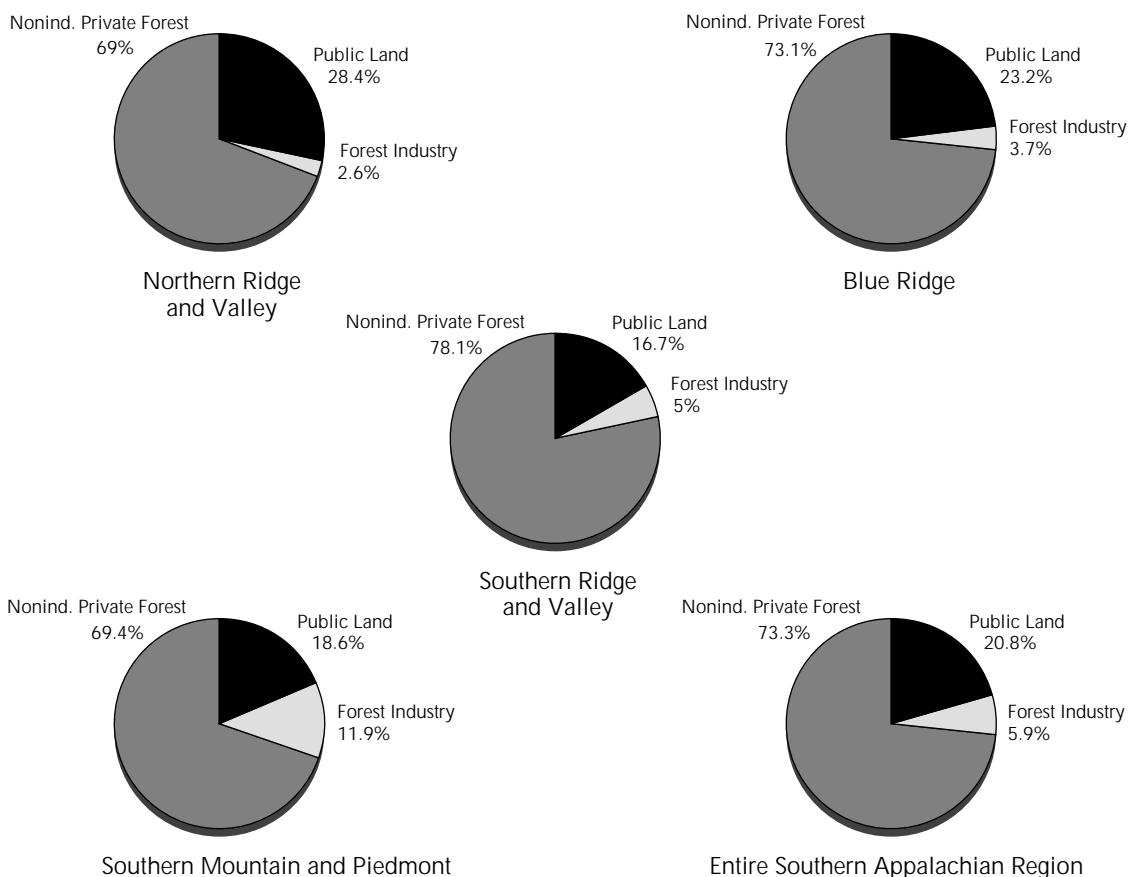


Figure 2.31 Distribution of timberland ownerships, by subregion. (Source: Forest Inventory and Analysis, 1994, USDA Forest Service, Southern Research Station, Asheville, NC)

(5.9 percent). The Southern Mountain and Piedmont subregion has more than twice the percentage of forest industry land as any other region. The Southern Ridge and Valley subregion holds the greatest share of nonindustrial private land, and the Northern Ridge and Valley leads in public land with over 28 percent. Figures 2.32 (a-c) show the distribution of these land classifications across every county in the region. Further

information on the status of private forest land in the region is given in figure 2.33. The 1994 Private Forest Lands Study echoes the FIA finding that approximately 75 percent of forest is in individual private ownerships. Oak-pine and oak-hickory forest types dominate across all but the Southern Mountain and Piedmont subregion, where loblolly-shortleaf pine is the most common species.

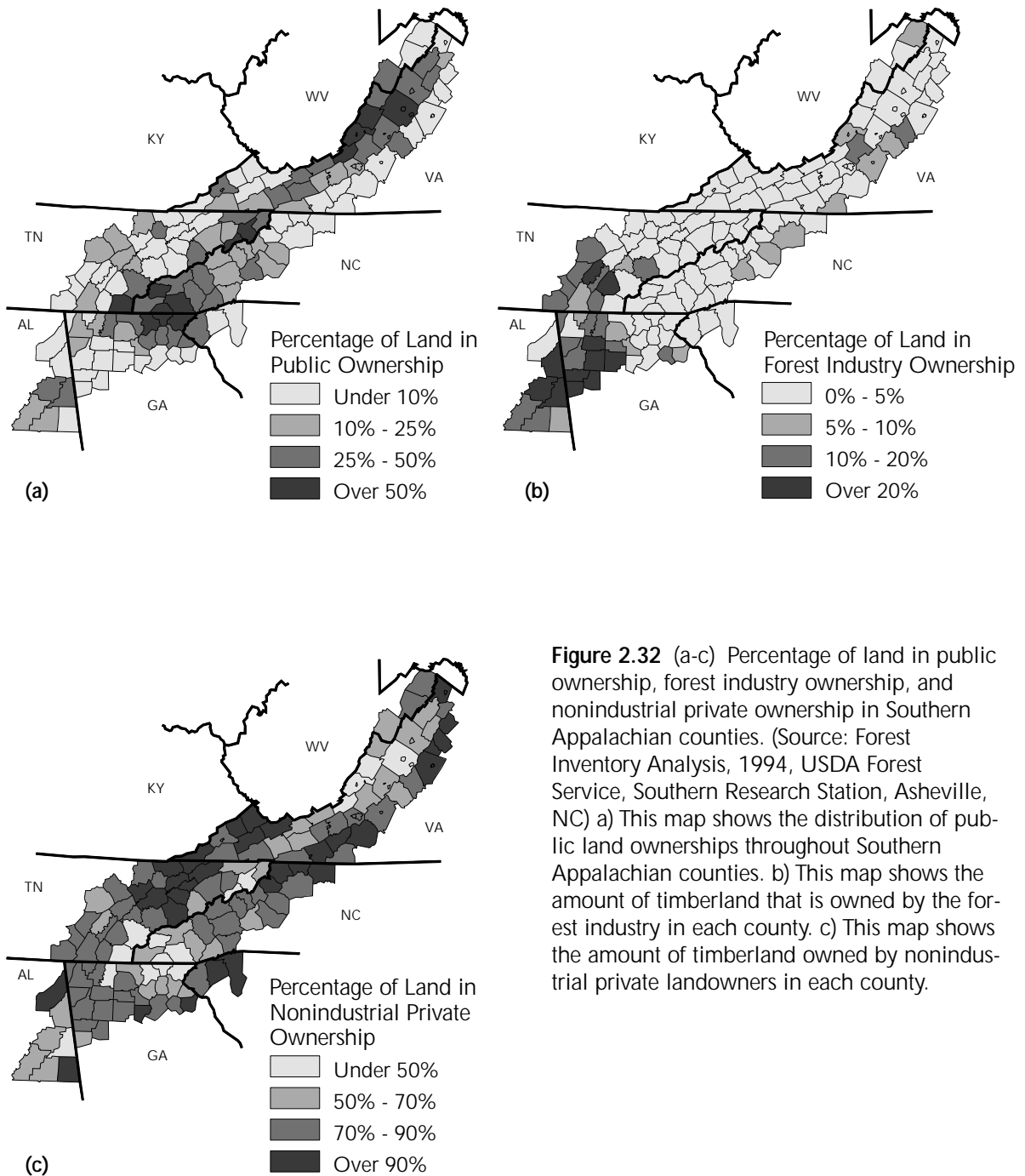


Figure 2.32 (a-c) Percentage of land in public ownership, forest industry ownership, and nonindustrial private ownership in Southern Appalachian counties. (Source: Forest Inventory Analysis, 1994, USDA Forest Service, Southern Research Station, Asheville, NC) a) This map shows the distribution of public land ownerships throughout Southern Appalachian counties. b) This map shows the amount of timberland that is owned by the forest industry in each county. c) This map shows the amount of timberland owned by nonindustrial private landowners in each county.

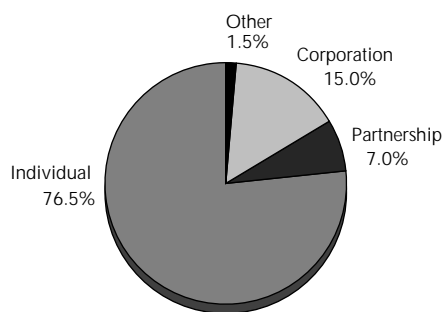


Figure 2.33 Forms of ownership of forest land (total acres), 1994. (Source: 1994 Private Forest Lands Study, T.W. Birch, USDA Forest Service, Northeast Research Station)

Almost two-fifths of private forest owners said the “enjoyment of owning” their land was the primary benefit they most expected over the next 10 years (table 2.37). Twenty-two percent of owners see their land increasing in value and other substantial percentages listed farming or domestic use and recreation as key benefits. In terms of total acres owned, land value gains emerged as the most important future benefit. Enjoyment of ownership still ranked high, but timber production jumped to the third most important expected benefit, reflecting the responses of forest industry.

Private Land Near Public Land

For forest planning and other purposes pertaining to public land, it is important to understand nearby private land. To address this need in part, private land in counties with public land was analyzed separately. Eighty-four of the 135 counties in the region contain national forest land. The NPLOS had 80 respondents and the National Private Forest Lands Survey had 308 owners in these counties.

More than half (58 percent) of these owners possess tracts smaller than 100 acres, while only 6 percent own properties larger than 500 acres. Personal recreation and enjoyment (73 percent) and living in a rural environment (66 percent) were the highest-rated ownership objectives. Just under 40 percent of landowners have owned their property for more than 30 years. This result is partly a function of the mean age of respondents (58 years).

Respondents were also largely male (88 percent), white (94 percent), and married (90 percent). One-third of respondents earned under \$20,000 in 1985 annual household income. About 18 percent earned over \$50,000 that year. One-fifth of respondents reported a net loss of income from their land in 1985. One-third said they received no income from their land and just under 19 percent earned more than \$5,000. The remainder earned less than \$5,000.

Table 2.37 Primary ownership benefit expected in the next 10 years for private ownership units and acres of private forest land.

Expected Benefit	Owners (thousands)	Share of Owners (%)	Area (million acres)	Share of Acreage (%)
Land value increase	178.5	22.1	4.9	26.4
Recreation	106.3	13.2	2.5	13.3
Timber production	18.1	2.	3.5	18.9
Farm/domestic use	118.3	14.6	1.9	10.3
Enjoyment of owning	307.6	38.1	4.1	22.1
Firewood	31.5	3.9	0.5	2.7
Other	21.4	2.6	0.7	3.9
No answer	26.0	3.2	0.5	2.5
Total	807.7	99.9	18.6	100.1

(Source: 1994 Private Forests Lands Study, USDA Forest Service, Northeastern Forest Experiment Station, Radnor, PA)

The Timber Economy of the Southern Appalachians

Forests and their use have strongly shaped the landscape and culture of the Southern Appalachians. Wood has been vital for subsistence and commerce in the region for many years. Practically all of the region's forests have been harvested at least once since the mid-1800s, and an industry based on continued timber growth and production from second-growth forests thrives today.

Forests in the region, however, have long been valued for their aesthetic qualities, their protection of watersheds, and their ability to prevent floods. Aesthetic returns from tourism and recreation are crucial to a region that contains the Great Smoky Mountains and Shenandoah national parks and the Blue Ridge Parkway. The values of clean water and of recreation increase as the urban areas downstream from the Southern Appalachians grow and as the composition and management of forests change.

The value of developed land in the region also is growing rapidly. The South is one of the fastest growing regions of the United States, and the Southern Appalachian area is one of the fastest growing parts of the South. The study area has been favored for retirement over the last 20 years. As a result, development has reduced the forested area and changed the ownership profile of forests. Shifting demographics and other factors portend important changes in the timber economy of the Southern Appalachians.

This chapter broadly examines current timber markets and their influence on the economy of the Southern Appalachians. It focuses on the extent, quality, and ownership of forest resources and factors that influence their use. It also examines the employment and income that are derived from the forest products industries in the region. It focuses especially on the role of national forests in the region's timber markets, offering a view of national forest production in the context of the entire landscape of the region.

Overview of Questions

Our approach to the assessment of the Southern Appalachian timber economy is rooted in questions posed by natural resource agencies and discussed with people of the region. The questions that follow helped organize the analysis and focus our response.

- 1. What are the supplies of and demands for wood products in the Southern Appalachians?**
- 2. Where and how does the wood-products industry depend on National Forest System timber in the Southern Appalachians?**
- 3. What are the relationships among timber production, employment, and income in the Southern Appalachians?**
- 4. What national forest land is tentatively suitable for timber production in the region and how can assessment findings be incorporated in further analysis of timber suitability?**

The Setting

Cultural, biological, and topographic conditions vary widely in this region stretching from northern Virginia to northeastern Alabama. Its forests cover 24.9 million acres, of which 95 percent (23.6 million acres) is considered timberland (fig. 3.1a). Forests clearly dominate the landscape.

In the northernmost part of this area, oak species dominate. Chestnut oak is the most prevalent species, but select white, select red, and other red oak species represent significant components of the inventory. In northern

The individuals, corporations, and government agencies that manage land in the Southern Appalachians vary widely in their goals and approaches to timber management. Of the 23.6 million acres of timberland in the region, roughly 20 percent is owned by the public and 80 percent is privately owned (fig. 3.1b). Forest industry controls 6 percent, farmers control 19 percent, other corporations control 10 percent, and other individuals control 45 percent of the area's timberland. While nonindustrial private landowners have many objectives, ranging from tree farming to sites for second homes, they provide a majority of the

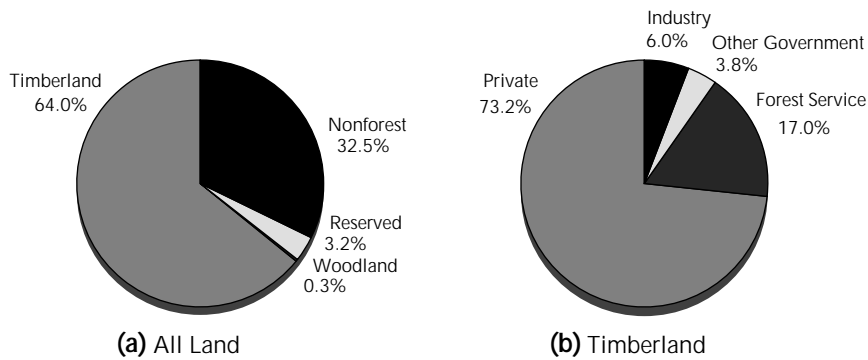


Figure 3.1 Ownership of timberland in the Southern Appalachian area. (Source: USDA Forest Service, Eastwide Database, Hansen and others, 1992)

Georgia, Virginia pine, chestnut oak, non-select red oaks, yellow-poplar, and shortleaf pine represent significant shares of the forest inventory. In eastern Tennessee, non-select white oaks and red oaks, Virginia pine, and yellow-poplar predominate. One feature of the region is high species diversity. More species of trees are native to the Southern Appalachians than to any other northern temperate region of the globe.

This diversity complicates the region's timber markets. A stand normally contains a whole array of potential forest products. Depending on species and size, sawtimber values can range from less than \$100 to more than \$800 per thousand board feet, and markets for these different products do not necessarily move together. Occurrence in the same stands, however, binds these varied markets together in subtle but important ways. For example, the presence of high-quality sawlogs yields cost advantages for producing lower value products like pulpwood.

timber supply throughout the Eastern United States. However, their production behavior is notoriously difficult to predict.

Government agencies hold 20.8 percent (4.9 million acres) of the timberland in the region. While this share is small compared to that in parts of the Western United States, it is the highest concentration of public lands in the Southern United States. More than 4 million acres are managed by the USDA Forest Service. The federal share of timberland in Southern Appalachian counties ranges up to 69 percent. In such counties, the federal government can very strongly influence local timber production.

The Southern Appalachians support a vast and varied mosaic of biota, land uses, land ownerships, and management approaches. Local differences, therefore, may be as important as trends for the region as a whole. Some factors affect the timber economy throughout the region (for example, national housing markets), but others are felt in only

parts of the region (for example, urban sprawl in northern Georgia). In the analyses that follow we attempt to capture both regional and small-scale factors.

Question 1:

What are the supplies of and demands for wood products in the Southern Appalachians?

Key Findings

Markets are strong for both the highest and the lowest quality timber in the region. As a result, we anticipate upward pressure on prices for these products and pressures for substituting medium grade timber material either up (e.g., more demand for grade 2 sawlogs in appearance applications) or down (e.g., more demand for grade 3 sawlogs as pulpwood) in quality applications. We anticipate that increasing population pressure could restrict supplies and have a broad influence on timber markets. National forests and forest policy may strongly influence the markets for the highest value timber and may have a disproportionate influence on production in specific parts of the Southern Appalachians.

These findings may represent an emerging opportunity for forest management in some areas. Production of high-quality timber often requires considerable stand improvement work, which is often economically unfeasible. Strengthened markets for pulpwood-sized material may improve the economics of commercial thinnings, thereby improving the economics for eventually producing more high-quality timber in the Southern Appalachians.

Key findings from our assessment of timber markets are:

- Total timber production has generally been stable to expanding in the Southern Appalachians. The only area to experience a decline is the Northern Ridge and Valley Subregion. The subregion with the highest growth in output is the Southern Ridge and Valley.
- Sawlog production has been relatively stable for the Southern Appalachian region as a whole. However, hardwood

sawlog production has fallen somewhat in the Northern Ridge and Valley and Blue Ridge subregions.

- Pulpwood production has grown in the Southern Appalachians. While pulpwood output declined in the Northern Ridge and Valley, it expanded strongly in the other three subregions especially in the Blue Ridge. As a result, the pulpwood share of timber output increased between 1983 and 1990 from 49 to 53 percent.
- Spatial evaluation of timber production indicates that the biggest shift towards pulpwood production is occurring in southwestern North Carolina and southeastern Tennessee.
- Softwood sawlog production is dominated by yellow pines, but there is a significant component of white pine now being produced in the Blue Ridge.
- While more than 17 species comprise hardwood sawlog production, only three species groups represent 69 to 85 percent of production: yellow-poplar, red oaks, and white oaks.
- Composite board material represents an important emerging industry in the Southern Appalachians. The area with the greatest growth in the composite board production is southwestern Virginia, a region with historically low pulpwood production levels.
- Prices for the highest quality hardwood sawlogs have risen over the last 20 years while prices for low-quality sawlogs have fallen. It appears that high-quality logs are becoming more scarce and that the ability to substitute lower quality logs in production is limited.
- The prices of softwood sawlogs have been more volatile. Prices recently climbed to unprecedented levels in the Southern Mountain and Piedmont subregion demonstrating its connection to broader markets in the South and nation.
- While 17 percent of timberland is held by the Forest Service, the agency manages 21 percent of all sawtimber, 27 percent of the grade 1 sawtimber, and 44 percent of the grade 1 select red oak sawtimber. The Forest Service and policies that control its timber production therefore can have an important impact on some timber markets in the assessment area.

- A comparison of growth, removals, and mortality indicates that total timber inventories expanded between the two most recent forest surveys. Net growth was highest on private lands.
- Total softwood inventories declined on private land in the assessment area, with all of the decline occurring in the Southern Mountain and Piedmont subregion. Net hardwood growth was strong throughout the subregion.
- Slope and cost profiles indicate that not all timber inventories are equally accessible. Access costs may be prohibitive on a large share of timberland. In general, the national forests are located on more severe and costly terrain, partially explaining differences in their timber production.
- Demand appears to remain strong for high quality appearance applications of hardwood sawtimber, but has softened for medium to low grade sawtimber. The most important contributing factor is a very recent drop in the production of shipping pallets.
- Demand for the lowest grade materials – mainly pulpwood but also some composite board material – appears to be expanding across a larger share of the region. As demand has expanded, so have pulpwood procurement zones.
- Growth in demand for composite board material is mainly concentrated in areas where pulpwood production has not been high.

Introduction

Timber supply and demand are complex relationships that bind forest landowners and wood-products firms together in timber markets. Timber supply is not simply the quantity of timber produced but is the relationship between the quantity sellers offer and the price. Timber demand is not simply the price of timber but is the relationship between the quantity demanded by wood-products manufacturers and price. Several other factors influence supply and demand as well. For example, private timber supply is strongly influenced by competing demands for forest land. In addition, shifting consumer preferences in housing,

furniture, and packaging are constantly redefining timber demands. The interaction of supply and demand defines markets, and market-clearing quantities of output and timber prices.

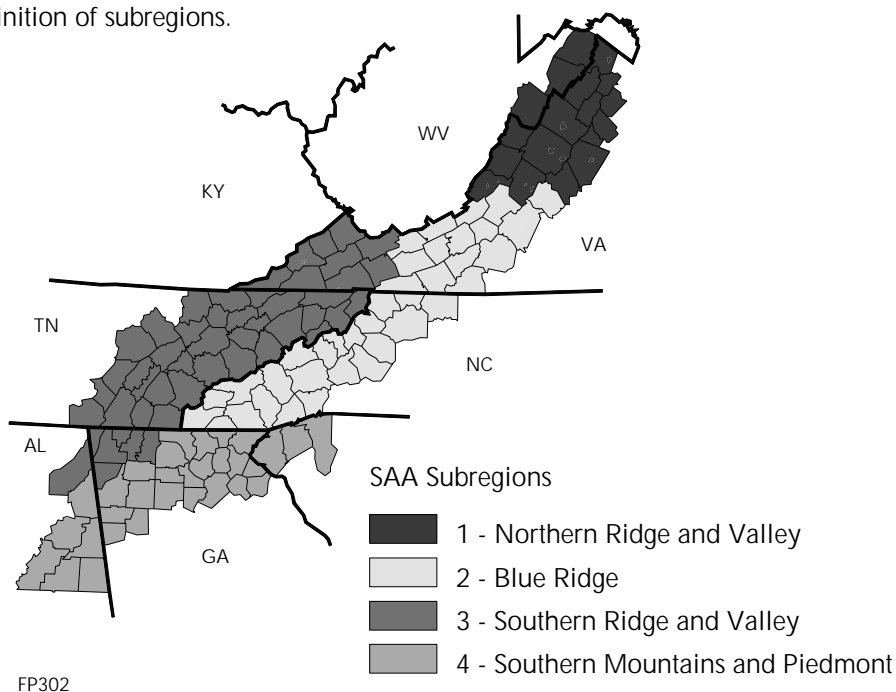
Timber from the Southern Appalachians is exchanged in several markets. Southern portions of the region produce large quantities of softwood sawtimber to manufacture structural lumber. The central and northern portions of the region produce hardwood sawtimber for both aesthetic uses e.g., furniture, cabinets, and flooring and industrial uses e.g., shipping pallets. Throughout the Southern Appalachians, low-quality timber is used to make paper and packaging material. All these markets, along with smaller but still important markets for composite board material and veneer logs, define perhaps the most complex interaction of timber markets in the United States.

While the region's timber is traded in several markets, it is also clear that the Southern Appalachians do not represent a complete market area for any of their timber products. The market for red oak, for example, extends from the Southern Appalachians into Ohio, Pennsylvania, and West Virginia, and pulpwood markets extend into the Piedmont regions of the South. In most cases, we do not anticipate countervailing trends in adjacent regions, so trends observed in the Southern Appalachians are generally indicative of the markets in general.

The complexity of market interactions, along with a general scarcity of data, limit our ability to definitively describe supply and demand relationships. Instead, our approach must be to study various supply and demand indicators using the best available data. We begin by examining the quantities of timber that have been produced in the region and their prices. These quantities and prices define the ultimate outcome of supply and demand interactions and, taken together, provide insights into the relative strength of supply and demand. We then examine various external factors that may strongly influence future supplies and demands of timber in the Southern Appalachians.

Throughout this analysis, we present results first for the region as a whole and then for four subregions shown in figure 3.2. These subregions were defined primarily by economic

Figure 3.2 Definition of subregions.



areas defined by the Department of Commerce, Bureau of Economic Analysis. Boundaries were modified in some cases to coincide with state lines and ecoregions.¹ Results for subregions highlight important differences within the Southern Appalachians. Beyond the subregion level, we then present results at the county or ranger district level where possible. Analysis at this level highlights the spatial patterns of market activity.

Timber Production

Our starting point for examining timber markets in the Southern Appalachians was simply to measure the amounts and types of timber being produced. Timber production data help to define (1) the amount and mix of forest products being produced in the region, (2) spatial patterns of timber production, and (3) the evolution of timber production over time.

There is no single source of timber production data for this region. We, therefore, had to assemble the results of various surveys of wood-products manufacturers to develop a county-by-county accounting of timber outputs. Because these surveys were conducted at

different intervals and for different products, we could define production for all counties only in 1983, 1986, 1989, and 1992. For Regions 1, 2, and 4 we also report production in 1980. We report sawlog and pulpwood production by softwoods and hardwoods. These products account for 80 to 90 percent of total timber output for the entire area. For parts of the region where data were available, we also report the production of veneer logs and composite board.

Quantities of Sawlogs and Pulpwood

Total production estimates (fig. 3.3) show a diverse portfolio of outputs from the region. Total timber production was relatively strong between 1983 and 1992, with the total output of sawlogs and pulpwood ranging from 403 to 435 million cubic feet (mmcf) (table 3.1 and fig. 3.3). Roughly equal volumes of pulpwood and sawtimber were produced. About 53 percent of the products were derived from softwoods, and the remaining 47 percent were produced from hardwoods.

While total output of sawlogs and pulpwood was relatively stable between 1983 and 1989, it grew roughly 8 percent from 403 mmcf

¹ Subregion 1 generally corresponds to Washington, DC, and Staunton, VA, Bureau of Economic Analysis (BEA) areas, Subregion 2 to Roanoke/Lynchburg, Winston-Salem, and Asheville areas, Subregion 3 to Chattanooga, Knoxville, and Johnson City areas, and Subregion 4 to Atlanta and Greenville areas.

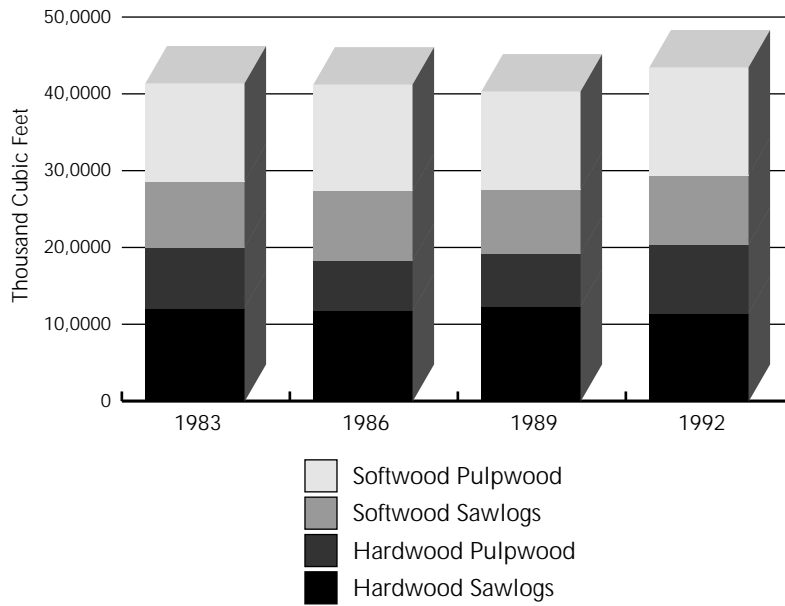


Figure 3.3 Sawlogs and pulpwood produced in the Southern Appalachian area. (Source: Timber Product Output and pulpwood surveys conducted by the USDA Forest Service, severance tax records in Alabama, and sawlog consumption surveys in Tennessee)

Table 3.1 Production of sawlogs and pulpwood (thousand cubic feet) by hardwoods and softwoods for the Southern Appalachian area, 1980, 1983, 1986, 1989, and 1990.

Subregion/Year	Hardwood			Softwood			Grand Total
	Sawlogs	Pulpwood	Total	Sawlogs	Pulpwood	Total	
Northern Ridge and Valley							
1980	18,132	12,074	30,206	2,657	5,279	7,936	38,142
1983	21,148	26,323	47,471	2,097	10,838	12,935	60,406
1986	20,700	11,282	31,982	4,045	3,647	7,692	39,674
1989	18,295	11,248	29,543	2,523	4,685	7,207	36,750
1992	17,780	11,051	28,831	2,982	4,749	7,731	36,562
Blue Ridge							
1980	38,464	17,153	55,617	22,131	9,548	31,679	87,296
1983	58,942	22,960	81,902	27,388	12,724	40,112	122,014
1986	50,800	23,902	74,702	27,245	13,746	40,991	115,693
1989	57,689	27,678	85,367	25,180	25,079	50,259	135,626
1992	49,182	30,566	79,748	25,991	21,645	47,636	127,384
Southern Ridge and Valley							
1980	NA	NA	NA	NA	NA	NA	NA
1983	29,130	18,270	47,400	18,463	34,587	53,050	100,450
1986	33,802	17,722	51,524	18,377	44,643	63,020	114,544
1989	35,685	15,884	51,569	21,295	41,528	62,823	114,392
1992	33,983	23,250	57,233	19,389	42,369	61,758	118,991
Southern Mountains and Piedmont							
1980	13,317	8,541	21,858	38,563	78,541	117,104	138,962
1983	12,399	11,376	23,775	38,164	68,858	107,022	130,798
1986	12,636	12,328	24,964	41,382	75,941	117,323	142,287
1989	12,014	13,775	25,789	34,943	55,653	90,596	116,386
1992	13,515	24,909	38,424	41,967	71,207	113,174	151,598
Total Assessment Area							
1980	NA	NA	NA	NA	NA	NA	NA
1983	121,619	78,929	200,548	86,113	127,007	213,120	413,668
1986	117,938	65,234	183,172	91,049	137,977	229,025	412,197
1989	123,683	68,585	192,268	83,941	126,945	210,885	403,154
1992	114,460	89,776	204,236	90,329	139,970	230,298	434,535

NA = not available

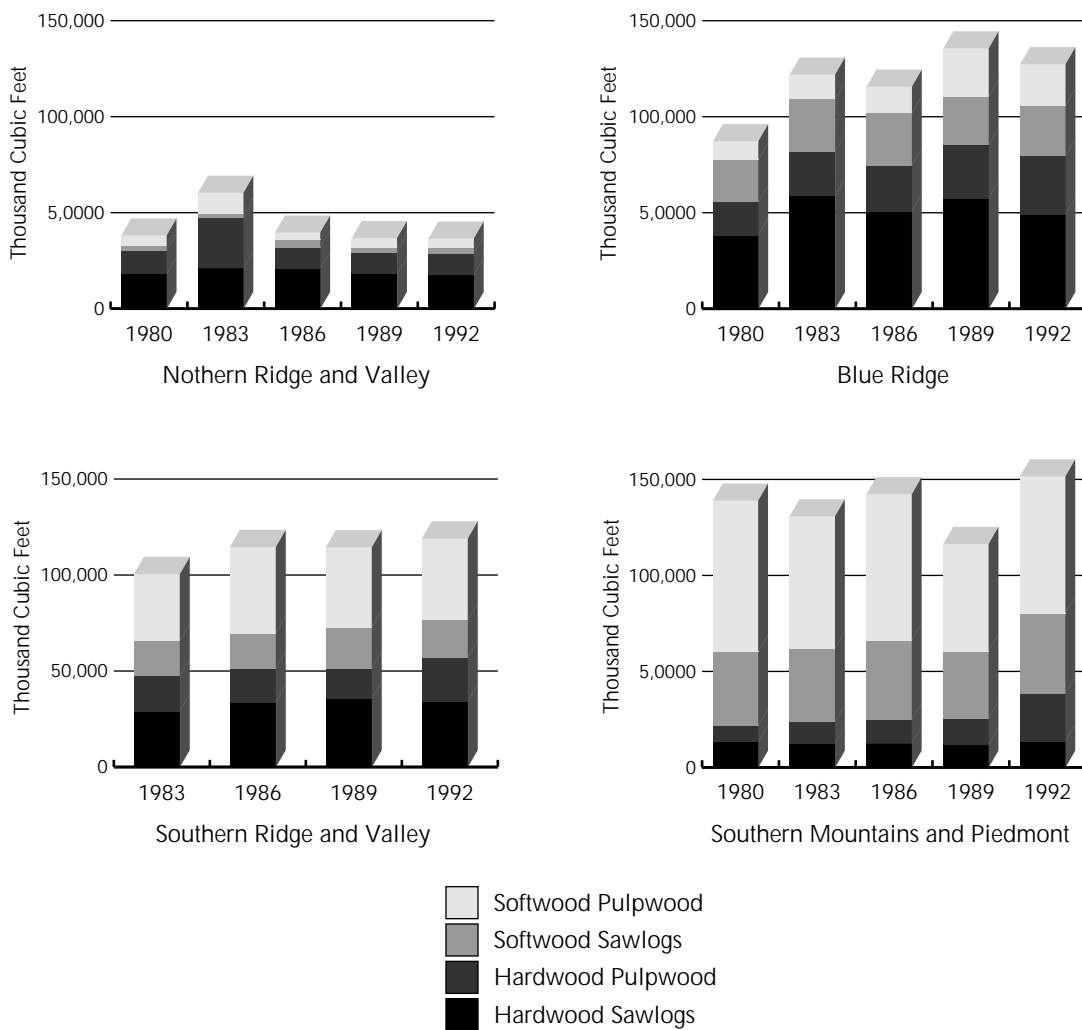


Figure 3.4 Sawlogs and pulpwood produced by subregion within the Southern Appalachian area. (Source: Timber Product Output and pulpwood surveys conducted by the USDA Forest Service, severance tax records in Alabama, and sawlog consumption surveys in Tennessee)

to 435 mmcf between 1989 and 1992. All of this output growth was explained by a 17 percent rise in pulpwood production, primarily hardwood pulpwood (fig. 3.3). In contrast, sawlog production fell by about 2 percent during this period. As a result, pulpwood's share of total output grew from 49 to 53 percent between 1989 and 1992.

Changes in subregions were considerably larger than those observed for the region as a whole. For example, while the region's production expanded by 5 percent between 1983 and 1992 (see fig. 3.3), production fell by about 38 percent in Subregion 1 but grew by 4, 19, and 16 percent in Subregions 2, 3, and 4, respectively (fig. 3.4). Additional information can be developed by examining production changes in each of the subregions.

Subregion 1: Northern Ridge and Valley.

The Northern Ridge and Valley subregion includes the 18 northernmost counties in the Southern Appalachian Assessment (SAA) area. Here, hardwoods dominate timber inventories, and softwoods represented only 20 percent of production in 1992. Sawlog production makes up about 57 percent of timber production, and was relatively stable in the region between 1980 and 1992. In contrast, pulpwood production expanded substantially between 1980 and 1983 but then fell by a nearly equal amount between 1983 and 1986. Total production declined between 1980 and 1992 in the Northern Ridge and Valley subregion.

Subregion 2: The Blue Ridge. The Blue Ridge Subregion includes the North Carolina portion of the assessment area along with

Table 3.2 Average annual sawlog removals (million board feet) by species for the four subregions and assessment area as a whole.

	Subregion 1		Subregion 2		Subregion 3		Subregion 4		Total	
	volume	(%)	volume	(%)	volume	(%)	volume	(%)	volume	(%)
Softwoods										
Longleaf-slash pines	0	0.00		0.00		0.00	16.3	3.55	16.3	1.62
Shortleaf-loblolly pine	6.5	14.51	35.6	12.34	115.2	53.98	341.1	74.22	498.4	49.53
Other yellow pines	32.4	72.32	73.5	25.49	83.1	38.94	72.5	15.77	261.5	25.99
Eastern white-red pines	5.9	13.17	163.3	56.62	7.8	3.66	25.2	5.48	202.2	20.10
Spruce-balsam fir	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Eastern hemlock	0	0.00	15.1	5.24	4.3	2.02	4.5	0.98	23.9	2.38
Other softwoods	0	0.00	0.9	0.31	3	1.41	0	0.00	3.9	0.39
Total softwoods	44.8		288.4		213.4		459.6		1006.2	
Yellow pine		86.83		37.83		92.92		93.54		77.14
White pine		13.17		56.62		3.66		5.48		20.10
Other		0.00		5.55		3.42		0.98		2.76
Hardwoods										
Select white oaks	27.2	20.56	30.4	6.72	24	6.68	45.5	18.99	127.1	10.74
Select red oaks	21.3	16.10	54.1	11.97	31	8.63	9.2	3.84	115.6	9.77
Other white oaks	21.6	16.33	58.1	12.85	40.2	11.19	23.8	9.93	143.7	12.14
Other red oaks	19.6	14.81	77.6	17.16	64.2	17.86	57.7	24.08	219.1	18.51
Hickories	5.4	4.08	15.4	3.41	32.9	9.15	14.2	5.93	67.9	5.74
Yellow birch	0	0.00	0.4	0.09	2.1	0.58	0	0.00	2.5	0.21
Hard maples	1.1	0.83	0	0.00	12.7	3.53	0	0.00	13.8	1.17
Soft maples	5.3	4.01	33.7	7.45	15.3	4.26	7.1	2.96	61.4	5.19
Beech	0	0.00	3.2	0.71	6	1.67	0.5	0.21	9.7	0.82
Sweetgum	0.6	0.45	0	0.00	2.3	0.64	11.1	4.63	14	1.18
Tupelos-blackgum	1.5	1.13	3	0.66	4.3	1.20	0.2	0.08	9	0.76
Ashes	0	0.00	2.4	0.53	5.5	1.53	1.7	0.71	9.6	0.81
Basswood	2.4	1.81	0.8	0.18	6.8	1.89	0	0.00	10	0.85
Yellow poplar	21.7	16.40	150.7	33.33	88.8	24.71	57	23.79	318.2	26.89
Black walnut	1.6	1.21	4.8	1.06	2.9	0.81	0	0.00	9.3	0.79
Other soft hardwoods	2	1.51	5.9	1.31	16.9	4.70	6.8	2.84	31.6	2.67
Other hard hardwoods	1	0.76	11.6	2.57	3.5	0.97	4.8	2.00	20.9	1.77
Total hardwoods	132.3		452.1		359.4		239.6		1183.4	
Select oaks		36.66		18.69		15.30		22.83		20.51
Other oaks		31.14		30.02		29.05		34.02		30.66
Yellow poplar		16.40		33.33		24.71		23.79		26.89
Subtotal		84.20		82.04		69.06		80.63		78.05
Total	177.1		740.5		572.8		699.2		2189.6	
Softwood share	25.30		38.95		37.26		65.73		45.95	

(Source: Eastwide Database, core table no. 21. Forest inventories are conducted in different states in different years, so the table does not have a consistent time period)

several counties in Virginia. Here, hardwoods comprise 63 percent of output. Total output expanded by 40 percent between 1980 and 1983 but leveled off thereafter. Since 1983, sawlog production steadily declined while the production of both softwood and hardwood pulpwood increased considerably. Between 1980 and 1992, output of softwood pulpwood nearly doubled, while output of hardwood pulpwood expanded by more than 75 percent.

Subregion 3: Southern Ridge and Valley. This subregion extends from southwestern Virginia to northeastern Alabama and includes eastern Tennessee. Softwoods accounted for 52 percent of total output, and pulpwood made up 55 percent of output in 1992. While sawlog and softwood pulpwood production were relatively stable from 1980 to 1992, hardwood pulpwood production was much more variable. Hardwood pulpwood output declined somewhat between 1980 and 1989, but then rose 44 percent between 1989 and 1992.

Subregion 4: Southern Mountain and Piedmont. This subregion includes northern Georgia and parts of Alabama and South Carolina. Here, softwoods comprise 74 percent of the product mix. Softwood production in this subregion varied considerably. While a relatively minor part of the product mix, hardwood sawlog production was relatively stable. In contrast, hardwood pulpwood production grew steadily between 1980 and 1992.

Taken together, production data for these subregions indicate at least stable, and in some cases expanding, timber markets. Total output has grown in all subregions except the Northern Ridge and Valley. This growth has not, however, been spread across all products. Instead, sawlog production has been generally stable, while pulpwood production, especially from hardwoods, has grown.

Species Distribution of Sawlogs

The species of a log plays a large part in determining its market value. It is therefore important to know something about the species composition of timber production, especially for sawlogs. Because our production data were not split out by species, we examined the species distribution of sawlogs produced in the region, using timber removal records from the Forest Service Eastwide Database (Hansen and others 1992). These records provide estimates

of the volume of sawtimber harvested by species for the most recent forest survey in each state. Thus, they represent different years in different states and do not permit estimates of trends.

For the area as a whole, the softwood and hardwood shares of sawtimber removals are 46 and 54 percent, respectively. The timber production data discussed above show roughly the same split between softwoods and hardwoods. The softwood:hardwood ratio increases from north to south within the assessment area (table 3.2).

Softwood production is dominated by yellow pines, which account for 77 percent of regional softwood production. White pine represents an additional 20 percent, while all other softwoods comprise only 3 percent. Yellow pine accounts for 93 percent of softwood production in Subregions 3 and 4 and 87 percent in Subregion 1. In Subregion 2, however, 57 percent of the softwood produced is white pine. This subregion alone produces about 80 percent of the white pine sawtimber in the Southern Appalachians.

Hardwood production is spread over 17 species and species groups. However, three species groups red oaks, white oaks, and yellow-poplar account for nearly 80 percent of hardwood sawtimber removals in the region (fig. 3.5). Oaks alone account for about 52 percent of production. No species outside of these three groups accounts for more than 9 percent of sawtimber production in any of the subregions. The sum of red and white oaks and yellow-poplar accounts for 81 to 84 percent of hardwood sawtimber removals for Subregions 1, 2, and 4. In Subregion 3, they account for 69 percent of hardwood sawtimber output.

Spatial Distribution of Production

To further examine the spatial distribution of timber harvests in the Southern Appalachians, we mapped the production of sawlogs and pulpwood per acre of timberland on a county-by-county basis for the years 1983 and 1992 (figs. 3.6 and 3.7). Increasingly dark shades indicate increasing rates of pulpwood production in units of 1,000 cubic feet per 1,000 acres of timberland (mcf/ma). In 1983, pulpwood production was concentrated in five distinct portions of the assessment area:

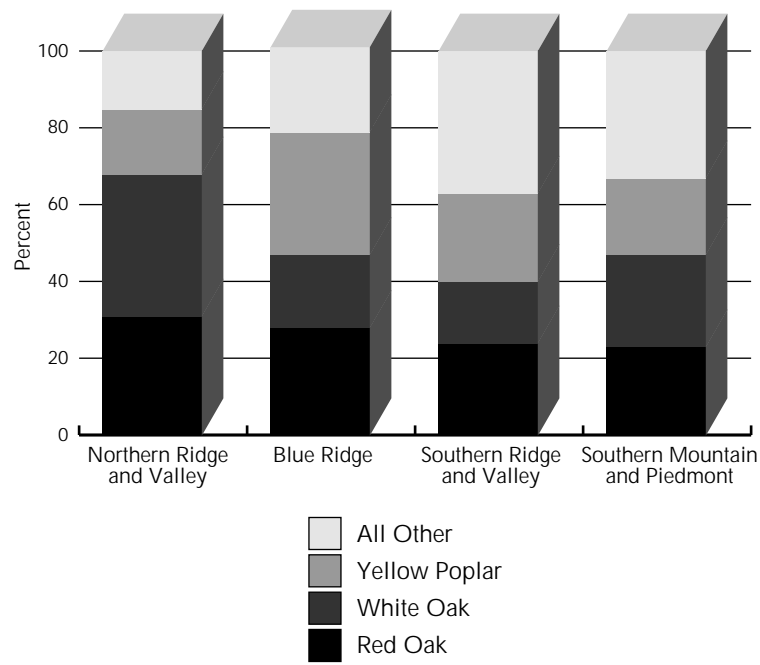


Figure 3.5 Species distributions of sawtimber removed by subregion and for the Southern Appalachian area as a whole. (Source: USDA Forest Service, Eastwide Database, Hansen and others, 1992)

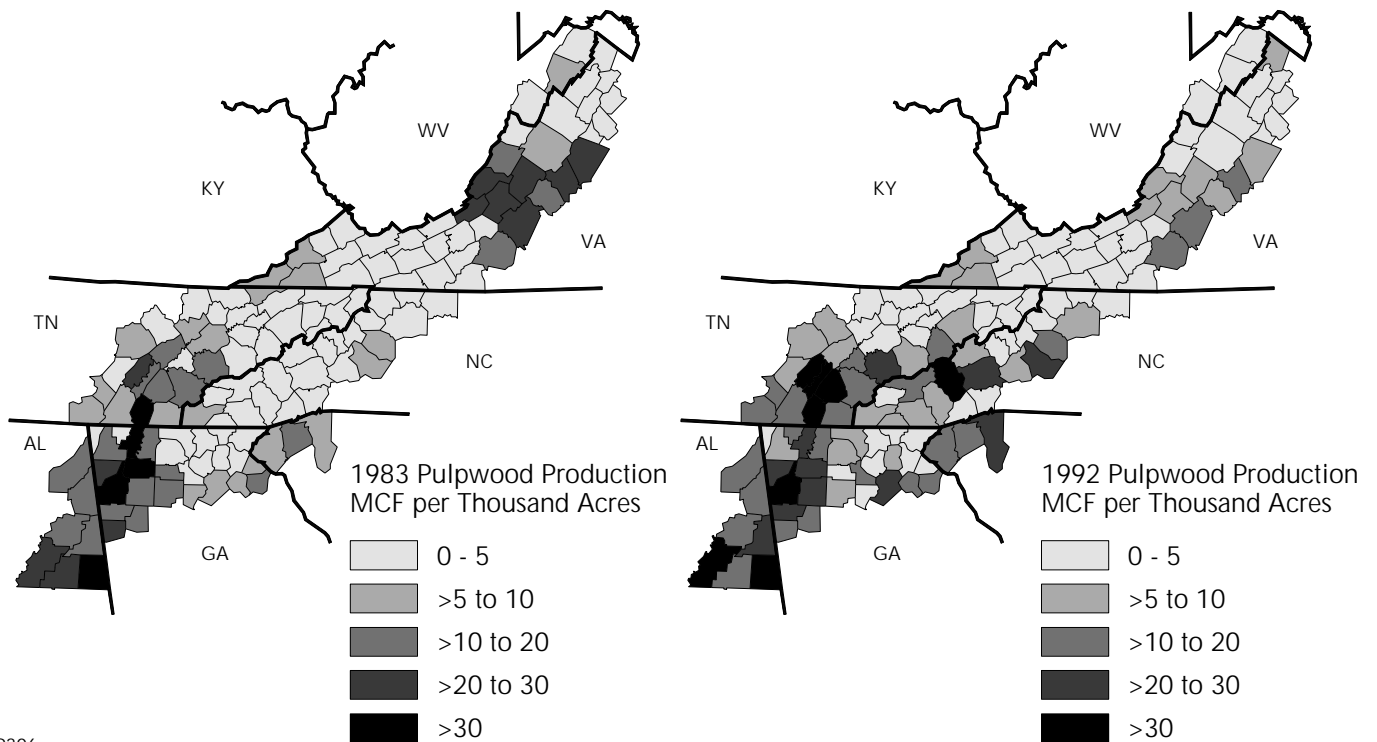


Figure 3.6 County maps of pulpwood production in 1983 and 1992 for the Southern Appalachian area.

- (a) An area roughly defined by the triangle connecting Covington, Charlottesville, and Roanoke, VA, had the highest concentration of pulpwood production in the region. Of the 11 shaded counties in this area (fig. 3.6), 8 produced more than 30 mcf/ma in 1983.
- (b) Four counties, three in the southwestern tip of Virginia and an adjacent one in Tennessee, produced between 5 and 10 mcf/ma.
- (c) Burke and Caldwell Counties in North Carolina, near Morganton, Lenoir, and Hickory, produced between 5 and 10 mcf/ma.
- (d) In an area stretching from Knoxville to Chattanooga in Tennessee and then south towards Birmingham, AL, and Atlanta, GA, 38 counties produced at least 5 mcf/ma, 11 produced more than 20 mcf/ma, and 4 produced more than 30 mcf/ma.
- (e) To the east of this very large block of intensive pulpwood production, three counties in Georgia and three in South Carolina produced at least 5 mcf/ma of pulpwood in 1983.

While all of the five areas defined in 1983 continued to be important in 1992, there were two notable shifts in the production pattern (fig. 3.6). First, production in the Charlottesville-Roanoke-Covington area fell dramatically between 1983 and 1992. While eight counties produced more than 30 mcf/ma in 1983, no county produced more than 20 mcf/ma in 1992. Pulpwood production in 1983 was unusually high in Virginia. Since pulping capacity has remained relatively constant in this region, it appears that pulpwood-using mills procured increasing amounts of wood in the Virginia Piedmont and in West Virginia in recent years.

The second major shift in pulpwood production between 1983 and 1992 was an expansion in southwestern North Carolina. In 1983, only three counties in the North Carolina portion of the study area produced between 5 and 10 mcf/ma. In 1992, 12 counties produced more than 5 mcf/ma, 6 produced more than 10, and 3 produced more than 20. This expansion in North Carolina had the effect of coalescing four of the five separate production areas defined for 1983 into a very large production area making up roughly one-third

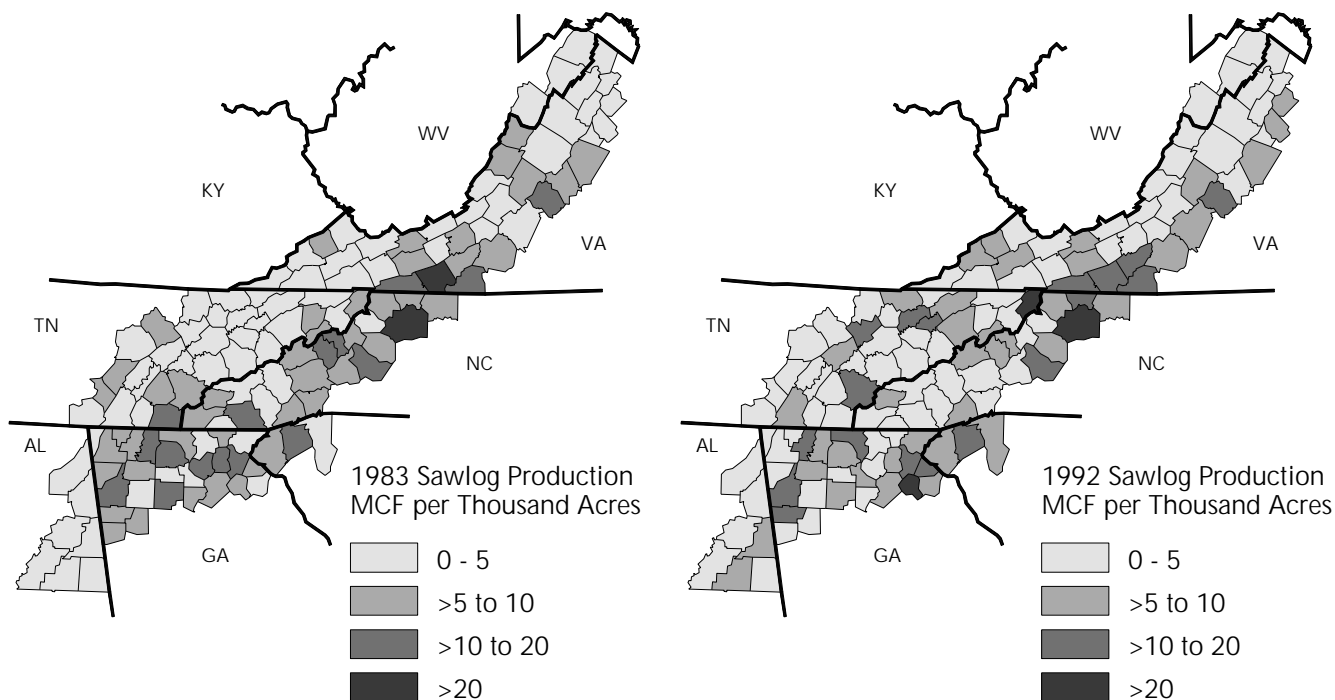


Figure 3.7 County maps of sawlog production in 1993 and 1992 for the Southern Appalachian area.

of the study area.

While sawlog production shifted somewhat among counties between 1983 and 1992, no strong spatial pattern of production emerged (fig. 3.7). Rather, production was spread evenly across the assessment area. One discernable shift was a general reduction in the quantity of sawtimber produced in those North Carolina counties that experienced an increase in pulpwood production between 1983 and 1992. In counties stretching from Chattanooga, TN, to Franklin, NC, the product mix has therefore shifted strongly from sawlogs to pulpwood.

Some clustering of pulpwood production is predictable because a few large mills utilize pulpwood. In contrast, sawmills are generally much smaller and are spread throughout the region.

Other Products

Southern Appalachian forests yield several important wood products in addition to sawlogs and pulpwood. While relatively minor compared to total supply, these products are important in local areas. Two in particular, veneer and composite board material, are important components of production, and we examine them here. Data availability is,

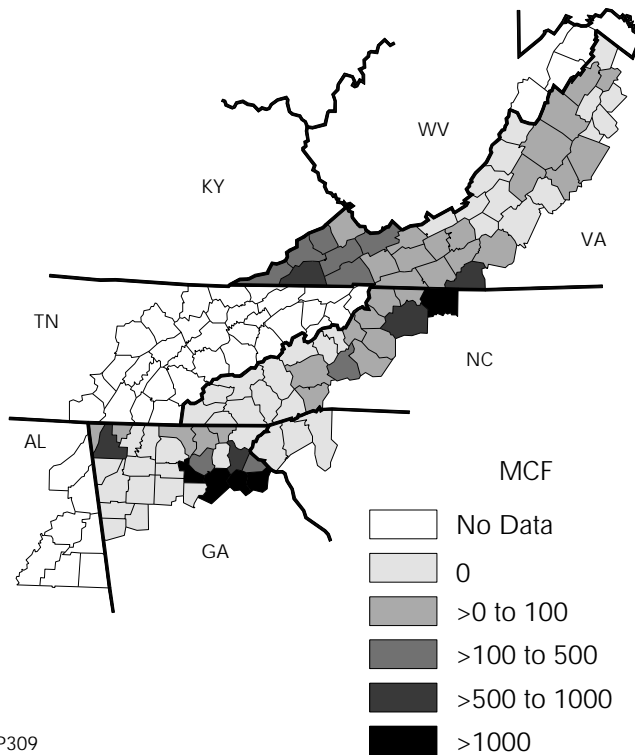


Figure 3.9 County maps of composite board material production for the Southern Appalachian area.

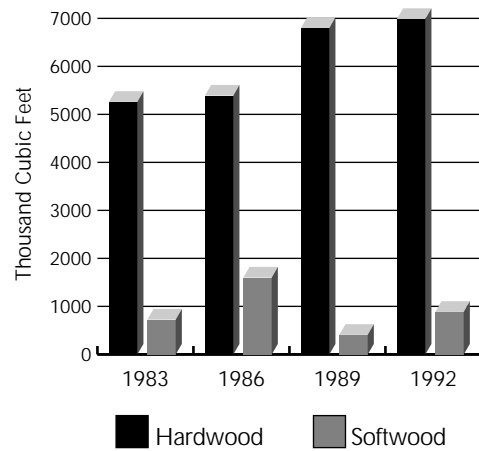


Figure 3.8 Production of veneer logs in the portion of the assessment area defined by North Carolina, South Carolina, Georgia, and Virginia. (Source: Timber Product Output surveys conducted by the USDA Forest Service)

however, somewhat limited. Output of these products has been surveyed only in the portions of the assessment area in Virginia, North Carolina, South Carolina, and Georgia, so the estimates are for these states only.

Veneer logs are used primarily to produce plywood panels; their prices exceed those for high-quality sawlogs. While plywood production has been declining in the United States, veneer log production in the Southern Appalachians grew steadily between 1983 and 1992 (fig. 3.8). Output in 1992 was 32 percent greater than in 1983. A full 90 percent of the veneer logs harvested in 1992 were hardwoods reflecting a strong market for hardwood plywood. While veneer-log production was very small in comparison to sawlog output (only 4 percent), its share of the revenue derived from timber production was likely much higher, given the premium prices paid for some veneer logs.

While veneer logs often represent competition for the highest quality sawlogs, composite board material is produced from low-quality trees. Its manufacturers therefore compete directly with pulpmills for raw materials. Prior to the mid-1980s, practically no composite board material was harvested in the Southern Appalachians. Since then, annual composite board production has grown to 17 million cubic feet, which is equivalent to roughly 7 percent of pulpwood production in the region.

Four areas have emerged as suppliers of wood for composite boards (fig. 3.9): (1) northern Virginia from just south of Charlottesville and Staunton, north to Winchester; (2) the southwestern corner of Virginia from Galax, Wytheville, and Bluefield west to Kentucky; (3) in North Carolina on the eastern edge of the study area from Mt. Airy to Marion; and (4) on the southern boundary of the study area near Gainesville, GA.

Comparison of figures 3.6 and 3.7 shows where composite board production may be beginning to compete with the pulp and paper industry for raw material. In areas 1 and 2, and in parts of area 3, pulpwood production has generally been absent or low. Here, the composite-board industry is emerging in areas where low-quality timber inventories have been lightly used. In area 4 and in parts of area 3, however, composite board production coincides with high pulpwood production, suggesting competing demands for low-quality timber.

Timber Prices

Besides timber output, the interaction of supply and demand defines timber prices. Prices provide perhaps the best indicator of market balance between supply and demand by reflecting the overall scarcity of a product. If prices are increasing, then shifting supplies and demands have made material more scarce and therefore more valuable. Declining prices, in contrast, indicate that material is easier to obtain, and therefore less expensive. In this section we examine trends in the prices of various timber products for evidence of increasing or decreasing scarcity.

A price trend must be precisely defined to determine the effects of scarcity. The price should be for a homogenous product. It should be measured as close to the forest as possible, ideally "on the stump." Finally, it should be adjusted to reflect the effects of inflation.

In evaluating timber prices in the Southern Appalachians, we used values for delivered logs rather than standing trees for two reasons. Available stumpage prices are averages for multiple species and grades of timber. In addition, they are averaged across highly variable site conditions, making it difficult to define the

price of a homogenous product. Delivered prices, in contrast, are reported by species and grade and are measured at a common point. While stumpage and delivered log price trends generally coincide, they may occasionally depart. For hardwood logs, we examined a regular price survey conducted by the State of Tennessee. This survey reports prices for the eastern region of Tennessee, which corresponds roughly to the area of the state included in the SAA. For comparison, we also report species-specific and grade-specific prices for Ohio. While outside of the study area, Ohio prices provide some insights into the spatial extent of hardwood log markets.

For prices of softwood sawlogs and softwood and hardwood pulpwood, we used data reported by Timber Mart South, a regional price reporting service. These data are recorded on a regular basis monthly from 1977 to 1987 and quarterly from 1988 to the present for subregions of all southern states. We report quarterly prices for the mountain regions of Georgia, Tennessee, North Carolina, and Virginia.

Timber prices are influenced by cyclic movements in the economy. It is important, therefore, that price trends start and stop at similar points in the cycle e.g., either in the vicinity of peaks or troughs. To roughly describe general market cycles, we examined red oak and yellow-poplar lumber prices for the region from the Hardwood Market Report between 1953 and 1995 (fig. 3.10). The period over which we study prices – 1978 to 1994 – begins and ends near market peaks indicated in figure 3.10. This result suggests that our starting and ending years are reasonably comparable.

Sawlog Prices

For sawlogs, we measured price trends for three species groups of hardwoods – white oaks, red oaks, and yellow poplar – and for yellow pine. Together, these species represent nearly 80 percent of total sawlog production in the Southern Appalachians (table 3.2). Of these species, red oak had the highest value. In both Ohio and Tennessee², real prices for grade 1 logs grew at an average annual rate of between 2 and 3 percent (table 3.3 and fig. 3.11). In contrast, prices for grade 2 logs were essentially stable in Ohio between 1978 and 1994. Prices of

² Ohio and Tennessee grading systems differ somewhat. In Ohio, the highest quality grade 1 material is valued as a prime grade. In Tennessee, prime grade material is included in grade 1. As expected, Tennessee grade 1 prices generally fall between Ohio grade 1 and prime.

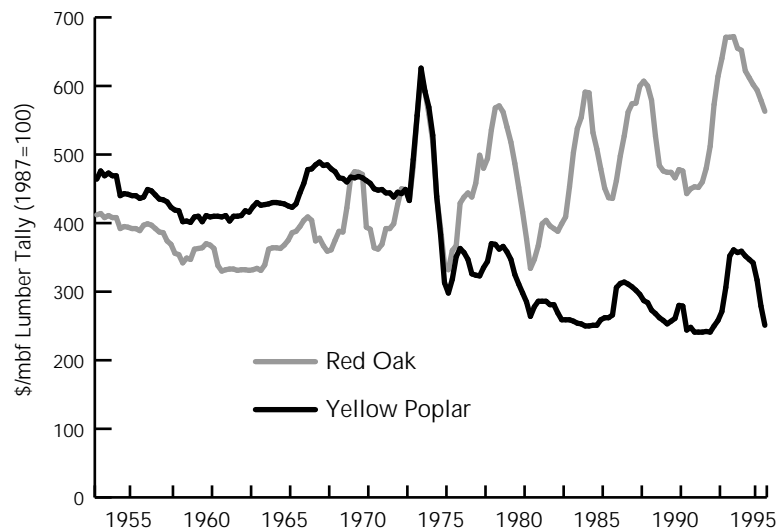


Figure 3.10 Real prices of Appalachian red oak and yellow poplar lumber, 1953-1995. (Source: Hardwood Market Reports)

Table 3.3 Rates of price change (percent) between 1977 and 1994 for various species, grades, and products.

Product	Location	Grade				Average
		Prime	No. 1	No. 2	No. 3	
Sawlogs						
Red oak	Tennessee	—	3.31	3.46	-1.82	—
Red oak	Ohio	2.96	2.18	—	-1.33	—
White oak	Tennessee	—	5.40	3.83	-2.25	—
White oak	Ohio	—	1.51	NS	-1.51	—
Yellow poplar	Tennessee	—	NS	NS	-2.94	—
Yellow poplar	Ohio	NS	NS	-1.37	-1.53	—
Yellow pine	North Carolina	—	—	—	—	NS
Yellow pine	Georgia	—	—	—	—	2.09
Yellow pine	Tennessee	—	—	—	—	NS
Yellow pine	Virginia	—	—	—	—	NS
Pulpwood						
Pine	North Carolina	—	—	—	—	NS
Pine	Georgia	—	—	—	—	NS
Pine	Tennessee	—	—	—	—	-0.82
Pine	Virginia	—	—	—	—	NS
Mixed Hardwoods						
	North Carolina	—	—	—	—	0.64
	Georgia	—	—	—	—	NS
	Tennessee	—	—	—	—	NS
	Virginia	—	—	—	—	NS

— indicates that the model does not apply to the referenced combination
 NS indicates that the rate was not significant so there was no evidence of non-stable prices

grade 2 red oak logs rose 3.5 percent per year in Tennessee. Over the same period, prices of low-grade red oak sawlogs declined at rates of 1 to 2 percent per year in both states.

Prices for white oak showed similar patterns. They rose for grade 1 logs and fell for grade 3 logs in both states. For medium grade material, Ohio prices were essentially flat, while prices in Tennessee grew at a rate of

nearly 4 percent per year.

In contrast to the oaks, yellow-poplar prices showed no signs of increasing between 1978 and 1994. Ohio prime and grade 1 logs as well as Tennessee grade 1 and 2 logs showed no significant price trends. Prices for Ohio grades 2 and 3 and Tennessee grade 3 logs declined over this period at rates between 1 and 3 percent per year.

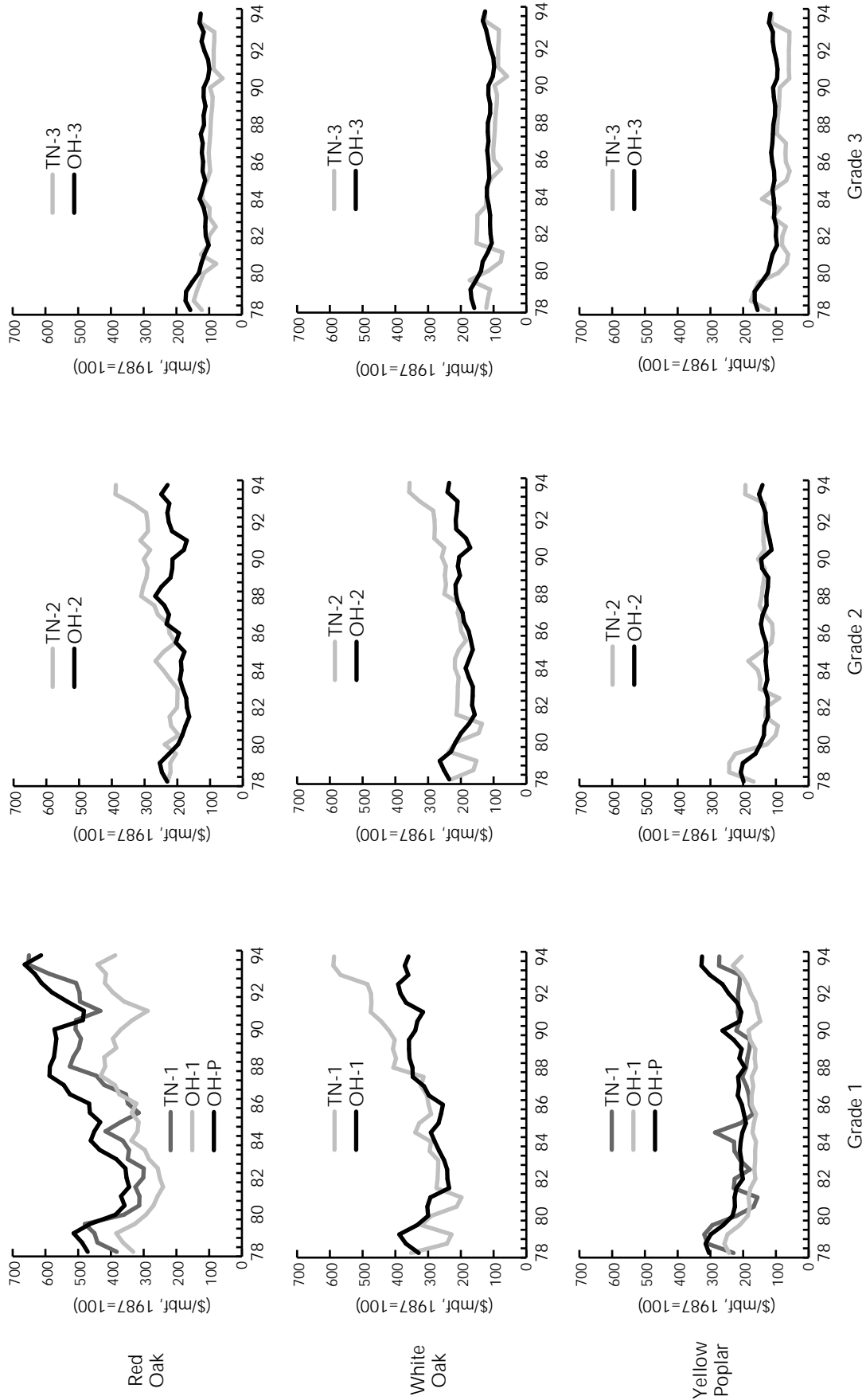


Figure 3.11 Real prices of delivered hardwood sawlogs by species and grade, 1978-1994. (Source: Ohio Agriculture Statistics Service, Tennessee Department of Agriculture, Division of Forestry)

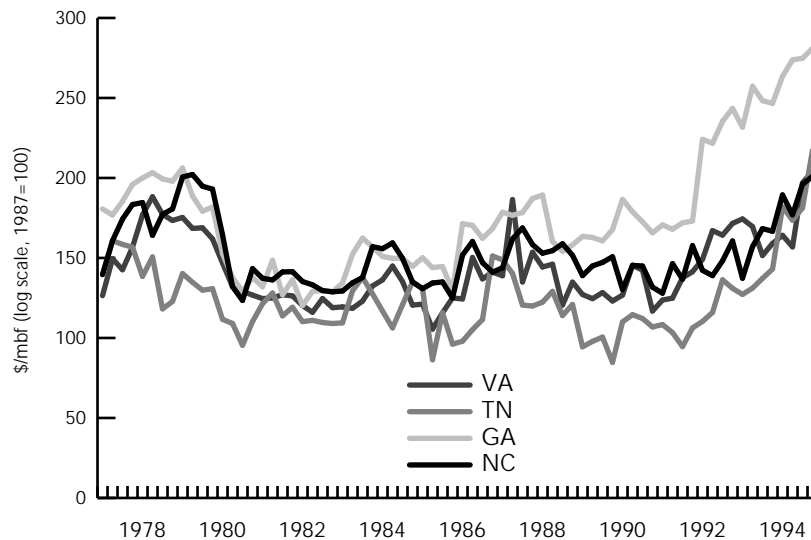


Figure 3.12 Real prices for delivered softwood sawlogs by state, 1977-1994. (Source: Timber Mart South, monthly and quarterly reports)

In general, prices for delivered yellow pine sawlogs were more volatile than those for hardwood sawlogs (fig. 3.12), reflecting the more cyclic nature of softwood markets. Pine sawtimber prices fell from a peak in 1979, leveled off, and then began to turn upwards in the 1990s. In North Carolina, Tennessee, and Virginia, however, prices were only approaching their 1979 peaks at the end of this period. As a result, we detected no significant trend in pine sawlog prices for these states between 1978 and 1994.

In northern Georgia, yellow pine price patterns were similar, but they reached unprecedented levels in the 1990s. As a result, prices there rose significantly between 1978 and 1994. This pattern strongly mirrors recent market developments in the large softwood-producing region to the south of the assessment area. Southern softwood markets have been very strong in the 1990s, as strong housing markets have coincided with declines in supply from public land in the Western United States. There appears to be little evidence to suggest that softwood sawtimber markets will dampen substantially in the near future.

Pulpwood Prices

In the four states that were analyzed, hardwood and softwood pulpwood prices declined somewhat between 1977 and 1981 and then leveled off until 1987 (fig. 3.13). Throughout

this period, price movements were dampened and gradual, possibly reflecting market dominance by the few pulpwood-consuming firms in the region. After 1987, however, price movements became more volatile, perhaps indicating increasing head-to-head competition for raw material. This change would be consistent with the coalescing of previously separate pulpwood producing areas, described earlier.

With two exceptions, we found no significant price trends for pulpwood in the Southern Appalachians (table 3.3, fig. 3.13). The exception for pine pulpwood was Tennessee, where prices trended downward at 0.8 percent per year, suggesting that this material is relatively more abundant in Tennessee. The exception for hardwood pulpwood was North Carolina, where prices increased an average of 0.6 percent per year between 1977 and 1994. Again, this is where the greatest growth in pulpwood production occurred between 1983 and 1992 (see fig. 3.6). Rising prices indicate increasing economic scarcity in this region.

Timber Supply Factors

The supply of timber is more complex than the supply of most commodities, because timber is produced by dynamic forests and controlled by a variety of owners. The inventory of timber growing stock can be altered by timber harvests, natural forces, or investments in regeneration and stand improvements.

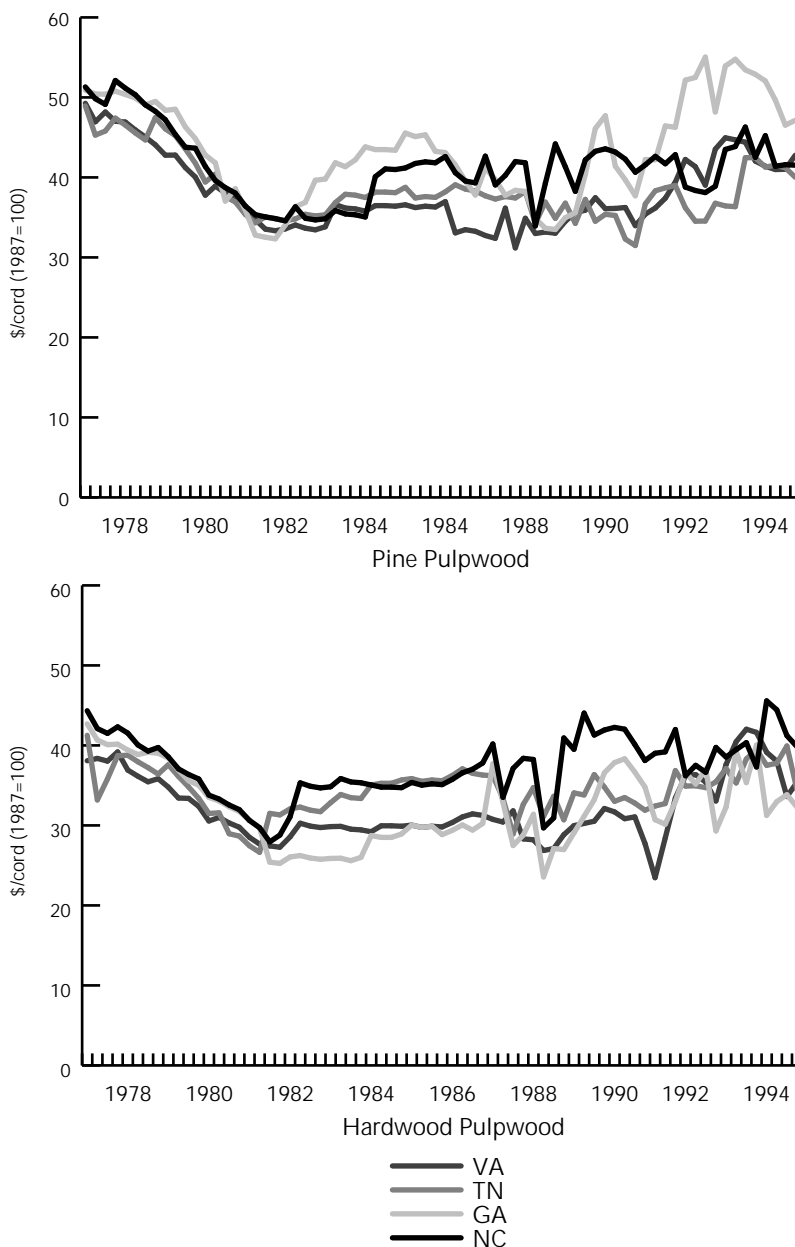


Figure 3.13 Real prices for delivered hardwood and pine pulpwood by state, 1977-1994. (Source: Timber Mart South, monthly and quarterly reports)

Harvest and investment decisions, in turn, are influenced by competing demands for forest land and by landowner preferences.

Economists have had some success in modeling softwood timber markets based on relevant factors, but they have generally not succeeded with hardwood markets, which are much more complex. In this assessment, therefore, instead of using timber market models, we examine various indicators of timber supply and, where possible, how they have changed over time. We focus especially on the structure, dynamics, and ownership of timber inventories in the region.

In examining these indicators, we move from the most general to the more specific. Throughout this analysis of timber supply, we use timber inventory data compiled by the USDA Forest Service and stored in the Eastwide Data Base. Unless otherwise stated, this is the source of all the inventory data used in the report. Hansen and others (1992) provides details on how these data are collected and compiled. We start by examining timberland and how it is distributed across the region. Next we examine timber inventories and their distributions across the species and quality classes that largely determine timber values as well as

recent changes in timber stocks. Because all timber inventories are not equally accessible, we also examine the distributions of inventory by various factors that influence the costs of producing timber, including slope classes and the proximity of timber to roads. In addition, we examine the implied harvesting and hauling costs for the inventory and compare costs across ownership groups. We close by examining two primary forces that have potential to shape forest land use and timber supply into the future. We examine the proximity of timber inventories to human populations and how this might influence both future timberland area and the willingness of forest owners to manage their land for timber production. We also examine recent changes in timber harvesting on national forests in the region.

Timberland Area

Of the 36.9 million acres in the assessment area, 23.6 million acres are timberland. Roughly 20 percent of timberland is owned by the public and 80 percent is privately owned. Forest industry controls 6 percent, farmers control 19 percent, other corporations control 10 percent, and other individuals control 45 percent of the area's timberland. Farmers, corporations that do not manufacture wood,

and other individuals together form the category of nonindustrial private forest owners, who control 74 percent of the region's timberland. Nonindustrial owners vary widely in objectives for and approaches to forest management. While nonindustrial private land has provided the majority of timber produced in the past, it is often considered the most volatile portion of timber supply.

Timberland is not spread evenly across the assessment area. The area with the least concentration of timberland extends from the Great Smoky Mountains National Park north to the Knoxville metropolitan area (fig. 3.14). This is the center of a broader area in the crescent between the Cumberland Plateau and the Appalachian Range. In this area along the Interstate 81 corridor between Knoxville and Roanoke and along the I-75 corridor between Chattanooga and Knoxville, timberland is generally less than 40 percent of the land area. Urban and agricultural land uses are dominant in this broad Ridge and Valley area. Another area with a relatively low concentration of timberland runs from the Shenandoah Valley to the eastern edge of the assessment area.

The two largest contiguous blocks of concentrated timberland (from 60 to more than 80 percent of the land area) are due north and due south of Asheville, NC. The area to the north extends to the Virginia border. The area to the south extends westward into Georgia and Alabama. Timberland is also concentrated along the western edge of the study area from the Alleghenies in Virginia to the Cumberland Plateau in Tennessee.

Timber Inventories

The most recent forest surveys of the region (table 3.4) show that the assessment area contains about 39 billion cubic feet (bcf) of growing stock, including about 175 billion board feet (International 1/4-inch log rule) of sawtimber. Spread across 23.6 million acres of timberland, the average stocking is about 1,700 cubic feet/acre, and about three-fourths of the growing stock is hardwood. The share of softwoods in the inventory increases from north to south: 15 percent in the Northern Ridge and Valley subregion, 22 and 21 percent in the Blue Ridge and Southern Ridge and Valley subregions, and 41 percent in the Southern Mountain and Piedmont subregion. The share of timber

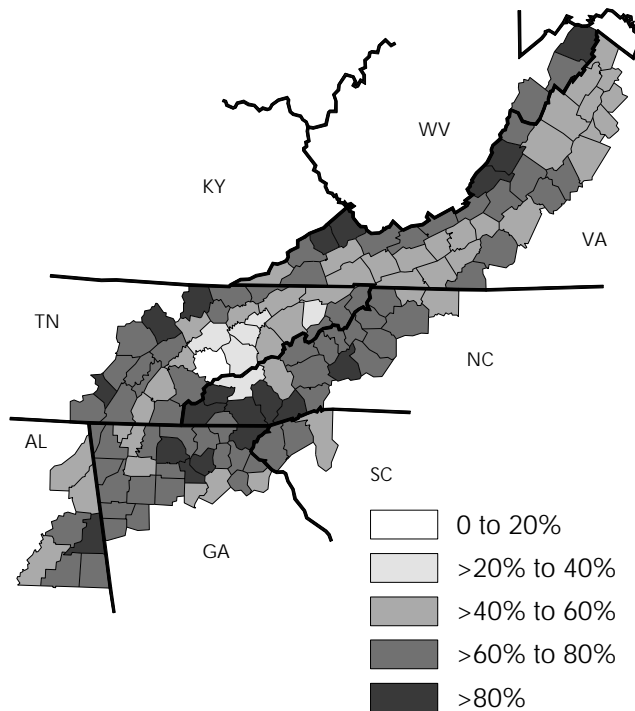


Figure 3.14 County map of the proportion of the area that is timberland.

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Table 3.4 Growing stock inventory (million cubic feet) and sawtimber share of growing stock for the assessment area and subregions.

Owner	Total Area			Subregion 1			Subregion 2			Subregion 3			Region 4		
	Growing Stock (mmcf)	Sawtimber Portion (mmcf)	Sawtimber Share (%)	Growing Stock (mmcf)	Sawtimber Portion (mmcf)	Sawtimber Share (%)	Growing Stock (mmcf)	Sawtimber Portion (mmcf)	Sawtimber Share (%)	Growing Stock (mmcf)	Sawtimber Portion (mmcf)	Sawtimber Share (%)	Growing Stock (mmcf)	Sawtimber Portion (mmcf)	Sawtimber Share (%)
Softwood															
USDA-FS	1,651.5	1,212.7	73	237.8	151.0	59	477.4	366.1	77	340.1	243.8	72	596.2	451.8	76
Private	7,617.0	4,605.5	60	673.3	400.6	63	2,449.7	1,539.8	63	1,892.1	1,111.1	59	2,601.9	1,554.0	60
Other Public	389.9	267.0	68	23.2	16.5	71	68.9	39.6	57	156.5	106.8	68	141.3	104.1	74
Total	9,658.4	6,085.2	63	934.3	568.1	61	2,996.0	1,945.5	65	2,388.7	1,461.7	61	3,339.4	2,109.9	63
Hardwood															
USDA-FS	5,957.2	3,461.6	58	1,429.6	810.6	59	2,525.5	1,522.6	60	1,113.0	592.7	53	889.1	535.7	60
Private	21,915.3	12,587.6	57	3,518.8	2,090.2	57	7,732.4	4,562.9	59	7,125.5	4,069.1	57	3,538.6	1,865.4	53
Other Public	1,260.0	629.8	50	160.7	103.7	65	262.6	153.5	58	525.1	286.3	55	311.6	86.3	28
Total	29,132.5	16,679.0	57	5,109.1	3,004.5	59	10,520.5	6,239.0	59	8,763.6	4,948.1	56	4,739.3	2,487.4	52
Total	7,608.7	4,674.3	61	1,667.4	961.6	58	3,002.9	1,888.7	63	1,453.1	836.5	58	1,485.3	987.5	66
Private	29,532.3	17,193.1	58	4,192.1	2,490.8	59	10,182.1	6,102.7	60	9,017.6	5,180.2	57	6,140.5	3,419.4	56
Other Public	1,649.9	896.8	54	183.9	120.2	65	331.5	193.1	58	681.6	393.1	58	452.9	190.4	42
Total	38,790.9	22,764.2	59	6,043.4	3,572.6	59	13,516.5	8,184.5	61	11,152.3	6,409.8	57	8,078.7	4,597.3	57
Ownership Shares	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Softwood															
USDA-FS	17	20	27	25	27	19	16	19	14	14	17	17	18	21	21
Private	79	76	71	72	71	79	82	79	79	79	76	76	78	74	74
Other Public	4	4	3	2	3	2	2	2	7	7	7	7	4	5	5
Hardwood															
USDA-FS	20	21	27	28	27	24	24	24	13	13	12	12	19	22	22
Private	75	75	70	69	70	73	73	73	81	81	82	82	75	75	75
Other Public	4	4	3	3	3	2	2	2	6	6	6	6	7	3	3
Total	20	21	27	28	27	23	22	23	13	13	13	13	18	21	21
Private	76	76	70	69	70	75	75	75	81	81	81	81	76	74	74
Other Public	4	4	3	3	3	2	2	2	6	6	6	6	6	4	4
Regional Shares	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Softwood	100	100	9	10	9	32	31	32	25	24	24	24	35	35	35
Hardwood	100	100	18	18	18	37	36	37	30	30	30	30	16	15	15
Total	100	100	16	16	16	36	35	36	29	29	28	28	21	20	20

inventory that is sawtimber size varies little across the region. The averages are 63 percent sawtimber for softwoods and 57 percent for hardwoods.

Sawtimber Quality

The most valuable portion of the timber inventory is high-quality sawtimber. Grade 1 logs sometimes are four to five times more

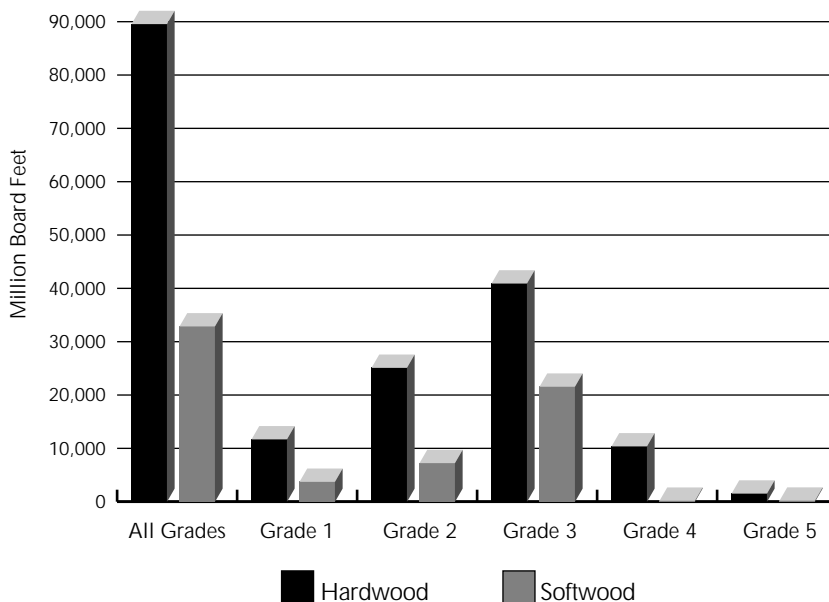


Figure 3.15 Grade distributions of sawtimber in the Southern Appalachians by softwoods and hardwoods. (Source: USDA Forest Service, Eastwide Database, Hansen and others, 1992)

Table 3.5 Distribution of sawtimber inventory (million board feet) by grade for national forests and private lands in the Southern Appalachian Assessment area.

Owner and species	Total	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
National Forests						
Total softwoods	6,783	1,016	1,684	4,005	44	34
Select white oaks	1,791	284	564	800	130	14
Select red oaks	3,312	900	1,158	1,119	99	37
Other white oaks	4,278	562	1,088	2,225	348	57
Other red oaks	2,873	389	843	1,266	353	22
Yellow poplar	2,310	616	713	891	68	22
Private						
Total softwoods	24,593	2,471	5,224	16,629	125	144
Select white oaks	8,061	887	2,312	3,645	1,107	110
Select red oaks	5,872	1,167	2,148	2,085	385	88
Other white oaks	10,113	821	2,479	5,325	1,283	203
Other red oaks	9,811	722	2,559	4,704	1,642	185
Yellow poplar	15,721	3,181	5,408	5,725	1,280	127
National Forest Share						
Total softwoods	22%	29%	24%	19%	26%	19%
Select white oaks	18%	24%	20%	18%	11%	11%
Select red oaks	36%	44%	35%	35%	20%	29%
Other white oaks	30%	41%	30%	29%	21%	22%
Other red oaks	23%	35%	25%	21%	18%	11%
Yellow poplar	13%	16%	12%	13%	5%	15%

valuable than grade 3 logs. It is therefore important to understand the quality distribution of standing timber and how it varies across ownerships and subregions.

Forest surveys report sawtimber inventories for grades 1-5 (international rule). The sawtimber inventory in the region is skewed towards the lower grades, with 51 percent in grade 3 and 10 percent in grades 4 and 5 (fig. 3.15). The remainder includes 26 percent in grade 2 and 13 percent in grade 1. There is some difference between softwood and hardwood distributions. For softwoods, only 33 percent of sawlogs are in grades 1 and 2, while 41 percent of hardwood sawlogs are in these grades.

The quality distribution of sawtimber varies significantly by ownership. While national forests occupy only 17 percent of timberland, they contain 21 percent of the sawtimber inventory. The Forest Service management policies result in many large trees. Three-fourths of the sawtimber is on private land, while the small remainder is on public tracts other than national forests. National forest timberland contains 27 percent of the grade 1 sawtimber in the region. In the Blue Ridge and Southern Mountain and Piedmont subregions, this share is 33 percent.

In addition to grade, species plays a crucial role in determining log value. Of the vast array of tree species grown in the Southern

Appalachians, a relatively small subset makes up a large portion of timber production. Among hardwoods, yellow-poplar, red oaks, and white oaks comprise nearly 80 percent of production. We therefore focus additional attention on these groups.

Sawtimber grades are also distributed differently across landowners (table 3.5). While the national forests contain 17 percent of the timberland area and 20 percent of the growing-stock inventory, they generally contain larger shares of the highest valued timber. For example, 44 percent of the grade 1 select red oak sawtimber and 24 percent of the select white oak sawtimber are on national forests (fig. 3.16). National forests also control a disproportionate share of high-quality softwood sawtimber, but generally in areas where softwood sawlogs are a minor part of the market. In contrast, the national forests control a relatively small portion of the high-quality yellow-poplar.

Timber Inventory Dynamics

Forests are dynamic. They respond to environmental and biological factors that influence growth and mortality as well as to people's uses of forest resources. The combined effects ultimately determine timber supplies. To examine the net effects of these factors, we report changes in timber inventories over the latest

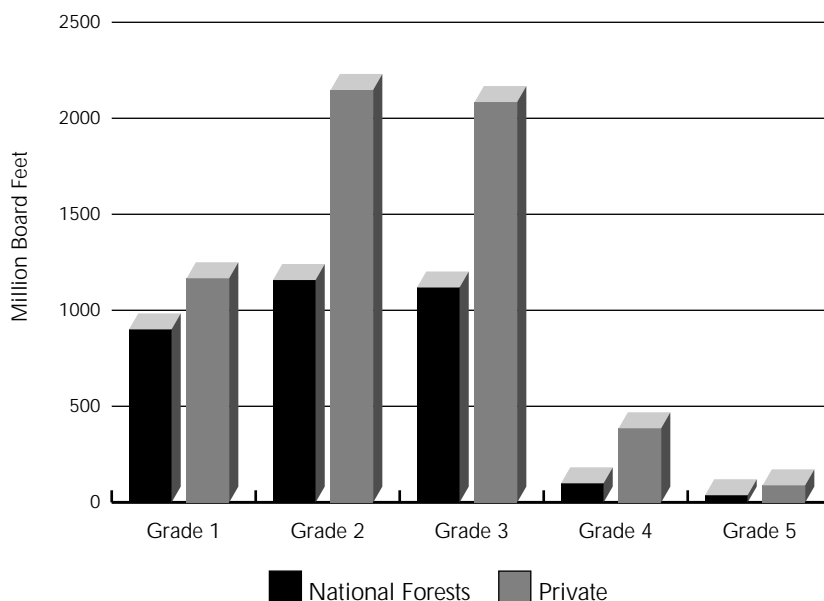


Figure 3.16 Red oak sawtimber inventory by grade and owner. (Source: USDA Forest Service, Eastwide Database, Hansen and others, 1992)

inventory cycles. These estimates generally reflect patterns of growth, removals, and mortality observed in the late 1980s.

Changes in timber inventories are outlined in figure 3.17. Growing-stock inventories are augmented by growth and reduced by removals. Data from the surveys provide estimates of the net annual growth of growing stock in the assessment area. Growing-stock volume is the volume of solid wood in trees with diameters at breast height (dbh) of 5 or more inches up to a top of 4 inches in diameter. In addition, these data provide estimates of the net annual growth of sawtimber growing stock. Sawtimber volume is the sawlog portion of trees 9 inches or more in dbh for softwoods and 11 inches or more for hardwoods.

Average annual removals of growing stock and sawtimber also are estimated in forest surveys. By subtracting removals and mortality from growth, we can determine total changes in growing stock and sawtimber volumes over the most recent survey cycle. We can see whether growing stock and sawtimber inventories are expanding or contracting.

Across all owners, growing-stock volume expanded at an average annual rate of about 1.10 percent in the late 1980s (table 3.6). The rate of growth was slightly higher for private (1.15 percent) than for public land (0.95 percent). One reason for rapid increases on private land is relatively low stocking at the start of the period. The sawtimber portion of the inventory grew faster at 1.97 percent per year. Again, net growth on private land (2.08 percent per year) out-stripped net growth on public land (1.54 percent per year).

There were also differences in the growth rates for softwood and hardwood species groups. Softwood growing-stock inventories expanded at a very small rate of about 0.14 percent per year. However, the total masks offsetting rates of change on public and private land. Inventories grew on public land at about 0.70 percent per year, while inventories declined slightly on private land (-0.02 percent per year). Large declines in natural pine inventories were offset by increases in plantation pine inventories. Natural pine stands are being replaced with plantations throughout the South (Wear 1993). Softwood inventories declined fastest on private land in the Southern Mountain and Piedmont region (-0.72 percent per year), where pines are most prevalent and most

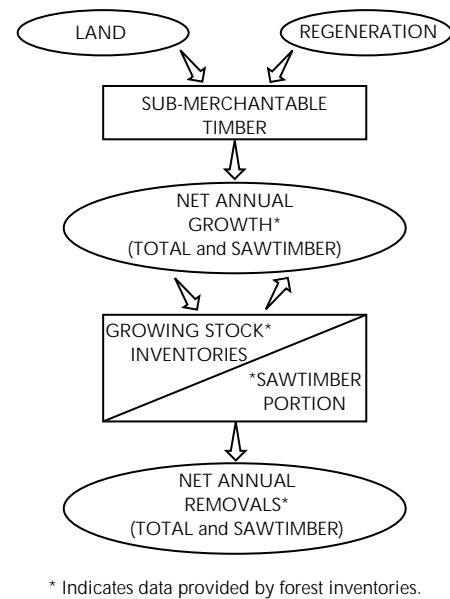


Figure 3.17 Flow chart of timber inventory dynamics.

widely used. Areas to the south of this region also are experiencing declines in softwood inventories (Cubbage and others 1995).

In contrast to softwood growing-stock inventories, softwood sawtimber volumes expanded in the late 1980s. The rate of increase was 1.38 percent, and growth was similarly strong on private and public lands. Growth in sawtimber but not growing-stock volume suggests increasing pressure on the inventory of pulpwood size material. For hardwoods, both growing stock and sawtimber volumes increased in all regions and ownership classes. The only exception was a slight rate of decline for hardwood sawtimber on public land in the Southern Mountain and Piedmont region.

In general, timber inventories grew modestly in the late 1980s. Growth was generally strong on both public and private land. In most of the study area, hardwood and softwood growing-stock and sawtimber volumes are expanding. The only exception is the Southern Mountain and Piedmont region, where growth of softwood growing stock did not keep pace with growing-stock removals, especially on private land. It is also important to note that timber production has expanded since the latest surveys. Estimates of removals may therefore not reflect activities in the early 1990s.

Intensity of Timber Production

The ratio of average annual timber removals to timber inventories can be instructive. As a rule, short rotations yield high removal-to-inventory ratios and long rotations yield low ratios. Thus, higher ratios would be expected on private than on natural forest land.

For the region as a whole, 1.62 percent of growing-stock volume was removed per year.

The rate was 1.76 percent on private land and 1.19 percent on public land. Private rates were greater than public rates in all subregions. The production intensity increased moving from north to south from 0.81 percent in the Northern Ridge and Valley subregion to 2.73 percent in the Southern Mountain and Piedmont subregion. This regional gradient reflects the increasing share of softwood production in the southern part of the assessment

Table 3.6 Annual rates of change (percent) in growing stock and sawtimber inventories for subregions and the assessment area as a whole.

Growing Stock Inventories	All Species	Softwoods				Hardwoods		
		Planted Pine	Natural Pine	Other	Total	Soft	Hard	Total
Northern Ridge and Valley								
All owners	1.35	11.23	0.24	2.43	1.07	2.00	1.26	1.41
Private	1.41	13.35	-0.20	2.25	0.85	2.18	1.32	1.52
Public	1.22	4.39	1.33	2.97	1.64	1.35	1.13	1.16
Blue Ridge								
All owners	0.92	1.88	-0.02	1.36	0.31	1.30	0.96	1.08
Private	0.86	1.93	-0.25	0.83	0.04	1.26	1.00	1.10
Public	1.08	1.70	1.14	2.29	1.43	1.47	0.87	1.01
Southern Ridge and Valley								
All owners	1.50	0.70	0.14	1.97	0.38	2.29	1.56	1.81
Private	1.56	0.75	0.37	2.14	0.59	2.26	1.59	1.82
Public	1.25	0.35	-0.66	1.30	-0.42	2.47	1.46	1.77
Southern Mountains and Piedmont								
All owners	0.66	0.81	-0.57	0.73	-0.44	2.02	1.23	1.47
Private	0.82	0.43	-0.87	1.06	-0.72	2.26	1.87	1.99
Public	0.09	8.03	0.44	0.45	0.59	1.00	-0.65	-0.24
Total area								
All owners	1.10	1.69	-0.17	1.71	0.14	1.82	1.24	1.42
Private	1.15	1.59	-0.33	1.61	-0.02	1.85	1.39	1.55
Public	0.95	2.36	-0.43	1.95	0.70	1.69	0.83	1.03
Sawtimber inventories								
Northern Ridge and Valley								
All owners	2.03	34.10	1.11	2.77	1.83	2.66	1.90	2.07
Private	2.17	53.85	0.71	2.51	1.60	2.93	2.05	2.27
Public	1.71	11.00	2.02	3.78	2.40	1.48	1.61	1.59
Blue Ridge								
All owners	1.82	5.58	1.16	1.61	1.57	2.12	1.78	1.90
Private	1.81	6.62	0.91	0.93	1.32	2.09	1.91	1.98
Public	1.84	3.00	2.32	2.71	2.48	2.25	1.51	1.68
Southern Ridge and Valley								
All owners	2.35	2.51	1.28	2.19	1.48	2.96	2.44	2.62
Private	2.40	2.64	1.69	2.52	1.87	2.91	2.36	2.55
Public	2.17	1.82	0.17	0.80	0.32	3.23	2.81	2.93
Southern Mountains and Piedmont								
All owners	1.65	3.93	0.81	1.46	1.01	2.73	1.98	2.20
Private	1.99	3.53	0.70	3.50	0.95	2.97	2.83	2.87
Public	0.68	14.46	1.09	0.00	1.16	1.75	-0.18	0.24
Total area								
All owners	1.97	4.59	1.05	1.95	1.38	2.55	2.04	2.20
Private	2.08	4.79	1.00	1.85	1.36	2.58	2.23	2.35
Public	1.64	3.68	1.21	2.15	1.42	2.37	1.54	1.73

(Source: Eastwide Database)

Table 3.7 Volumes of inventory by different slope class for national forests and other owners.

	Growing Stock Inventory (bcf)	Sawtimber Inventory (bbf)	Grade I Sawtimber Inventory (bbf)	Growing Stock Inventory (percent of ownership)		
Non-National Forest System						
35% or less	21.44	53.73	6.09	0.64	0.62	0.55
60% or less	9.41	26.17	4.13	0.28	0.30	0.37
Greater than 60%	2.46	6.67	0.94	0.07	0.08	0.08
Total	33.32	86.57	11.16	1.00	1.00	1.00
National Forest System						
35% or less	3.71	10.14	1.51	0.46	0.44	0.37
60% or less	3.52	10.32	1.99	0.43	0.45	0.49
Greater than 60%	0.92	2.48	0.59	0.11	0.11	0.15
Total	8.15	22.94	4.09	1.00	1.00	1.00

bcf = billion cubic feet
bbf = billion board feet

area. Softwoods are generally harvested at an earlier age than hardwoods.

Costs of Timber Harvesting

In a mountainous area like the Southern Appalachians, the cost of harvesting and hauling timber is an important determinant of timber value. It may be impractical to harvest even the highest valued log if it is located on severe terrain or in a remote location. We examine two factors to gauge the economic feasibility of timber harvesting. First, we examine the slopes of sites supporting timber because of slope's critical influence on timber harvesting costs and potential site damage. We then estimate what the costs of harvesting and hauling timber

from these sites would be. These two factors provide some insights into what the operable portion of the timber inventory might be.

The slope defines both what kind of logging system is feasible on a site and, for a given logging system, the amount of effort expended to harvest timber. We assume that tractor skidding becomes impractical when slopes exceed 35 percent, and that other forms of yarding are not practical on slopes exceeding 60 percent. On slopes of over 60 percent, potential soil losses may often preclude logging in any case.

We sorted all forest survey plots in the Southern Appalachian region by slope and divided the inventory by slope class. A majority of the growing-stock inventory (64 percent) is on slopes less than 35 percent (table 3.7 and figure

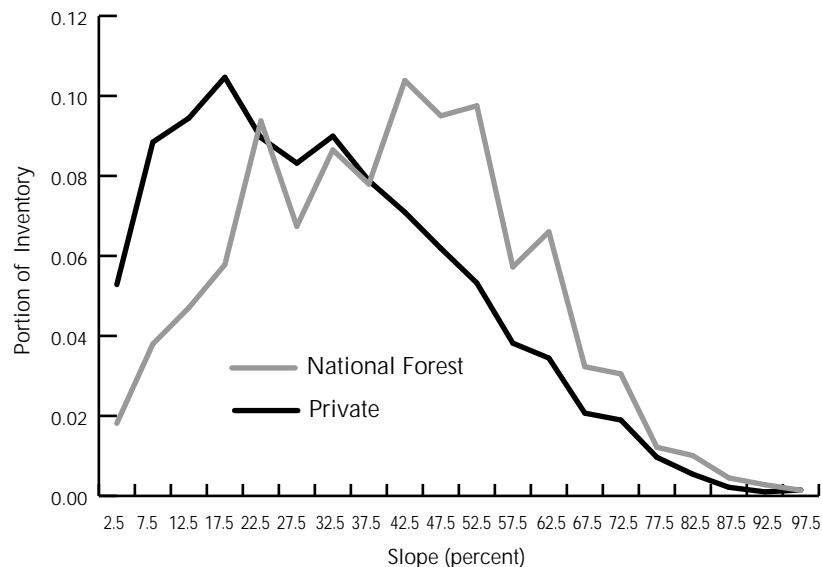


Figure 3.18 Distribution of growing stock inventories by slope class for national forests and private lands. (Source: USDA Forest Service, Eastwide Database, Hansen and others, 1992)

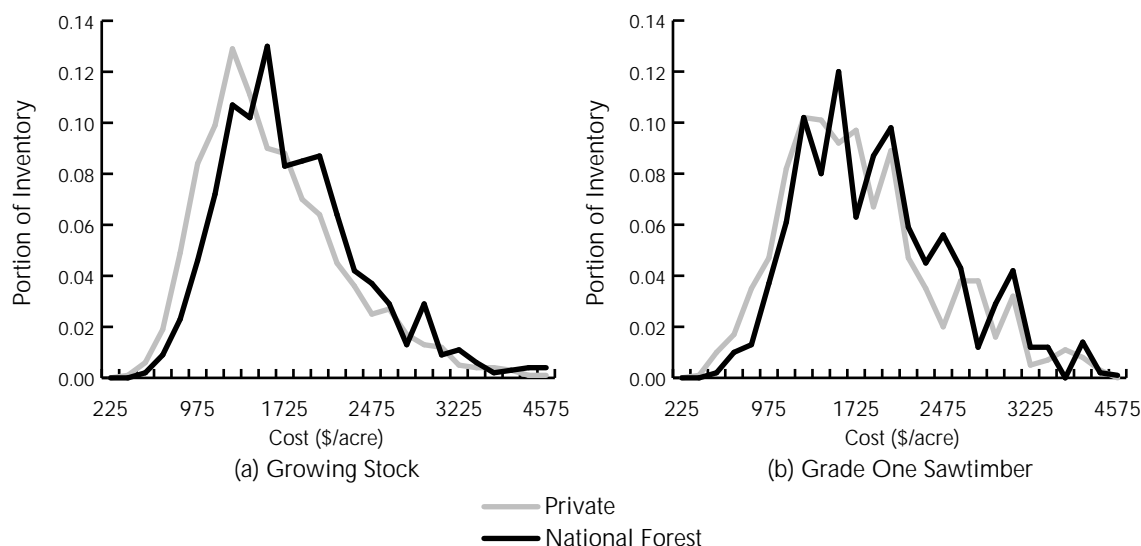


Figure 3.19 Distribution of growing stock and grade one sawtimber inventories by harvest costs for national forests and private lands. (Source: Eastwide Database; cost estimates ECOST simulator applied to inventory plots, Le Doux, 1988)

3.18), 29 percent is on slopes between 35 and 60 percent, and the remaining 7 percent is on slopes greater than 60 percent. The sawtimber inventory is similarly distributed across slope classes. However, only 54 percent of grade 1 sawtimber is on slopes less than 35 percent.

On average, the inventories of the national forests are on steeper slopes than those of private land. While a majority of all types of private timber is found on tractor sites, considerably less than half of national forest growing stock, sawtimber, and grade 1 sawtimber is on sites with less than 35 percent slope.

Besides timber prices, the factor that determines economic accessibility is the total cost of harvesting and hauling timber.³ While costs are partially determined by slope classes, they are also influenced by other factors such as the density of vegetation, the proximity of a site to a road, and the distance along roads to markets. We estimated the costs of harvesting and hauling for all survey plots in the Southern Appalachians and constructed cost profiles for Forest Service and other ownerships. Survey data provide estimates of slope, trees per acre, and distance from the plot to the closest road.

These data, along with assumed average hauling distances for sawlogs and pulpwood, were input to a logging cost simulation model (LeDoux 1988). Reflecting differences in the slope distribution, the results show somewhat higher potential harvest costs for national forest land (fig. 3.19a). The volume-weighted average cost is about \$1,425.00 per acre for private land and \$1,575 per acre for national forests. Twenty-five percent of private growing-stock volume is on land with costs of less than \$1000.00 per acre; only 15 percent of national forest growing-stocks is on such land.

The decision to harvest timber depends on a comparison of these costs with potential harvest revenues. Harvesting high-quality sawlogs on steep sites may be economically feasible while harvesting pulpwood may not. Cost profiles for grade 1 sawlogs (fig. 3.19b) reflect higher costs for high-quality material—average costs of \$1,600.00 per acre on private land, and \$1,800.00 per acre on national forest land. Twenty-five percent of private grade 1 sawtimber is on sites with costs in excess of \$2,000.00 per acre; 35 percent of national forest grade 1 volume is on these sites.

³ Delivered log prices minus harvesting and hauling costs define stumpage prices for timber. Harvesting is a feasible option only when stumpage prices are positive.

Table 3.8 Growing stock and sawtimber removals by purpose.

Type of Material and Purpose	Total (mmcf)	Softwood (mmcf)	Hardwood (mmcf)
Growing stock			
Growing stock harvest of timberland plots	497.7	239.5	258.2
Conversion to reserved timberland	41.1	4.9	36.2
Conversion to other uses	85.7	43.3	42.4
Total	624.5	287.7	336.8
	(mmbf)	(mmbf)	(mmbf)
Sawtimber			
Sawtimber harvest of timberland plots	1,815.4	868.1	947.4
Conversion to reserved timberland	130.3	21.4	108.9
Conversion to other uses	243.9	116.9	127.0
Total	2,189.7	1,006.4	1,183.3

mmcf = million cubic feet

mmbf = million board feet

Uses of Private Land

Private landowners generally bring more timber to market when prices are higher and less when prices are lower (Newman and Wear 1993), but nonindustrial private landowners consider many factors when deciding whether and when to harvest their timber. Recent changes in the composition of these owners raise a number of questions about future timber supply.

The population of the Southern Appalachians grew rapidly in the last two decades. Increased population density means increased land development and less acreage for traditional forestry. In addition, many new residents in the Southern Appalachians have retired from jobs elsewhere. Their perspectives about forest uses may differ from those of former owners. New residents do not possess the same knowledge of local ecological systems (Lee 1992), and urbanites often do not have a rural utilitarian view of land and resources. The ultimate result may be a general decrease in the willingness of private landowners to manage forests and harvest timber.

Increased harvest rates observed on land in North Carolina may not be evidence of landowner attitudes on timber harvesting. Timber harvesting often is the initial stage of land clearing and development. The most recent forest surveys suggest that a substantial share of growing-stock and sawtimber removals can be tied to changes in the use of forested land (table 3.8). About 14 percent of removals from growing stock were associated with the conversion of private forest to other land uses. About 7 percent of these removals were

associated with the designation of former timberland as wilderness and park.

It is also important to consider where land use change is likely to occur. A detailed analysis of land cover changes between 1975 and 1991 in the Little Tennessee River basin – a part of the Southern Appalachian area – indicates that slope is the most important limiting factor for nonforest uses (Wear and Flamm 1993; Turner and others, in press). Development generally progresses from city centers and along valley bottoms in mountainous regions. This progression puts remaining timber inventories on increasingly remote and steep land.

The Little Tennessee study also indicates that elevation and proximity of land to roads are becoming less important in determining where nonforest uses will occur. People are developing some increasingly remote areas, raising the population density throughout the region.

Population density is a useful proxy for many of these changes. Where populations are high, the demand for alternative uses of forest land will also be high. To examine the potential implications for timber supply, we examined timber inventories in counties with various population densities. Growing stock, sawtimber, and grade 1 sawtimber have similar distributions across population density (fig. 3.20). Roughly 36 percent of the inventory is in counties with a low population density of 30 to 60 people per square mile. However, a full 28 percent is in counties where the population density is greater than 100 people per square mile. The likelihood of timber management may fall off dramatically at this population density (Wear and others 1995).

National Forests

The USDA Forest Service is the area's largest single landholder. Thus, the actions of the region's national forests can hold more sway over markets than those of any other single landowner. The supply behavior of the public sector is, however, exceedingly difficult to predict. Timber supply from the national forests is governed by laws, agency policy and regulations and a management approach that addresses multiple uses as well as ecological conditions.

Timber production from national forests in this region grew from the late 1970s to the late 1980s. It peaked in 1989, and declined steadily in the 1990s, a period in which timber markets have been strong and total production has expanded. In 1994, national forests sold 150 million board feet of timber in the region, 37 percent less than the 239 million board feet sold in 1989. While these declines are mild in comparison to declines observed in the Western United States, they represent an important shift in production from the region.

Perhaps more important than the amount of timber managed by the national forests is the quality of timber. The national forests control a disproportionately large share of high-quality oak timber in the Southern Appalachians. This is the component of the inventory with the

highest value. National forest harvest decisions will likely have market-level impacts for high-quality oak. However, grade 1 sawtimber, especially that on the national forests, is located on sites that are more expensive to harvest. These cost factors strongly influence the portion of the grade 1 volume that is feasible to harvest.

The Demand for Timber

To estimate demands for timber, we start by examining a recent national assessment (Haynes and others 1995). We then examine trends in the productive capacity of the wood-products industries in the region and highlight where and how change has occurred.

National Trends

The population of the United States has grown an average of 1 percent per year from 205.1 million in 1970 to 255.5 million in 1992 (Haynes and others 1995). Through 2010, population is projected to grow at the somewhat lower rate of 0.7 percent per year. Forecasts are from the economy-wide Wharton Econometric Model. Perhaps more importantly for demand, per-capita disposable personal income has increased at a substantial rate of 1.8 percent per year from \$8134 in 1970 to \$12,021 in 1992 (1982 dollars) and is projected to increase at a

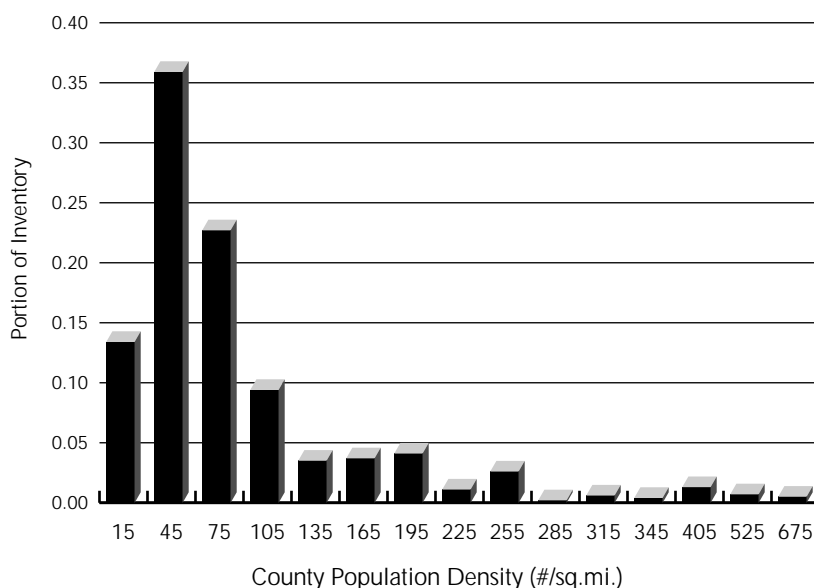


Figure 3.20 Distribution of growing stock inventories by population density. (Source: Inventory data from the USDA Forest Service, Eastwide Database, Hansen and others, 1992 and population data from the Bureau of Census)

real average annual rate of 1.4 percent to the year 2010. As a result, total disposable personal income grew at an average annual rate of 2.8 percent from 1970 to 1992 and is forecast to grow at a rate of 2.1 percent to the year 2010 and beyond.

An expanding population with increasing disposable income suggests rising demand for wood products and therefore for timber. Haynes and others (1995) make the following general predictions:

- (1) Strong growth in the consumption of paper and paperboard – though the future of pulpwood production, especially softwood pulpwood, depends on the extent of paper recycling (Ince 1994).
- (2) Substantial growth in the prices of softwood sawtimber and lumber throughout the nation.
- (3) A shift in the market share of solid-wood products to the Eastern United States, especially to the South.
- (4) Growth in the production of oriented strand board and wafer board that will displace plywood production, as total wood panel production remains relatively stable.
- (5) Increases in hardwood lumber and sawtimber prices as softwood plantations displace hardwood stands, especially in the South.
- (6) Increasing use of hardwood in products, most notably an increase in the hardwood share of pulpwood (from 40 percent in 1992 to 50 percent in 2010).

Evidence of all of these trends can be found in the Southern Appalachians: (1) Pulpwood production has expanded over the last 10 to 15 years with hardwood market share increasing. (2) Prices for yellow pine in the region have risen steadily in the 1990s, to unprecedented levels in the Southern Mountain and Piedmont subregion, which produces the majority of softwood sawlogs in the Southern Appalachians. (3) Production has been strong over the last 20 years, in spite of land-use pressures that have reduced the area of timberland in the region. (4) Oriented strand board appears to be an important emerging market for timber in the Southern Appalachians. (5) There has been steady growth in the prices for high-quality hardwood sawlogs; prices for medium-quality sawlogs have been stable, and those for low-quality logs have declined. (6) The product

share of hardwoods in the Southern Appalachians has also expanded.

The demand for softwood lumber, panels, and sawlogs is most strongly influenced by cyclic housing markets. Residential construction has been strong in recent years. Forecasts are for a slight decline followed by strong housing demand over the next three decades (Haynes and others 1995).

National projections of increasing scarcity of softwood lumber are clearly being borne out in the South. Many softwood-producing areas are operating at or near capacity and other factors are impinging on forest land use (Cubbage and others 1995). While only a decade ago the South was seen as an area with significant potential for expanding timber production, this potential appears to have been largely realized. Strong national demands for softwood lumber will necessarily keep softwood sawlog prices high in the South. As a result, we expect that softwood sawlog demand will expand, especially on the Piedmont Plateau of the South.

While the demand for softwood solid-wood products can be traced to two or three dominant factors, the demand for hardwood lumber and other solid-wood products is influenced by a broad range of factors. Following Luppold (1993), it is useful to split hardwood lumber consumption into two broad areas: (1) appearance applications and (2) industrial applications. Appearance applications are uses that depend on the aesthetic qualities of the material. These include furniture, millwork, cabinets, and flooring. In contrast, industrial applications are uses where strength and durability are the primary concerns. Industrial applications include pallets, treated products such as railroad ties, and other structural members.

Nationally, the use of hardwood lumber has generally grown over the last three decades (Haynes and others 1995). However, the use of this lumber has changed substantially. In 1977, appearance applications accounted for about 51 percent of hardwood lumber consumed; industrial applications, 43 percent (table 3.9). The remaining 6 percent was used in miscellaneous products and exports. Furniture alone accounted for 21 percent. From 1977 to 1991, total hardwood lumber consumption expanded by nearly 50 percent. However, almost all of the growth came in industrial applications, specifically in the production of pallets. In 1991, furniture accounted for only 12 percent

Table 3.9 U.S. hardwood lumber consumption by major use, 1977, 1982, 1987, and 1991.

	1977		1982		1987		1991	
	(mmbf)	(%)	(mmbf)	(%)	(mmbf)	(%)	(mmbf)	(%)
Appearance applications								
Wood household furniture	1,250	15	932	11	1,058	8	898	7
Upholstered furniture	354	4	284	3	317	2	283	2
Commercial furniture	221	3	275	3	425	3	370	3
Millwork	498	6	506	6	705	6	613	5
Kitchen cabinets	244	3	366	4	671	5	602	5
Flooring	304	4	265	3	476	4	529	4
Dimension	1,326	16	982	11	1,379	11	1,176	10
TV cabinets	51	1	31	0	20	0	15	0
Plywood	61	1	93	1	112	1	103	1
Total appearance	4,309	51	3,734	43	5,163	40	4,589	37
Industrial applications								
Pallets	2,313	28	2,900	33	4,513	35	4,704	38
Treated products	735	9	819	9	781	6	777	6
Structural members	247	3	389	4	534	4	437	4
Prefab buildings	276	3	101	1	308	2	245	2
Total industrial	3,571	43	4,209	49	6,136	48	6,163	50
Miscellaneous products	264	3	403	5	794	6	719	6
Exports	240	3	325	4	688	5	850	7
Total all uses	8,384	100	8,671	100	12,781	100	12,321	100

mmbf = million board feet

(Source: This table reproduced from Luppold, 1993)

of hardwood lumber use in the United States. Exports also expanded, from 3 percent in 1977 to 7 percent in 1991.

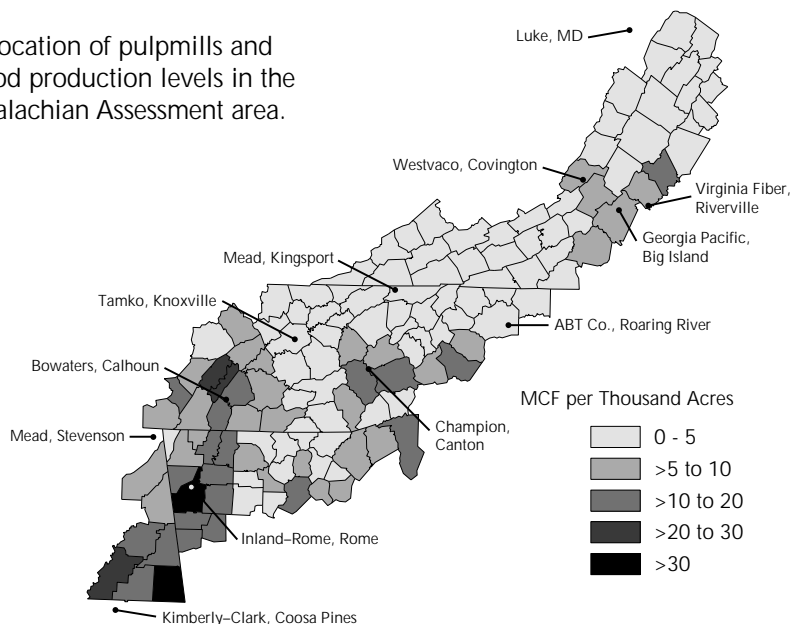
Local Factors

Pulpwood accounted for more than half of timber production in 1992. Growth in pulpwood output was strong between 1980 and 1992. The demand for pulpwood in the region is from 12 pulpmills, all of which have been

in operation since 1980 (see fig. 3.21). Because of environmental constraints, especially those related to the Clean Water Act, we do not expect the number of mills to grow. The amount of pulpwood processed by existing mills could expand, however.

In table 3.10, we chart the production capacity of 11 mills in the region from Southern Pulpwood Reports for the years 1977, 1980, 1985, 1990, and 1993. Total pulping capacity has grown over this period, especially in the

Figure 3.21 Location of pulpmills and 1992 pulpwood production levels in the Southern Appalachian Assessment area.



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Table 3.10 Total 24-hour pulping capacity of pulpmills in the Southern Appalachian area, 1977, 1980, 1985, 1990, and 1993 (tons).

Mill Location	1977	1980	1985	1990	1993
Coosa Pines, AL	1,425	1,940	2,040	2,040	2,040
Stevenson, AL	650	775	850	1,030	1,030
Rome, Georgia	1,600	1,600	2,100	2,200	2,200
Roaring River, NC	120	250	500	500	475
Canton, NC	1,365	1,400	1,440	1,480	1,450
Calhoun, TN	1,625	2,230	2,557	2,400	2,480
Kingsport, TN	250	250	325	350	350
Knoxville, TN	0	120	180	125	125
Big Island, VA	525	525	575	675	600
Riverville, VA	510	500	600	600	550
Covington, VA	1,304	1,304	1,626	1,360	1,300
Total	9,374	10,894	12,793	12,760	12,600

first half of the period. Between 1977 and 1985, pulping capacity expanded by 36 percent but then leveled off between 1985 and 1993. Nearly all of the growth in pulpwood capacity was in the far southern portion of the region. Pulping capacity was generally constant in the Northern Ridge and Valley and Blue Ridge subregions.

In spite of stable pulping capacity in the region, pulpwood harvesting increased from 1986 to 1992 (table 3.1). Almost all of this growth was in southwestern North Carolina, where pulpwood production expanded by 53 percent. Pulping capacity in that region is relatively small, suggesting that the mills to the south and west – in Georgia and Tennessee – are drawing increasing amounts of material from this region. The implication is that hauling distances and zones of procurement for pulpwood are expanding, foreshadowing increasing demand for pulpwood timber. Increasing prices for hardwood pulpwood timber in the mountains of North Carolina provide further support for this conclusion (see table 3.3).

Hardwood sawlog production is much more diffuse across the region. The number of sawmills varies with economic conditions. While the total production of hardwood sawlogs was essentially stable in the Southern Appalachians between 1983 and 1992, price patterns indicate that the strength of hardwood sawlog demand varies by species and grade. In general, our analysis of timber prices indicates that the demand for the industrial applications of hardwood lumber has been declining. This

trend may be supported by very recent increases in the recycling of pallets and the introduction of substitute shipping platforms. Pallets are the largest industrial use of hardwood lumber.

In contrast, the demand for hardwood lumber for appearance applications appears to be strong. Our price analysis indicates that grade 1 red oak and white oak timber is becoming increasingly scarce, with high rates of price increase. Strong furniture demand driven by expanding disposable income suggests continued growth in demand for high-grade lumber. Grade 2 material is largely used in millwork, kitchen cabinets, flooring, and dimension lumber. National output of these medium-grade products has grown (table 3.9). We project expanding demand for medium-grade material.

Softwood and hardwood markets are not completely isolated from one another. Increasing demand for softwood sawtimber in the South could lead to substitution of hardwood for softwood solid-wood products. One species that might replace softwood is yellow-poplar. Our analysis of grade 1 and higher yellow-poplar timber between 1977 and 1994 reveals some signs of price increases since 1990. Perhaps, substitution is starting to occur.

Question 2:

Where and how does the wood-products industry depend on National Forest System timber in the Southern Appalachians?

Key Findings

National forest land is distributed unevenly so that the Forest Service manages from 0 to 69 percent of the timberland in individual counties. In counties with major national forest holdings, decisions by the Forest Service may significantly influence the size of the local wood processing sector. In general, national forest land has more growing stock and higher-quality timber than private land. While the Forest Service has produced between 10 and 12 percent of timber since the early 1980s, that share has also varied widely across the region.

We find that:

- (1) National forests, on average, produce less timber than private lands in the region. As a result, national forests have more timber inventory per acre, less removals, less growth, and slightly higher mortality than private lands in the area. Areas with a high portion of national forests therefore have a smaller timber economy than areas without.
- (2) The national forests have provided roughly 10 to 12 percent of Southern Appalachian timber production since the early 1980s.
- (3) Timber production from the national forests of the region expanded from the late 1970s through the mid-1980s. After peaking in 1985, timber sale levels have declined in the region, especially beginning in 1991. Current sale levels are roughly comparable to sale levels of the late 1970s.
- (4) National forests in Virginia and North Carolina produce proportionally more pulpwood than surrounding lands. In Tennessee and Georgia, in contrast, the national forests produce proportionally more sawlogs.
- (5) While holding only 17 percent of the timberland in the assessment area, the national forests hold a disproportionately high share of the highest-valued sawtimber. It is likely that national forests have and will continue to have dominant influence over the production and therefore the prices of high-quality oak sawtimber in the Southern Appalachians.
- (6) The importance of local timber production is not evenly spread across the landscape of the Southern Appalachians. The national forests are generally located in the mountainous core of the area and are concentrated in only certain areas. In two distinct areas, national forests produce a very high share (35 to 52 percent) of total timber output. One area stretches from Asheville south to northern Georgia. The other ranges from the northeastern corner of Tennessee up to the West Virginia Border above Wytheville.
- (7) In these two areas it is likely that the national forests have their strongest influence on the size of the wood-products industries. While actions taken by the forests may not influence prices at a market level because there are adequate substitute sources of material in the region, they may influence the location of mills and therefore influence the structure of local economies.

Introduction

As the region's largest timberland manager, the USDA Forest Service can strongly influence the structure and function of the region's timber markets. Since its inception, the agency has produced timber while pursuing many objectives. These multiple objectives define a management approach that is distinct from those found on the private land in the region. Results include different rates of timber production, qualitatively different forests, and different timber inventories. Thus, the national forests are far from typical timber suppliers.

To determine where and how the wood-products industries depend on national forest timber, we first examine where national forests control a large share of timberland. We then examine the historical production of timber from national forests in the region as a whole and in specific areas. We also compare national forest production rates with those on private timberland.

Timberland Area

Of the 24.5 million acres of timberland in the region, the Forest Service manages 4 million, or roughly 17 percent of the total (fig. 3.1). This share of timberland is not evenly spread across the landscape; 50 of the 135 counties in the Southern Appalachians contain no national forest land at all.

In general, the national forests are concentrated in the mountainous core of the Southern Appalachians (fig. 3.22). Here the share of timberland ranges from 25 to more than 69 percent of timberland in individual counties. Two areas have particularly high concentrations of timberland. One in the northern part of the region includes Pendleton County in West Virginia and Rockingham, Augusta, Bath, Allegheny, and Craig Counties in Virginia. The other area is centered in southwestern North Carolina. It includes Monroe and Polk Counties in Tennessee, Cherokee, Graham, Clay, and Macon Counties in North Carolina, and Fannin, Union, Towns, and Rabun Counties in Georgia. In these two areas, national forests control about 50 percent of the timberland.

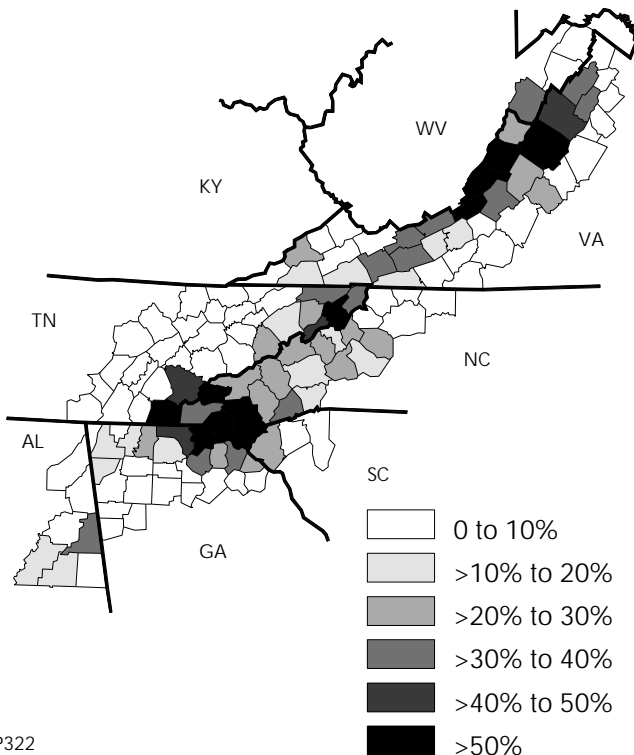


Figure 3.22 Share of timberland in national forests by county.

Timber Production from the National Forests

Management Intensities

There are fundamental differences in the management of private and public forests. Land and resource management are strongly guided by market forces on private land. Prices, therefore, strongly influence both land use and timber management. In contrast, national forests are managed for many benefits, some of which are not traded in markets. Timber production is therefore only one of a complex array of uses and ecological conditions for which the national forests are managed. The Forest Service also is guided by administrative rules and congressional actions. One result is that the Agency's supply of timber does not mirror production from private land.

Comparison of the timber inventories on the two ownerships is instructive. National forests on average have 20 percent more growing-stock volume and 28 percent more sawtimber volume than private forests in the region (fig. 3.23). The greatest differences between the two ownerships are in the Southern Mountain and Piedmont and the least differences are in the Northern Ridge and Valley. In the latter area, growing-stock volumes are 8 percent higher and sawtimber volumes are 4 percent higher in national forests than in private forests.

One reason national forests have higher levels of timber inventories is that they are managed on longer rotations. The Forest Service is generally bound by law to not harvest a forest stand until after the age of "culmination of mean annual increment," or the age when the maximum physical (though not necessarily economic) yield can be achieved. As a result, the average growth rates are substantially higher on private forests than on national forests. The national forests' growth:inventory ratios are 2.04 percent per year for growing stock and 2.71 for sawtimber (table 3.11). On private land, the growing-stock ratio is 2.89 percent per year and the sawtimber ratio is 4.01 percent per year.

National forests also contain different types of timber. With 17 percent of timberland in the region, the national forests contain 21 percent of the sawtimber, 27 percent of the grade 1 sawtimber, and 44 percent of the select red oak

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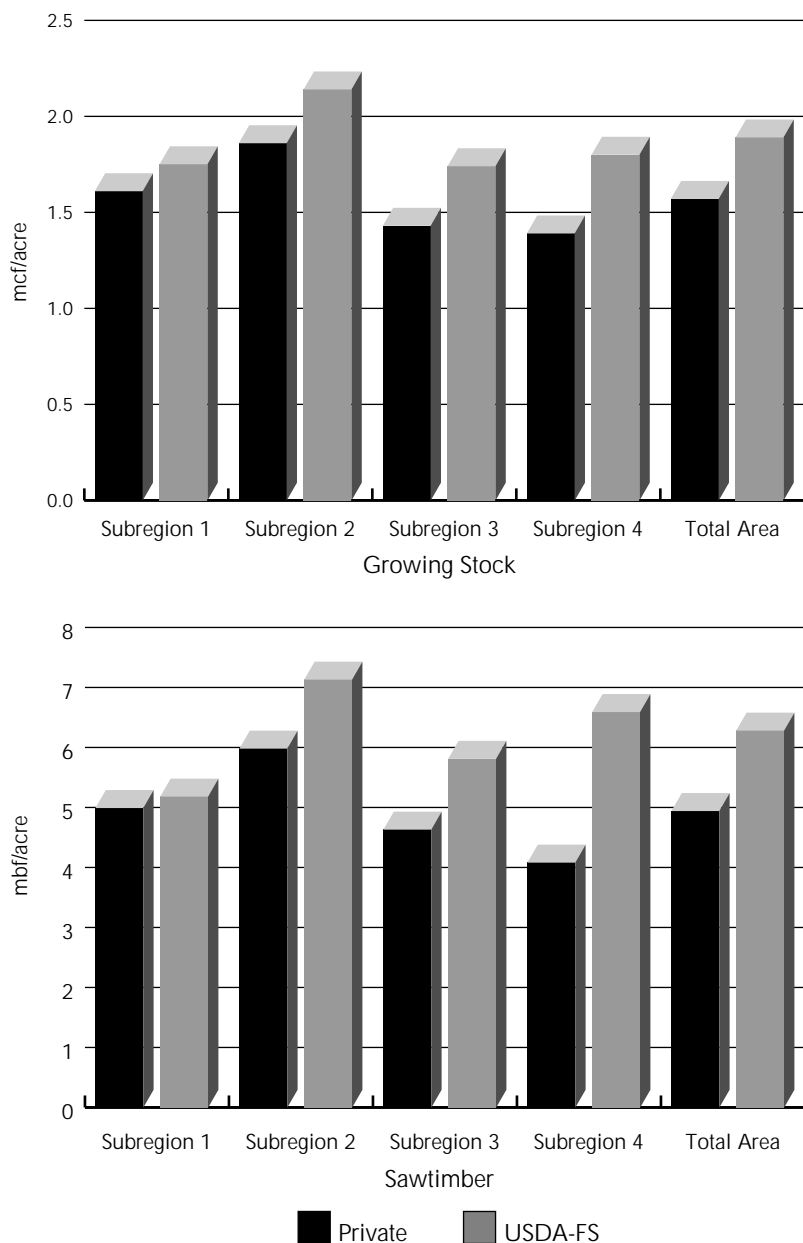


Figure 3.23 Growing stock and sawtimber inventories on private lands and national forests. (Source: USDA Forest Service, Eastwide Database, Hansen and others, 1992)

grade 1 sawtimber in the region. Clearly, the national forests dominate markets for the highest-quality timber.

Differences in management also can influence average mortality rates in forest stands. Because national forest stands are generally older, we would expect higher natural mortality. Mortality:inventory ratios show, however, that mortality occurs at similar rates on national forest and private land. The rates for growing stock are nearly identical (0.80 and 0.81

percent of inventory lost per year) and the rates for the sawtimber differ by only 8 percent (0.71 percent per year for the national forests, and 0.65 percent per year for private forests).

Another way to compare the management profiles for national forests and private lands is to compare their timber removals. Table 3.11 shows removals for all causes, including the designation of timberland as wilderness or some other reserved category, and conversions of private timberland to other uses. To compare

Table 3.11 Inventory, growth, mortality, and removals on national forests and private land.

Variable	Units ¹	Subregion 1		Subregion 2		Subregion 3		Subregion 4		Total Area	
		USDA-FS	Private	USDA-FS	Private	USDA-FS	Private	USDA-FS	Private	USDA-FS	Private
Timberland Area	(acres)	952.7	2,604.1	1,402.7	5,360.6	836.9	6,300.8	823.1	4,414.6	4,015.4	18,680.1
Inventory											
Growing stock	(mmcf)	1,667.6	4,192.8	3,002.9	9,982.1	1,453.0	9,018.4	1,485.3	6,140.5	7,608.8	29,333.8
Sawtimber	(mmbf)	4,938.9	13,005.5	10,006.7	32,055.8	4,860.5	29,144.3	5,420.9	18,018.7	25,227.0	92,224.3
Growth											
Growing stock	(mmcf)	29.9	96.8	56.1	251.2	32.9	277.7	36.0	223.1	154.9	848.8
Sawtimber	(mmbf)	114.0	421.2	260.4	1,210.9	151.9	1,166.9	158.3	897.2	684.6	3,696.2
Mortality											
Growing stock	(mmcf)	12.2	24.9	27.1	81.8	10.8	75.7	11.3	50.9	61.4	233.3
Sawtimber	(mmbf)	37.3	64.9	80.8	219.3	19.7	183.9	41.1	127.5	178.9	595.6
Removals											
Growing stock	(mmcf)	9.5	38.5	23.7	165.8	19.8	139.1	34.9	172.9	87.9	516.3
Sawtimber	(mmbf)	29.5	145.4	88.6	641.3	64.8	483.4	119.2	544.8	302.1	1,814.9
Inventory: Area											
Growing stock	(mcf/acre)	1.8	1.6	2.1	1.9	1.7	1.4	1.8	1.4	1.9	1.6
Sawtimber	(mbf/acre)	5.2	5.0	7.1	6.0	5.8	4.6	6.6	4.1	6.3	4.9
Removals: Area											
Growing stock	(cf/acre)	9.97	14.78	16.90	30.93	23.66	22.08	42.40	39.17	21.89	27.64
Sawtimber	(bf/acre)	30.96	55.84	63.16	119.63	77.43	76.72	144.82	123.41	75.24	97.16
Removals: Inventory											
Growing stock	(percent)	0.57	0.92	0.79	1.66	1.36	1.54	2.35	2.82	1.16	1.76
Sawtimber	(percent)	0.60	1.12	0.89	2.00	1.33	1.66	2.20	3.02	1.20	1.97
Mortality: Inventory											
Growing stock	(percent)	0.73	0.59	0.90	0.82	0.74	0.84	0.76	0.83	0.81	0.80
Sawtimber	(percent)	0.76	0.50	0.81	0.68	0.41	0.63	0.76	0.71	0.71	0.65
Growth: Inventory											
Growing stock	(percent)	1.79	2.31	1.87	2.52	2.26	3.08	2.42	3.63	2.04	2.89
Sawtimber	(percent)	2.31	3.24	2.60	3.78	3.13	4.00	2.92	4.98	2.71	4.01

¹Units:

mmcf = million cubic feet

mmbf = million board feet

mcf/acre = thousand cubic feet per acre

mbf/acre = thousand board feet per acre

cf/acre = cubic feet per acre

bf/acre = board feet per acre

timber removals, we split them by cause in table 3.12, and then isolated harvests on timberland plots. The timber harvest:inventory ratio for national forest timberland is about one-half that on all other timberland. Since national forests have more volume per acre than private land, however, the difference in harvest per acre is smaller. Still, private timber harvests per acre of timberland are 70 percent higher for growing stock and 77 percent higher for sawtimber.

National forests are in the mountainous core of the Southern Appalachians. As a result, their timber volumes are on steeper terrain. These and other factors that influence costs may constrain timber harvesting and partially

explain differences in timber production. There is some evidence, however, that national forest timber harvesting decisions in this region are not heavily influenced by these cost factors (Wear and Flamm 1993).

National forests and private forests differ considerably. On average, national forest stands are older, occupy poorer sites, have lower growth rates and slightly higher mortality, and produce substantially less timber than do private forests. Thus, one primary effect of national forests on wood-products industries is the production of less timber than might be expected if the forests were privately owned, though this is at least partially related to differences in forest quality.

Table 3.12 Timber removals by cause for national forests and other lands in the assessment area.

	Growing Stock Removals			Sawtimber Removals		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	(mmcf)			(mmbf)		
All Owners						
From timberland plots	497.7	239.5	258.2	1815.4	868.1	947.4
Conversion to reserved status	41.1	4.9	36.2	130.3	21.4	108.9
Conversion to other use	85.7	43.3	42.4	243.9	116.9	127
Total	624.5	287.7	336.8	2189.7	1006.4	1183.3
National Forests						
From timberland plots	54.7	15.7	39	196.3	69.7	126.7
Conversion to reserved status	33.3	4.6	28.7	105.8	19.8	86
Conversion to other use	0	0	0	0	0	0
Total	87.9	20.2	67.7	302.2	89.5	212.7
Non-National Forest						
From timberland plots	443	223.8	219.2	1619.1	798.4	820.7
Conversion to reserved status	7.8	0.3	7.5	24.5	1.6	22.9
Conversion to other use	85.7	43.3	42.4	243.9	116.9	127
Total	536.6	267.5	269.1	1887.5	916.9	970.6

mmcf = million cubic feet

mmbf = million board feet

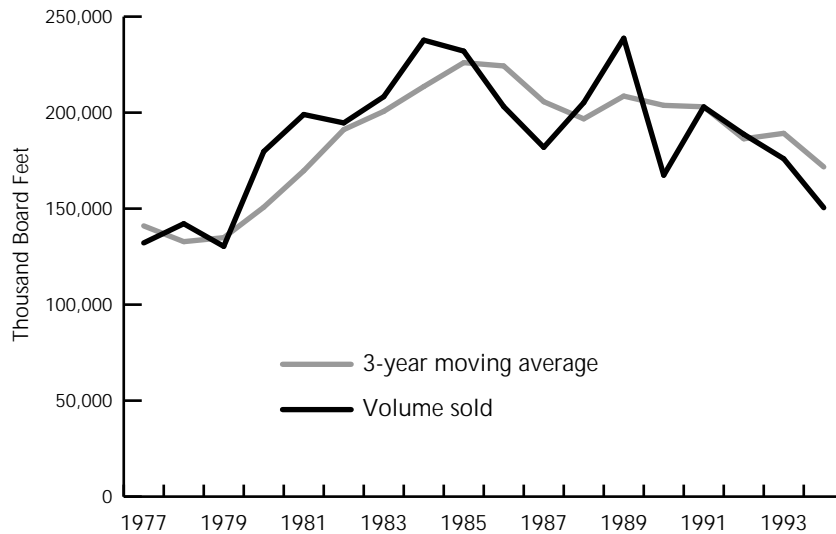


Figure 3.24 Total volume of timber sold from national forests in the Southern Appalachian Assessment area. (Source: Timber cut and sold records, Southern Region, USDA Forest Service)

History of Production

Since 1977, the pattern of timber production from the national forests has changed considerably. Figure 3.24 charts the volume of timber sold by all national forest districts in the region from 1977 to 1994. Since timber can actually be cut over a period determined by the sale contract, the sale volume is not necessarily an accurate accounting of actual timber harvesting in a given year. To approximate actual harvests, we also plotted a 3-year moving average of sales volumes for the same period.

Between 1977 and 1994, national forest timber sales averaged about 183 million board feet per year. Sales were lowest in the late 1970s, when they ranged from 130 to 140 million board feet. Production climbed steadily into the mid-1980s, peaking at about 225 million board feet. Since 1985, the 3-year moving average has declined to 172 million board feet in 1994. The actual timber sale volume in 1994 was 151 million board feet.

For the years 1983, 1986, 1989, and 1992 – years in which we have estimates of total production – the national forests provided between 10 and 12 percent of total production. Since national forests have 17 percent of timberland, their share of total production reflects a less intensive management approach than on private timberland.

Production by Product

Differences in the management of national forests should give rise to different mixtures of timber outputs. To examine product differences, we divided production between softwoods and hardwoods and between pulpwood and sawtimber for the national forests and private forests in the region (table 3.13). Unavoidably, these national forest figures include small amounts produced outside of the SAA area.

For the region as a whole, shares of pulpwood and sawlogs from national forests are very similar to those produced from all land. While product shares are comparable overall, there are some important differences in individual subregions. For example, in the northern part of the assessment area, the George Washington National Forest produces 62 to 69 percent pulpwood, while the average pulpwood share for all forests in the Northern Ridge and Valley subregion is about 43 percent. The same holds for the Jefferson and North Carolina national forests, where the pulpwood share is 10 to 25 percentage points higher than on private land. In contrast, the southernmost national forests produce relatively more sawtimber than the market as a whole. For example, the Cherokee National Forest produced 59 to 65 percent sawlogs between 1990 and 1994, while the averages for the Southern Ridge and

Table 3.13 Share of hardwoods, softwoods, pulpwood, and sawlogs produced by the national forests in the Southern Appalachians and for the various subregions of the assessment area (percent).

Fiscal Year	National Forest Product Shares			Calendar Year	Total Product Shares		
	Hardwood	Softwood	Sawtimber		Hardwood	Softwood	Sawtimber
Subregion 1–Northern Ridge and Valley							
George Washington							
1994	85	15	66				34
1993	91	9	67				33
1992	84	16	62	1992	79	21	43
1991	81	19	69				57
1990	76	24	64	1989	80	20	43
Subregion 2–Blue Ridge							
Jefferson							
1994	78	22	49				51
1993	88	12	52				48
1992	88	12	63	1992	63	37	41
1991	93	7	62				59
1990	87	13	60	1989	63	37	39
North Carolina							
1994	59	41	47				53
1993	67	33	49				51
1992	60	40	53	1992	63	37	41
1991	60	40	49				51
1990	60	40	56	1989	63	37	39
Cherokee							
1994	57	43	41				59
1993	45	55	35				65
1992	54	46	38	1992	48	52	55
1991	58	42	41				45
1990	50	50	39	1989	45	55	50
Chatahoochee							
1994	26	74	34				66
1993	23	77	31				69
1992	24	76	37	1992	25	75	63
1991	22	78	35				37
1990	21	79	41	1989	22	78	60
Entire assessment area							
Total							
1994	43	57	53				47
1993	51	49	48				52
1992	43	57	50	1992	47	53	53
1991	41	59	51				47
1990	42	58	51	1989	48	52	49
			51				51

1. Lee
2. Deerfield, Dry River, James River, Pedlar, Warm Springs
3. Blacksburg, Newcastle, Glenwood
4. Mt. Rogers, Wythe
5. Clinch
6. Unaka, Watauga
7. Nolichucky
8. Grandfather, Toecane
9. French Broad, Pisgah
10. Cheoah, Highlands, Wayah
11. Hiawasse, Tellico, Ocoee
12. Tusquitee
13. Armuchee
14. Brasstown, Cestatee, Tallulah, Toccoa, Cohutta
15. Chattooga
16. Andrew Pickens
17. Shoal Creek, Talladega

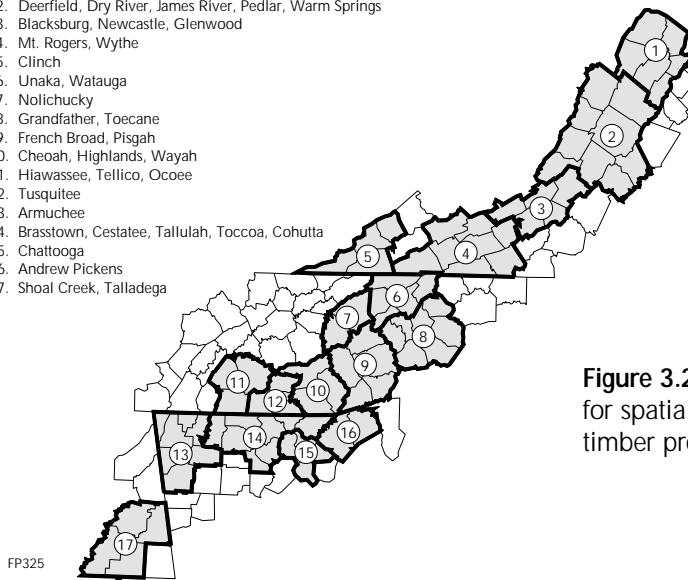


Figure 3.25 Ranger district groupings for spatial analysis of national forest timber production.

Valley subregion were 45 to 50 percent between 1989 and 1992. Similarly, the Chattahoochee produced 59 to 69 percent sawlogs, while 37 to 40 percent were produced on all forests in the Southern Mountain and Piedmont subregion.

Spatial Distribution of Production

The national forests and their timber production are unevenly distributed across the Southern Appalachians. To display a spatial

distribution, we examine timber production for 17 groupings of ranger districts (fig. 3.25).

By comparing timber product output (TPO) records by counties with production from ranger districts, we calculate product shares as shown in figure 3.26. Shares displayed are the sums of production for the years 1983, 1986, 1989, and 1992. While the Forest Service produces 10 to 12 percent of total timber production in the SAA area, there is a wide range among zones. The areas with the smallest shares of timber production are the Armuchee

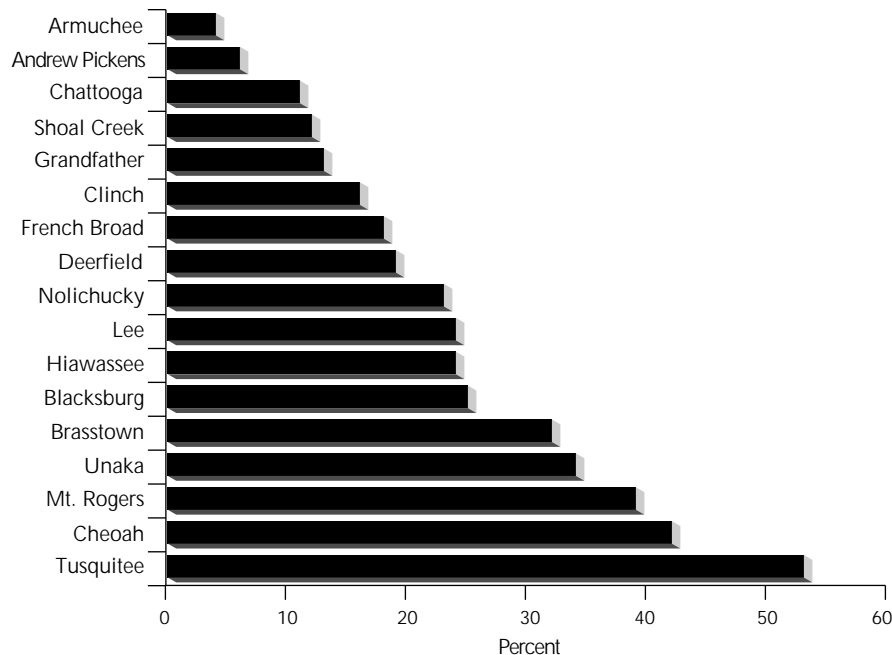
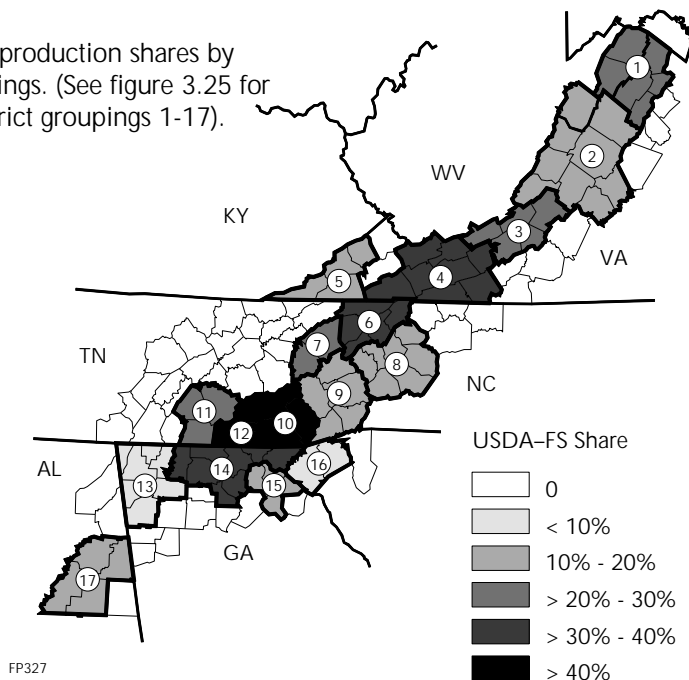


Figure 3.26 Share of timber produced by national forests for individual ranger district groupings. See Figure 3.25 for definitions of groupings.

Figure 3.27 Timber production shares by ranger district groupings. (See figure 3.25 for names of ranger district groupings 1-17).



Ranger District on the Chattahoochee National Forest in Georgia (4 percent) and the Andrew Pickens Ranger District on the Sumter National Forest in South Carolina (6 percent).

The national forests' share of timber production is especially high in two areas. The Tusquitee Ranger District in the southwestern corner of North Carolina has the highest share of production at 53 percent (fig. 3.27). Adjacent and to the north of Tusquitee is the second highest concentration of Forest Service production, the Cheoah-Highlands-Wayah constellation of ranger districts (42 percent). In this six-county area, national forests account for roughly one-half of local timber production. To the immediate south of this area, the Brasstown, Cestatee, Tallulah, Toccoa, and Cohutta Districts provide roughly 32 percent of timber production.

The other area where national forest production is especially significant extends from the northeastern corner of Tennessee north and east into Virginia and up to the West Virginia border. The Unaka and Watauga Districts of the Cherokee National Forest account for 34 percent of the area's timber production. The Mt. Rogers and Wythe Districts of the Jefferson National Forest provide 39 percent of the local production.

No other zone provides more than 25 percent of local production. Four groupings provide 23 to 25 percent of local production described above, and six groupings provide 10 to 20 percent.

Question 3:

What are the relationships between timber production, employment, and income in the Southern Appalachians?

Key Findings

Wood-products industries have provided a stable source of income and employment in the Southern Appalachians over the last 20 years. Both income and employment grew over this period, but at rates smaller than for the economy as a whole. As a result, their share in the economy dropped. Solid-wood products provide more income and jobs than do pulpwood products, but pulpwood jobs have higher wages. In addition, pulpwood-using industries are concentrated in a few locations while solid-wood industries are spread throughout the rural areas. Shifts in forest product mix could reduce employment and shift the location of jobs.

Specific findings are:

- (1) Between 1975 and 1994 wage employment averaged 2.05 million jobs. There were, on average, 24,300 jobs in lumber and wood-products industries; 51,800 jobs in furniture industries; and 23,200 in pulp and paper industries.
- (2) Total lumber and wood products and pulp and paper employment grew between 1975 and 1994. Employment was stable in the furniture industry.

- (3) Because wood-products employment grew slower than total products employment, its share declined from 6 percent in 1975 to about 4.2 percent in 1994.
- (4) The Blue Ridge Region had the highest share of wood-products wage employment with an average of about 8 percent. All other regions had shares between 3 and 4 percent.
- (5) In 1993, wage employment in wood products was 106,750 in the Southern Appalachians. Self-employment in this sector could contribute as much as an additional 23,000 jobs.
- (6) Total wage income in the Southern Appalachians averaged \$34.9 billion between 1975 and 1994. It grew at an average annual rate of 3.0 percent and was \$45 billion in 1994.
- (7) Wage income in the wood-products industries averaged \$348 million from lumber and wood products, \$779 million from furniture, and \$657 million from pulp and paper. The share of wage income from wood-products sectors ranged from 6 percent in 1975 to 4.6 percent in 1994.
- (8) Average wage income in the region was about \$17,000 per job and fairly stable. Lumber and furniture industries had slightly lower average wages per job, but wages in that industry were approaching the regional average by 1994. Average wage income was substantially higher in the pulp and paper sector.
- (9) Employment per harvest is about twice as high for the solid-wood industries (lumber and furniture) as it is for pulp-wood-using industries.
- (10) Economic impact analysis shows that reducing solid-wood products output by \$1 million would displace 11 workers and cause total income in the region to fall by \$326,000. A \$1 million drop in pulpmill output would displace 6.3 jobs and reduce income by \$237,700.

Introduction

Timber production and wood-products manufacture have long had an important role in the local economies of the Southern Appalachians. From the late 1800s until well into the 20th century, the wood-products industry was the major source of manufacturing employment in a very isolated region. Since then, the region has become progressively less isolated, its economy has become much more diverse, and wood products represents a smaller share of overall employment. Still, timber harvesting and its derivative employment remain independent to the Southern Appalachian economy.

In this section, we use two types of data to show how timber harvesting in the Southern Appalachians is related to employment and income in the region. First, we examine trends in wood-products employment and income for 1975 through 1994. We also examine the shares of total employment and income represented by these industries. In addition, we use a computer model that simulates the structure of the region's economy to examine how changes in the production of wood-products manufacturing might influence the economy as a whole. These models may not fully reflect large-scale effects, but they provide insights into marginal changes.

Throughout this analysis, we examine employment and income for three specific sectors of the economy: (1) Lumber and Wood Products – Standard Industry Classification (SIC) 24, (2) Paper and Allied Products – SIC 26, and (3) Furniture and Fixtures – SIC 25.

Employment

To measure total employment in the Southern Appalachians, we use data reported through the unemployment insurance programs administered by all states in the region (the ES-202 database). These data are compiled by individual firms, but confidentiality is preserved by prohibiting access at the firm level. Since counties may have only one firm in a given sector (e.g., one paper mill), many of the data cannot be accessed at the county level.

We were, however, able to compile comprehensive data on employment and income for the Southern Appalachians and for each of our four subregions.⁴

ES-202 data records include all employees covered by unemployment insurance but do not include self-employed people. They therefore underreport total employment. To estimate potential self-employment, we also examined rates of self-employment for wood-products industries at the state level.

Wage Employment

Between 1975 and 1994, total employment in the Southern Appalachians averaged 2.05 million. There were on average 24,300 jobs in lumber and wood-products industries, 51,800 jobs in the furniture industries, and 23,200 jobs in paper and allied products. Wood-products industries provided a total of 99,300 jobs and comprised an average of 4.8 percent of the wage employment in the Southern Appalachians. Wage employment in

the wood-products industries grew moderately between 1975 and 1994 (fig. 3.28). Wage employment in the lumber and wood-products industries (SIC 24) expanded at an average annual rate of 1.4 percent per year while employment expanded at 0.9 percent per year in the paper and allied products sector (SIC 26, see table 3.14).⁵ In contrast, employment in the furniture and fixtures sector (SIC 25) was essentially stable (i.e., we found no significant trend in employment for this sector).

While the number of jobs in the wood-products industries grew between 1975 and 1994, employment in the rest of the economy grew faster. As a result, the share of employment in the wood-products industries fell from more than 6 percent in 1975 to 4.2 percent in 1994.

While these findings are generally reflected in all regions of the Southern Appalachians, there are some countervailing trends. In the Northern Ridge and Valley subregion, total employment grew at the same rate as in the region as a whole. However, wood-products

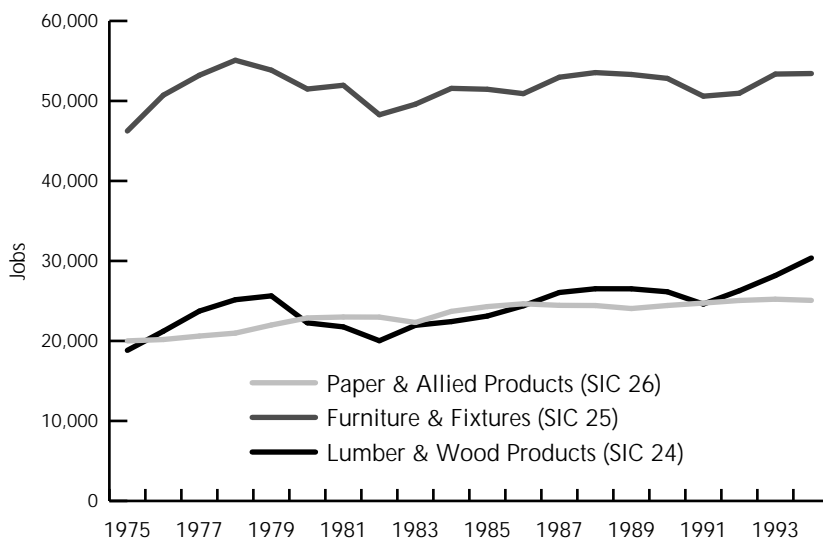


Figure 3.28 Wage and salary employment in lumber and wood products, furniture and fixtures, paper and allied products in the Southern Appalachians, 1975-1993. (Source: Department of Labor, unemployment insurance database, ES-202)

⁴ These data were compiled by analysts in the Bureau of Labor Statistics, Department of Labor. All reports were scanned by security programs to maintain the confidentiality of information reported by individual firms.

⁵ All rates of change described in this section were estimated using statistical regression techniques. We report only those trends that were statistically significant at the 95 percent confidence level. Note that rates of change were calculated for the period 1978-1994. This period begins and ends at peaks in the business cycle.

industries saw substantial change between 1975 and 1994 (fig. 3.29, table 3.14). Employment in the furniture industries fell at an average annual rate of 3.1 percent per year. In contrast, employment grew at an average annual rate of 4.3 percent per year in the lumber and wood-products industries and 1.9 percent per year in the paper industries. As a result, the share of employment in wood-products industries fell by only a small amount in the Northern Ridge and Valley subregion, from 4.5 percent in 1975 to 3.2 percent in 1994.

Wood-products employment was most significant in the Blue Ridge subregion. Here, wood product employment was 8 percent of total employment and the subregion represented 60 percent of the SIC 25 employment and 36 percent of the SIC 24 employment in the Southern Appalachians. Trends for these two sectors were very similar to the averages for the entire area – furniture employment was stable,

while lumber and wood-products employment grew at about 1.6 percent per year. Employment in the paper industries, however, declined at an average annual rate of -1.0 percent per year. Since the growth rate from 1975 to 1994 was 2.0 percent for the economy as a whole, the Blue Ridge experienced a drop in the share of wood-products employment – from 10.7 percent in 1975 to 6.9 percent in 1994.

The Southern Ridge and Valley was the only subregion not to experience an increase in employment in the lumber and wood-products industries and the only region to experience an increase in the furniture industries (+1.6 percent per year). In addition, this region showed the most growth in the paper industries (+2.3 percent per year). As a result, the composition of wood-products employment shifted strongly towards paper manufacturing, and the share of wood-products employment fell from 4.8 percent in 1975 to 3.4 percent in 1994.

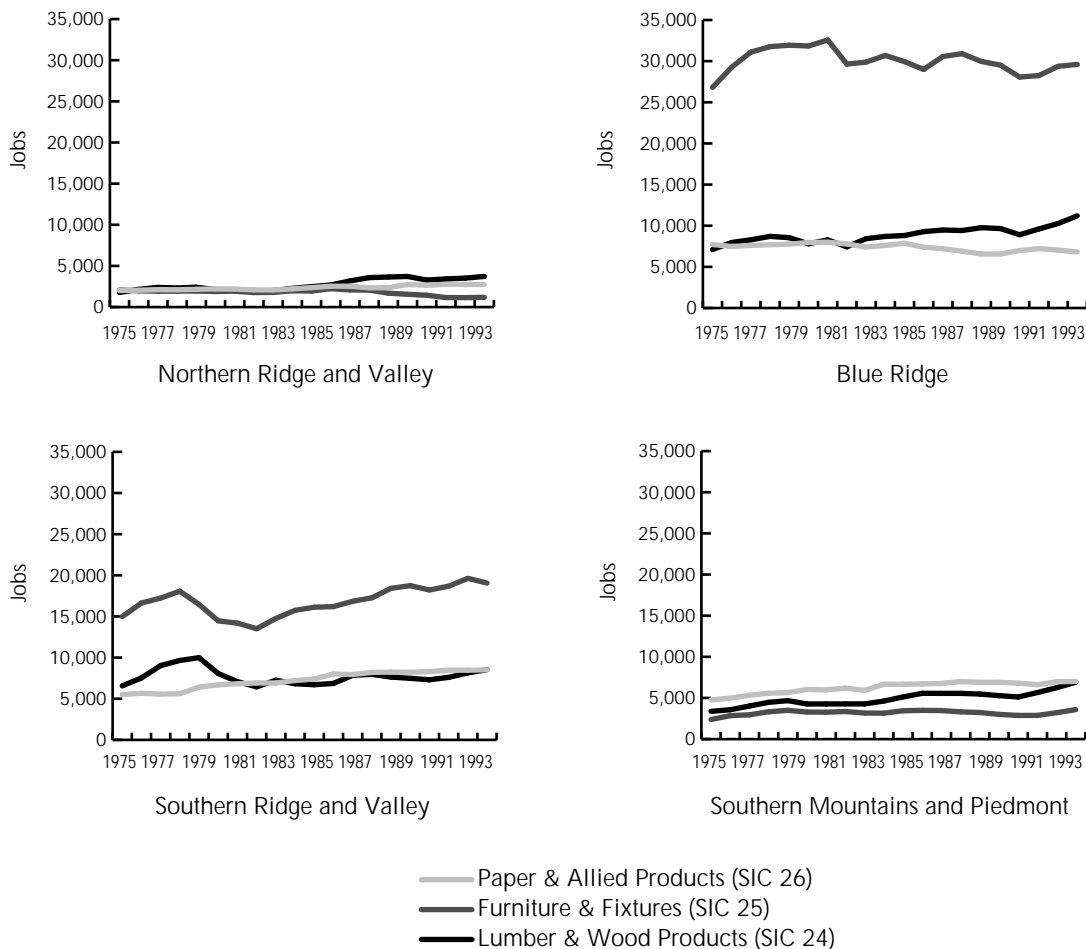


Figure 3.29 Wage and salary employment in lumber and wood products, furniture and fixtures, and paper and allied products for four subregions in the Southern Appalachians, 1975-1993. (Source: Department of Labor, unemployment insurance database, ES-202)

The Southern Mountain and Piedmont sub-region had the highest rate of growth in overall employment among the four subregions. Here, growth in the lumber and wood-products industries was also the highest in the Southern Appalachians (+2.5 percent per year), while trends for the furniture sector (no change) and the paper industries (+1.4 percent per year) were very similar to the averages across all regions. The wood products share of employment fell from 3.4 percent in 1975 to 2.9 percent in 1994.

Other Employment

To estimate self-employment, we examined ratios of total employment (self-employed and wage employment) to wage employment alone for the wood-products sectors and for the entire economies in North Carolina and West Virginia. These two states bracket conditions in the Southern Appalachians. North Carolina has a broad complement of forest industries from plantation pine forestry on the coastal plain to hardwood production in the Southern

Appalachians. Its timber economy is influenced more by softwood production than is the economy of the assessment area as a whole. We therefore also examined the same data for West Virginia, a state where hardwood production dominates the timber economy. These two states provide a range of results that may apply to the assessment area.

In North Carolina, a roughly constant 16 percent of the work force was self-employed between 1969 and 1993 (fig. 3.30). Self-employment in the wood-products industries varied. There was no significant self-employment in the paper sector and only 1 to 2 percent self-employed in the furniture industries. Lumber and wood-products manufacturing however, had an average level of self-employment that was comparable to the economy as a whole – about 16 percent. However, the share of self-employment in lumber and wood products trended downwards between 1969 and 1993, perhaps reflecting a shift towards fewer and bigger mills in the region.

Table 3.14 Average wage and salary employment and annual rates of change in all sectors, lumber and wood products (SIC 24), furniture and fixtures (SIC 25), and paper and allied products (SIC 26) in the Southern Appalachians, 1978-1994.

Subregion/Sector	Average Employment (thousand employees)	Average Annual Rate of Change (%)
Total area		
All sectors	2,151.5	2.2
SIC 24	24.8	1.4
SIC 25	59.7	NS
SIC 26	23.8	0.9
Northern Ridge and Valley		
All sectors	203.5	2.2
SIC 24	2.8	4.3
SIC 25	1.7	-3.1
SIC 26	2.4	1.9
Blue Ridge		
All sectors	586.4	2.0
SIC 24	9.1	1.6
SIC 25	30.2	-0.6
SIC 26	7.4	-1.0
Southern Ridge and Valley		
All sectors	870.8	2.2
SIC 24	7.7	NS
SIC 25	16.8	1.6
SIC 26	7.5	2.3
Southern Mountain and Piedmont		
All sectors	490.7	2.5
SIC 24	5.1	2.5
SIC 25	3.3	NS
SIC 26	6.5	1.4

NS indicates that the rate of change was not significant at the 99% level.
(Source: Department of Labor, unemployment insurance database, ES-202)

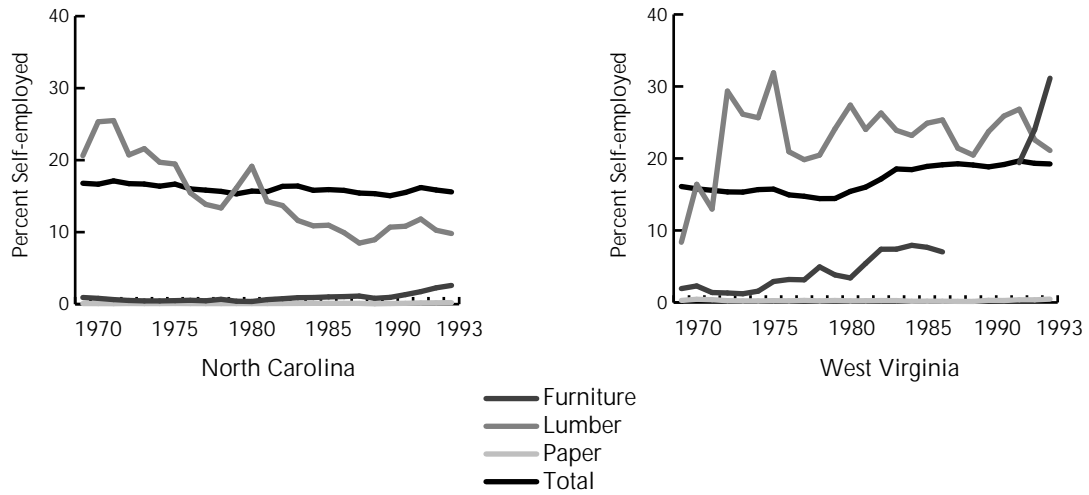


Figure 3.30 Ratio of total employment in lumber and wood products, furniture and fixtures, paper and allied products, and all sectors for North Carolina and West Virginia, 1969-1993. (Sources: Wage and salary employment from Department of Labor, unemployment insurance database, ES-202, total employment from Department of Commerce, Regional Economic Information System [REIS])

In West Virginia, the total share of self-employment rose from about 16 percent in 1969 to about 19 percent in 1993 (fig. 3.30). As in North Carolina, there were practically no self-employed workers in the paper industries. In contrast to our findings for North Carolina, self-employment in lumber and wood products averaged about 24 percent and remained at this level over the entire period. Self-employment in the furniture industry was also higher, showing strong growth in the last 3 years of the period.

Furniture does not represent as big a share of employment in West Virginia as it does in North Carolina, however.

Results for the lumber and wood-products industries in North Carolina and West Virginia raise some interesting differences. In North Carolina, where softwoods are important components of production, we observed that self-employment had fallen off substantially, consistent with shifts towards bigger wood-processing operations and labor-saving

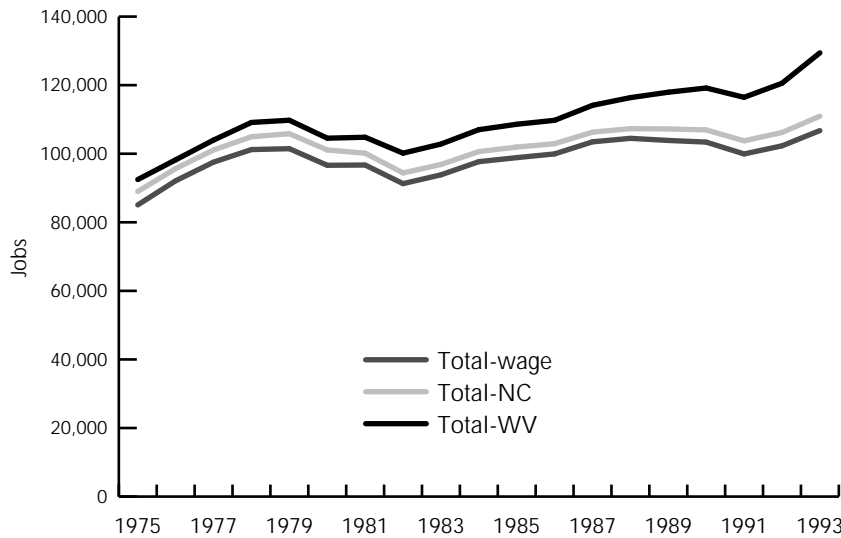


Figure 3.31 Total employment in the wood products industries calculated using self-employment ratios for West Virginia and North Carolina and wage employment alone. (Sources: Wage and salary employment from Department of Labor, unemployment insurance database, ES-202, total employment from Department of Commerce, Regional Economic Information System [REIS])

technology (Wear 1989; Stier and Bengston 1994). In West Virginia, where hardwoods dominate the product mix, we did not observe the same decline. Owner-operators remained an important part of the timber economy there.

To examine the net effects that self-employment might have on the share of total employment in the Southern Appalachians, we constructed a simple comparison. First, we calculated employment in the wood-products industries using the ES-202 data alone. Then we calculated total employment and employment shares using rates of self-employment for North Carolina and West Virginia (fig. 3.31). Total wood-products employment in 1993 under these scenarios were 106,750 using ES-202 alone and 129,432 using West Virginia's self-employment rates. Shares, however, were much more similar, with differences being no greater than one-half a percent. Ignoring self-employment can lead to serious underestimates of actual numbers of workers, especially in the lumber and wood-products sector. However, our results suggest that employment shares

calculated from unemployment data may be reasonably accurate.

Income

To measure the contribution of wood-products industries to income generated in the Southern Appalachian region, we consider first the contributions of wage and salaries to income. As with employment, these data are taken from the ES-202 database maintained by the Department of Labor. Wages and salaries are not, however, a complete accounting of earnings in an industry. We also examine other sources of earnings in wood-products sectors at the state level.

Wages and Salaries

Between 1975 and 1994 wage income in the Southern Appalachians averaged \$34.9 billion and grew at an average annual rate of 2.5 percent (table 3.15). (Throughout this section we correct for the effects of inflation and

Table 3.15 Wages and salaries and annual rates of change in all sectors, lumber and wood products (SIC 24), furniture and fixtures (SIC 25), and paper and allied products (SIC 26) in the Southern Appalachians, 1978-1994.

Subregion/Sector	Average Wage and Salary (million dollars) ¹	Average Annual Rate of Change (%)
Total area		
All sectors	36,616.6	2.5
SIC 24	358.8	2.7
SIC 25	786.8	0.6
SIC 26	682.3	1.7
Northern Ridge and Valley		
All sectors	3,435.5	2.7
SIC 24	43.4	6.2
SIC 25	29.7	-2.1
SIC 26	74.6	2.5
Blue Ridge		
All sectors	9,465.2	2.3
SIC 24	134.2	2.7
SIC 25	457.1	NS
SIC 26	218.3	NS
Southern Ridge and Valley		
All sectors	15,398.6	2.3
SIC 24	108.5	NS
SIC 25	247.8	2.6
SIC 26	202.4	2.8
Southern Mountain and Piedmont		
All sectors	8,317.3	3.0
SIC 24	72.8	6.6
SIC 25	52.3	0.9
SIC 26	186.9	2.0

¹1987=100, prices are adjusted for inflation and expressed in terms of value in 1987.

NS indicates that the rate of change was not significant at the 99% level.

(Source: Department of Labor, unemployment insurance database, ES-202)

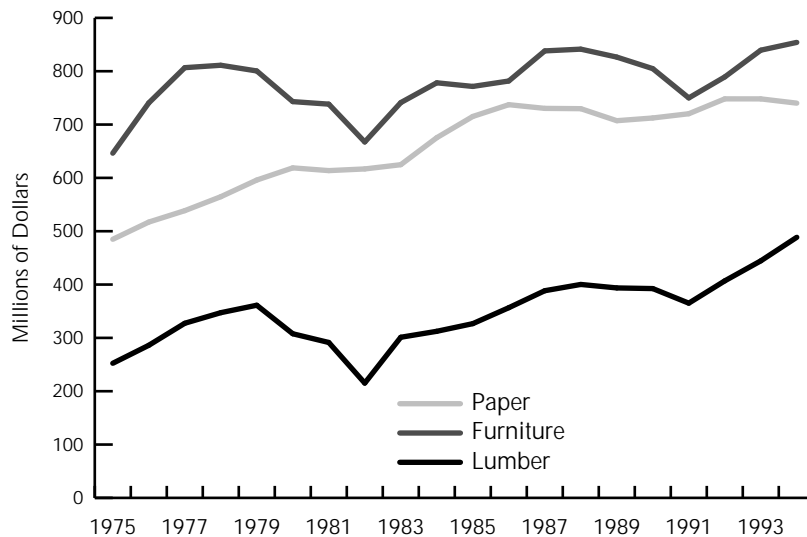


Figure 3.32 Real wages and salaries (1987=100) for lumber and wood products, furniture and fixtures, and paper and allied products in the Southern Appalachians, 1975-1993. (Source: Department of Labor, unemployment insurance database, ES-202)

measure dollars in terms of their spending-power in 1987. We adjust values from other years using the GDP price deflator. Rates of change are calculated for the period 1978-1994.) As a result, wage income grew from about \$25 billion in 1975 to \$45 billion in 1993. On average, the wood-products industries contributed about 5.5 percent of the wage and salary income, with lumber and wood products providing an average of \$348 million, furniture and fixtures contributing \$779 million, and paper and allied products contributing \$657 million. Wage growth in the wood-products sector was not as strong as for the economy as a whole, so that the wood-products share of wages declined from about 6 percent in 1975 to 4.6 percent in 1994 (fig. 3.32, table 3.15).

Regional patterns of growth in wage and salary income are generally very similar to patterns of growth in employment. In every subregion and every sector, wage and salary growth has been stronger than employment growth. As a result the wage per job in the wood-products industries has risen throughout the region (see tables 3.14 and 3.15). The average wages per job for the economy as a whole were about \$17,000 and changed very little between 1975 and 1994 (\$16,900 to \$17,400, fig. 3.33). Wages in the lumber and wood-products industries (\$14,250) and the

furniture and fixtures industries (\$15,020) were about 15 percent below this average. In contrast, wages per job in the paper and allied products industries were nearly twice as high (\$28,147). In all three areas – especially paper and allied products – wages per job trended upward from 1975 through 1994 (fig. 3.32).

Total Earnings

Wages and salaries are only a portion of the total compensation provided by employers. Total earnings are composed of wages and salaries, contributions to benefit and retirement programs, and proprietors' incomes. To estimate total earnings in the wood-products industries in the Southern Appalachians, we applied ratios for each sector from North Carolina and West Virginia. These states were used because their timber economies bracket conditions observed in the Southern Appalachians.

In both states, sources other than wages and salaries contribute about 18 percent to total earnings. In the wood-products sectors, the share of non-wage income is about 11 percent for paper and allied products and 10 percent for furniture in both states. The share of non-wage income is higher for the lumber and wood-products industries (between 22 and 27 percent), reflecting a higher proportion of self-employed workers.

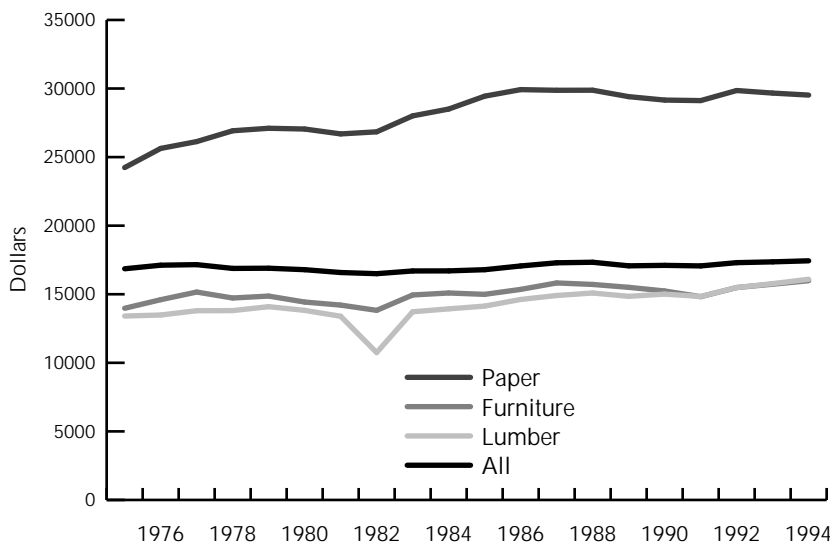


Figure 3.33 Real wages per job in lumber and wood products, furniture and fixtures, paper and allied products, and all sectors, 1975-1994. (Source: Department of Labor, unemployment insurance database, ES-202)

Applying these shares of nonwage income to wage data for the Southern Appalachians shows that wage estimates underestimate total contributions to earnings by about 15 percent. However, adjusting for nonwage income has no appreciable effect on earnings shares.

Effects of Timber Production

Timber Harvests and Jobs

Perhaps the most direct way to examine the relationship between jobs and forest products is to measure employment:timber harvest ratios. We compared the employment in the pulp and paper industries with the amount of pulpwood harvested in the Southern Appalachians in 1980, 1983, 1986, 1989, and 1992. In addition, we compared employment in the lumber and wood-products and furniture industries with sawlog harvests in the same years. In the pulp and paper industries, the average employment harvest ratio is about 0.15 jobs/mcf or about 7.5 mcf per job (fig. 3.34). In the solid-wood industries, the average ratio is roughly three times higher at 0.47 jobs/mcf or 2.1 mcf per job.

While the ratio for solid-wood industries may somewhat overstate the contribution of timber harvests because lumber from other

regions may flow to local furniture mills, these results point to an important effect of timber harvest changes. Shifts towards pulpwood and away from sawlog production in the region would cause a drop in derivative employment. In addition, because pulpwood travels greater distances to fewer mills, increases in paper manufacture would concentrate

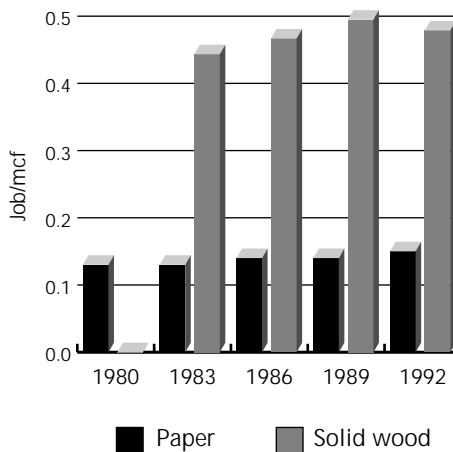


Figure 3.34 Ratio of jobs to volume harvested in the Southern Appalachians. (Source: Timber Product Output and pulpwood surveys conducted by the USDA Forest Service, severance tax records in Alabama, and sawlog consumption surveys in Tennessee; Department of Labor, unemployment insurance database, ES-202)

employment and income at the few locations with paper mills. As a result, employment and income would fall in smaller and more remote communities.

Economic Impacts

Timber production has local effects that extend into the entire economic matrix. To estimate the effects across all sectors of the Southern Appalachian economy, we use an economic input-output model called IMPLAN. We examined the effects of a small or marginal change in wood-products manufacturers. Results are reasonable for minor shifts in production, but the reliability of the estimates decreases as the shift in production increases. This is because large shifts can lead to structural changes in the economy that cannot be captured by input-output models. For example, the closure of firms and subsequent loss of income can displace people and cause other closures. Because IMPLAN assumes that the general structure of the economy remains constant, we can estimate only marginal changes with reasonable confidence.

Marginal effects were generated by reducing the output from either the lumber or the pulping industries by \$1 million (table 3.16). If the lumber industry's output were reduced by this amount – equivalent to between 2 and 5 million board feet – employment would fall by about 11 jobs. Total income would fall by about \$326,000 dollars. When output from the

pulpmill sector is reduced by \$1 million, the effects on employment and income are consistent with our observations on job:harvest ratios. Employment would fall by 6.3 jobs and income would be reduced by \$237,700. Pulp and paper manufacturing is much less labor-intensive than the solid-wood industries.

There are some interesting differences between subregions. Lumber production shifts have much smaller effects on the Northern Ridge and Valley and the Blue Ridge subregions. Here employment would fall by 8.1 and 7.4 jobs, respectively, while income would fall by \$138,500 and \$164,100. The impacts in the Southern Ridge and Valley and the Southern Mountain and Piedmont are stronger – 12.9 and 12.6 jobs and \$387,400 and \$378,800, tied to the last \$1 million worth of lumber output. A similar result holds for the pulpmill sector. These differences likely stem from differences in the product composition of the subregions and therefore in the quantities of lumber and paper represented by \$1 million of output.

Question 4:

What national forest land is tentatively suitable for timber production in the region and how can assessment findings be incorporated in further analysis of timber suitability?

Table 3.16 Employment and income impacts generated for a \$1 million reduction in output from the lumber or pulpmill sectors.

Subregion/Sector ¹	Total Employment (jobs)	Total Income (dollars) ²
Northern Blue Ridge		
Sawtimber	8.1	248,600
Pulp	4.4	138,500
Southern Blue Ridge		
Sawtimber	7.4	207,400
Pulp	4.8	164,100
Ridge and Valley		
Sawtimber	12.9	387,400
Pulp	6.7	250,100
Southern Mountain and Piedmont		
Sawtimber	12.6	378,800
Pulp	6.1	219,500
Southern Appalachian Assessment		
Sawtimber	10.9	326,900
Pulp	6.3	237,700

¹Estimates were generated by the IMPLAN model for the Southern Appalachians and four subregions.

²1987=100, prices are adjusted for inflation and expressed in terms of value in 1987.

Key Findings

A recent review of timber suitability on national forests in the Southern Appalachians identified 616,000 acres (11 percent) as not suitable for timber production. The remaining 3.7 million acres are tentatively suitable for timber production. Recent changes in national forest management indicate a need for a careful review of silvicultural prescriptions in subsequent analysis of suitability. In addition, timber supply and demand analysis indicates that prices and price trends vary greatly by species and grade. Therefore, detailed rather than averaged prices and price forecasts should be applied to suitability analysis. Historical prices from national forest sales should be used with caution.

Introduction

Planning the management of national forests is complex and requires information on the various values and capabilities of forest land. An especially important step in this analysis is determining which land is and is not suitable for timber production. Initial suitability analysis “screens out” land from further consideration at an early stage in the planning process. Screening therefore can have an important effect on the eventual supply of timber from national forests.

Suitability analysis is mandated by the Resources Planning Act as amended by the National Forest Management Act (RPA/NFMA) and is defined precisely by the Acts’ implementing regulations. Section 6.k of the RPA/NFMA states that “...the Secretary [of Agriculture] shall identify lands within the management area which are not suited for timber production, considering physical, economic and other pertinent factors to the extent feasible...”

Once unsuitable land is identified, timber harvesting can only occur there under exceptional conditions. Determination of suitability is reviewed every 10 years.

The planning regulations spell out a three-stage process to define whether or not land is

suitable for timber production.⁶ The first stage examines physical suitability and defines four conditions that make land unsuitable for timber production: “(1) The land is not forest land,⁷... (2) Technology is not available to ensure timber production from the land without irreversible resource damage to soil productivity, or watershed conditions. (3) There is not reasonable assurance that such lands can be adequately restocked. (4) The land has been withdrawn from timber production by an Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service (Section 219.14.a).” The Forest Service Handbook provides additional detail on how to complete a suitability analysis and defines two additional criteria for stage one: “(5) Identify lands that are not capable of producing crops of industrial wood as unsuitable for timber production. (6) Identify forest land as unsuitable for timber production if there is not adequate information available, based on current research and experience, to project (timber growth) responses to timber management practices.”

Land that is not identified as unsuitable by one or more of these six criteria is considered tentatively suitable for timber production. As such, timber management is considered an option in subsequent analysis of planning alternatives.

The second stage of suitability analysis is used to define the management intensity that maximizes the net financial returns to timber management for various categories of land on a national forest. The third stage of suitability analysis is the allocation of land to various uses based on timber production economics, multiple-use goals, and information on alternative values.

This section examines two separate issues. First, it displays how individual national forests in the Southern Appalachians have begun their 10-year review of suitability decisions. We present the results of their stage-one analysis. In addition, we examine how findings from this assessment – especially regarding timber supply and demand – might be used in the subsequent two stages of evaluating timber suitability.

⁶ The forest planning regulations are found in the Federal Register, Vol. 47, No. 190, Pg. 43037-43052. The reference number is 36 C.F.R. 219, and suitability analysis is defined at 219.14.

⁷ Forest land is defined as land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use.

Table 3.17 Acres defined as unsuitable in stage one of timber suitability analysis in 1986 and 1992

National Forest	Non-Forest Land	Withdrawn from Timber Production	Not Restockable Within Five Years	Technology Not Available to Prevent Damage	Not Capable of Producing Commercial Wood		Inadequate Response Information	Total
Status as of 1986								
Cherokee	7,159	62,294	0	0	3,752	0	0	73,205
Alabama	4,016	6,986	0	0	0	0	0	11,002
Chattahoochee	2,489	88,169	2,367	14	0	0	0	93,039
George Washington	11,000	34,000	1,000	0	56,000	3,000	0	105,000
Pisgah and Nantahala	7,968	98,051	232	8,362	0	8,926	0	123,539
Sumter	1,328	7,323	0	0	0	0	0	8,651
Jefferson	13,777	47,872	0	3,710	0	0	0	65,359
Total	47,737	344,695	3,599	12,086	59,752	11,926	0	479,795
Status as of 1995								
Cherokee	8,937	62,736	4,980	48	157	0	0	76,858
Alabama	4,016	6,986	0	0	0	0	0	11,002
Chattahoochee	2,236	200,998	2,080	0	46	0	0	205,360
George Washington	5,504	42,044	0	0	44,724	0	0	92,272
Pisgah and Nantahala	6,878	128,389	113	10,044	0	9,857	0	155,281
Sumter	1,328	7,352	0	0	0	0	0	8,680
Jefferson	8,469	57,654	0	0	673	0	0	66,796
Total	37,368	506,159	7,173	10,092	45,600	9,857	0	616,249
Change from 1986 to 1995								
Cherokee	1,778	442	4,980	48	-3,595	0	0	3,653
Alabama	0	0	0	0	0	0	0	0
Chattahoochee	-253	112,829	-287	-14	46	0	0	112,321
George Washington	-5,496	8,044	-1,000	0	-11,276	-3,000	0	-12,728
Pisgah and Nantahala	-1,090	30,338	-119	1,682	0	931	0	31,742
Sumter	0	29	0	0	0	0	0	29
Jefferson	5,308	9,782	0	-3,710	673	0	0	1,437
Total	-10,369	161,464	3,574	-1,994	-14,152	-2,069	0	136,454

Review of Suitability Findings

RPA/NFMA requires a review of suitability every 10 years. In the Southern Appalachians, all national forests have either recently completed or are in the process of completing a review of their suitability analyses. All forests have at least completed an initial review of their stage-one classifications. We compiled the results of stage-one analysis for 1986 (defined by forest plans) and the preliminary results of the 10-year review.

The initial set of forest plans in the Southern Appalachians defined about 0.5 million acres as unsuitable for timber production in stage-one analysis (table 3.17). A large majority (72 percent) was land withdrawn from timber production for wilderness and other reserved designations. About 10 percent (47,737 acres) was classified as “non-forest land” and 12 percent (59,752) was considered incapable of producing commercial wood. Screening by the three remaining criteria, (1) not restockable within 5 years, (2) technology not available to prevent damage, and (3) inadequate response information, together accounted for only 6 percent of the area deemed unsuitable for timber production.

The preliminary results from the 10-year review of suitability conducted in 1995 shows that the area of unsuitable land has expanded by about 28 percent to 616,249 acres. Most of the changes were concentrated on two national forests, the Chattahoochee (+112,321 acres) and the Pisgah and Nantahala (+31,742 acres). On both forests changes were almost entirely related to increased wilderness designations. Over the region as a whole, land withdrawn

from timber production for a reserved use increased by 161,464 acres between 1986 and 1991. The area identified as unsuitable in the remaining categories declined by about 25,000 acres.

About 3.7 million acres of national forest land are tentatively suitable in the Southern Appalachians (table 3.18). In total then, 14 percent of national forest land is unsuitable, but this share varies across forests. The highest share of unsuitable land is on the Chattahoochee (27 percent), which has the largest amount of reserved lands. The National Forests in Alabama have the lowest share of unsuitable land (5 percent). Its topography is also least severe. The shares of unsuitable land for all remaining forests are between 10 and 15 percent of the total land area.

Assessment Findings and Suitability Analysis

The second part of this question asks how assessment findings might be used in subsequent analysis of suitability. Stage two involves the direct use of cost-benefit analysis to define the management intensity that maximizes the net financial returns to timber management for all categories of land on the national forest. Stage three also involves estimates of costs and benefits in the analysis and comparison of planning alternatives. Findings from the timber supply and demand analysis as well as other parts of the assessment may provide useful information for conducting these analyses.

A financial analysis of timber management requires defining feasible management prescriptions and their associated yields, management costs, and benefits. Often silvicultural

Table 3.18 Tentatively suitable forest area and the percent of unsuitable area by national forest in the Southern Appalachians.

	Total area	Unsuitable (acres)	Tentatively Suitable	Share Unsuitable (%)
Cherokee	627,734	76,858	550,876	12
Chattahoochee	749,072	205,360	543,712	27
Pisgah and Nantahala	1,026,984	155,281	871,703	15
George Washington	959,392	92,272	867,120	10
Jefferson	688,278	66,796	621,482	10
Sumter	79,897	8,680	71,217	11
Alabama	226,504	11,002	215,502	5
Total	4,357,861	616,249	3,741,612	14

prescriptions can be applied to any given forest stand. Stage two requires the analyst to find the prescription with the highest financial return, a well-defined criterion. However, pursuing different multiple-use goals under stage three requires a broad range of silvicultural prescriptions, especially for hardwoods.

Silvicultural prescriptions applicable to Southern Appalachian forests are described in-depth in the Terrestrial Technical Report (SAMAB 1996) for the assessment. These guidelines should provide a useful starting point for analyzing viable silvicultural prescriptions.

The other area of the assessment that has direct bearing on the analysis of suitability is the section of this document on timber supply and demand. Findings in this area have implications for defining the prices used in forest planning analysis.

Our supply and demand analysis indicates that the prices of timber products vary substantially by species, grade, and quality. Over the last 20 years, only the prices for high-grade oak and pine sawtimber rose significantly. Real prices for other sawlog products have been stable or, in some cases, have actually declined. Real prices for pulpwood have also been generally stable, but they have trended up in recent years in certain parts of the Southern Appalachians. These findings suggest (1) that timber inventories and analyses for silvicultural prescriptions need to be specific to the species and grade of material, (2) that the location of land relative to specific markets needs to be considered, and (3) that price forecasts need to be carefully constructed for individual products and not for product aggregates.

These findings also raise questions about the appropriate point of valuation for the financial analysis of silvicultural prescriptions. The two alternatives are to use: (1) stumpage prices or (2) delivered log prices. Our analysis of timber supply and demand used delivered log prices because these were the only data available for separate species and grades. Stumpage prices are generally reported for species averages or at least for sites with variable conditions. They therefore cannot capture detailed price dynamics. However, to use log prices in forest planning analysis requires explicit consideration of timber harvesting and hauling costs, which can be developed from available cost simulation models, e.g., LeDoux 1988. Our finding that price trends vary widely by species and grade and that costs vary widely on national forests suggests that these more specific log prices, along with explicit cost models, be applied to suitability analysis.

Recent shifts away from clearcutting and towards ecosystem management also have implications for pricing approaches. The use of stumpage prices in financial analysis is generally based on data from local timber sales. The evidence allows the analyst to estimate the effects of various site factors on value. These estimates may represent the best local information on timber values. However, they are valid only over the range of conditions present on previous timber sales. The price estimates may therefore be invalid for sale designs and silvicultural prescriptions that are relatively new. Again, this problem would suggest use of delivered log prices and cost models to estimate the net price for national forest timber.

Outdoor Recreation Demand and Supply in the Region

Introduction

The Southern Appalachians are well known for scenery, recreation opportunities, and the traditions and culture of the people. A 1994 report by the Appalachian Regional Commission noted that: "The well-known positive images of the region – beautiful mountainous scenery and unlimited outdoor recreation possibilities – are why most tourists who go to Appalachia do so. However, the unknown attractions and activities in the region represent an untapped potential for the region to attract the types of travelers who are looking for a wide range of different activities in a vacation destination."

This portion of the assessment addresses a series of questions about the present and future importance of recreation in the Southern Appalachians. It views recreation in two ways: (1) as a social and economic engine that provides meaningful experiences to visitors and employment for residents, and (2) as a provider of a sense of place to communities and visitors.

Questions most closely related to recreation as an economic force are:

1. **What opportunities are there for public land in the Southern Appalachians to provide unique or unsatisfied forest-related recreation demands?**
2. **How has the recreating public within traveling distance of public land changed in the past 10 years and what are the predicted future changes?**
3. **What are the supplies of and the demands for major types of recreation settings and activities within the area?**

Questions related to providing a sense of place are:

4. **How is the changing social context within the Southern Appalachians likely to affect future recreation demands on public lands?**
5. **How do recreation opportunities affect the lifestyle and local culture of the area?**

These questions, posed by natural resource agencies and discussed with the people of Southern Appalachia, helped organize the analysis and focus our response.

Question 1:

What opportunities are there for public land in the Southern Appalachians to provide unique or unsatisfied forest-related recreation demands?

Key Findings

The public owns about 16 percent of the study area. Most of this public land is in mountainous terrain with high peaks and ridges that offer spectacular views and opportunities for nature-based recreation.

About 24 percent of the region is in roaded-natural appearing settings. About one-third of these settings are on public land. Activity opportunities are abundant, but the following places are becoming crowded:

- (1) road corridors that parallel rivers and streams for fishing and dispersed road-side camping,
- (2) interconnected trail networks for mountain biking, horseback riding, off-road vehicle driving, and hiking, and
- (3) trail and road corridors for access to favorite places, such as waterfalls and scenic overlooks.

About 8 percent of the region lies in remote settings. About two-thirds of these settings are on public land. The Great Smoky Mountains National Park has the only primitive setting in the Southern Appalachian Assessment (SAA) region. Most remote settings lie in rugged mountainous terrain.

Public land provides natural appearing settings for highly active, nature-based recreation experiences in the region. Of the 6 million acres of public land in the region, about 80 percent are in roaded natural-appearing or remote settings.

Most rural settings, which make up about 45 percent of the region, are on private land. These settings provide scenic, cultural, and working landscapes such as pasture and partially forested landscapes. These settings support passive types of recreation activities such as sightseeing, and nature and cultural resource study. Highly active recreation experiences, such as hunting, occur but are limited by private landowners.

High density of recreation use occurs at the

outer edges of mountain ranges on federal land, particularly in the southern portion of the Blue Ridge Mountain section. Large urban areas, such as Atlanta, GA, Knoxville, TN, and Charlotte, NC, apparently cause this pattern of use. The pattern creates urban-forest interfaces and their associated problems for public land managers.

Settings and Activities That Focus on Nature

In this assessment, we focused largely on recreation activities in settings that require interaction with nature. We assume that findings will be used primarily by public land managing agencies. The information is intended to assist in local planning decisions. We did not study activities related to theme parks, resorts, and golf courses. These activities are economically and socially important, but they are generally not influenced by public land managing agencies.

Recreation Supply

In this assessment, supply is defined as the opportunity to participate in a desired recreation activity in a preferred setting to realize desired and expected experiences. Three components of supply are settings, activities, and facilities. These three components are linked in the following manner.

Landscapes are available for people to use in recreational pursuits. Landscapes are characterized by settings, which provide the physical and social environments needed to produce experiences. Recreationists choose a setting and activity to create a desired experience. Facilities, such as campgrounds and trails, are supplied to assist uses of the setting and to support activities. Settings, activities, and support facilities are managed to maintain the conditions necessary to produce the expected experiences.

There are limits to the use of settings. When use is too intensive for recreators to achieve desired experiences, the carrying capacity has been exceeded. Providing additional support facilities may increase the capacity of settings.

Landscape Setting Descriptors

We used two systems to determine amounts and types of settings across the Southern

Table 4.1 Recreation and Scenery Characteristics.

Characteristics	Spectrum of Settings						
	PRIMITIVE	SEMI-PRIMITIVE	ROADED	RURAL	TRANSITIONAL	SUBURBAN	URBAN
Scenery	Naturally Evolving	Natural Appearing Naturally Evolving	Natural Appearing	Forested Partially Forested Pastoral/Agricultural			
Access	Essentially natural landscape. Minimal human influence.	Increasing cultural influence on the landscape					Landscape dominated by hard-surfaces and structures except for natural enclaves such as parks.
Remoteness	Non-motorized trails or cross-country travel only.	Increasing modes of travel possible					Most modes of travel possible. High degree of dependence on motor vehicles.
Size	More than 1½ hour walk from motorized travel.	Increasing remoteness					Remoteness limited. Occurs only in natural enclaves.
Social Encounters	>5000 Acres	Increasing importance of size of area					No size criteria.
Recreation Facilities and Site Management	<6-10 other groups met per day.	Increasing frequency of social encounters					Moderate to very high at public parks or playgrounds.
Nature-based Activity Opportunities	No facilities for user comfort. Structures are rare and for site protection only.	Increasing diversity and quantity of facilities					Facilities are designed for user comfort, and barrier-free signage is prevalent.
Recreation Experience Opportunities	Backpacking, nature study, and orienteering are the most common activities.	Increasing number of activities possible and nature of activities change					Nature-based activities such as walking and nature study occur mostly in parks and greenways.
	High probability of isolation from sights and sounds of humans, self-reliance, and closeness to nature.	Increasing need for outdoor skills					Very high probability of experiencing affiliation with groups and individuals.

(Source: Recreation Opportunity Spectrum Primer and Field Guide, 1990)

Appalachians. The Recreation Opportunity Spectrum (ROS) (U.S. Department of Agriculture 1990) provides settings descriptors that integrate physical, social, and managerial characteristics to classify the landscape. The Scenery Management System (SMS) (U.S. Department of Agriculture 1995a) accounts for natural and cultural systems and their influence on the landscape. By combining the two systems, we developed landscape setting descriptors with recreation and scenery components.

**PRIMITIVE –
Naturally Evolving**



Figure 4.1 This setting is characterized by a high degree of remoteness and relatively few contacts with other people. A naturally evolving landscape predominates. Only the highest ridges of the Great Smoky Mountains National Park meet these criteria.

For more information, refer to “Background on Composite Setting Descriptors” (Hendricks 1995).

Table 4.1 illustrates how scenery, access, remoteness, size, social encounters, recreation facilities, site management, activities, and experiences define these landscape setting descriptors. We also provide a brief description and photograph (fig. 4.1 through 4.10) of each type of setting.

**SEMIPRIMITIVE – Naturally
Evolving (Non-Motorized)**



Figure 4.2 This setting is characterized by a high degree of remoteness and a naturally evolving landscape such as is found in designated wildernesses, wild and scenic rivers, or parts of national parks where human influence is minimal.

SEMIPRIMITIVE – Natural Appearing or Areas with High Remoteness Potential (Non-Motorized and Motorized)



Figure 4.3 This setting is characterized by a high degree of remoteness or the potential for a high degree of remoteness and a predominantly natural appearing landscape. Some areas may be accessible by low-standard roads.

ROADED – Natural Appearing



Figure 4.4 This setting is characterized by a predominantly natural appearing forested landscape with access by moderate standard roads (sometimes a gravel surface). Some areas are classified as naturally evolving if they are within wildernesses, wild and scenic river corridors, or parts of national parks. This setting occurs primarily on public land but may also occur on private land.

RURAL – Forested



Figure 4.5 This setting is characterized by a culturally influenced landscape with forest cover. Structures may be present but usually occur in clusters. This setting occurs on public and private land.

RURAL – Partially Forested



Figure 4.6 This setting is characterized by an altered landscape that is partially forested. Structures may be present but usually occur in clusters. This setting occurs primarily on private land.

RURAL – Pastoral/Agricultural



Figure 4.7 This setting is characterized by an altered landscape that is partially open. Structures may be present but usually occur in clusters. This setting occurs primarily on private land.

SUBURBAN



Figure 4.9 This setting is characterized by residential and commercial development interspersed with some buffers of vegetation. Development may include communities and small towns that do not have an urban character.

TRANSITIONAL



Figure 4.8 This setting is characterized by emerging development patterns or roads with high traffic volume. It occurs on both public and private land.

URBAN



Figure 4.10 This setting is characterized by a predominance of paved surfaces and large buildings. Trees and other vegetation offer some aesthetic relief and contrast.

Distribution of Settings Across the Region

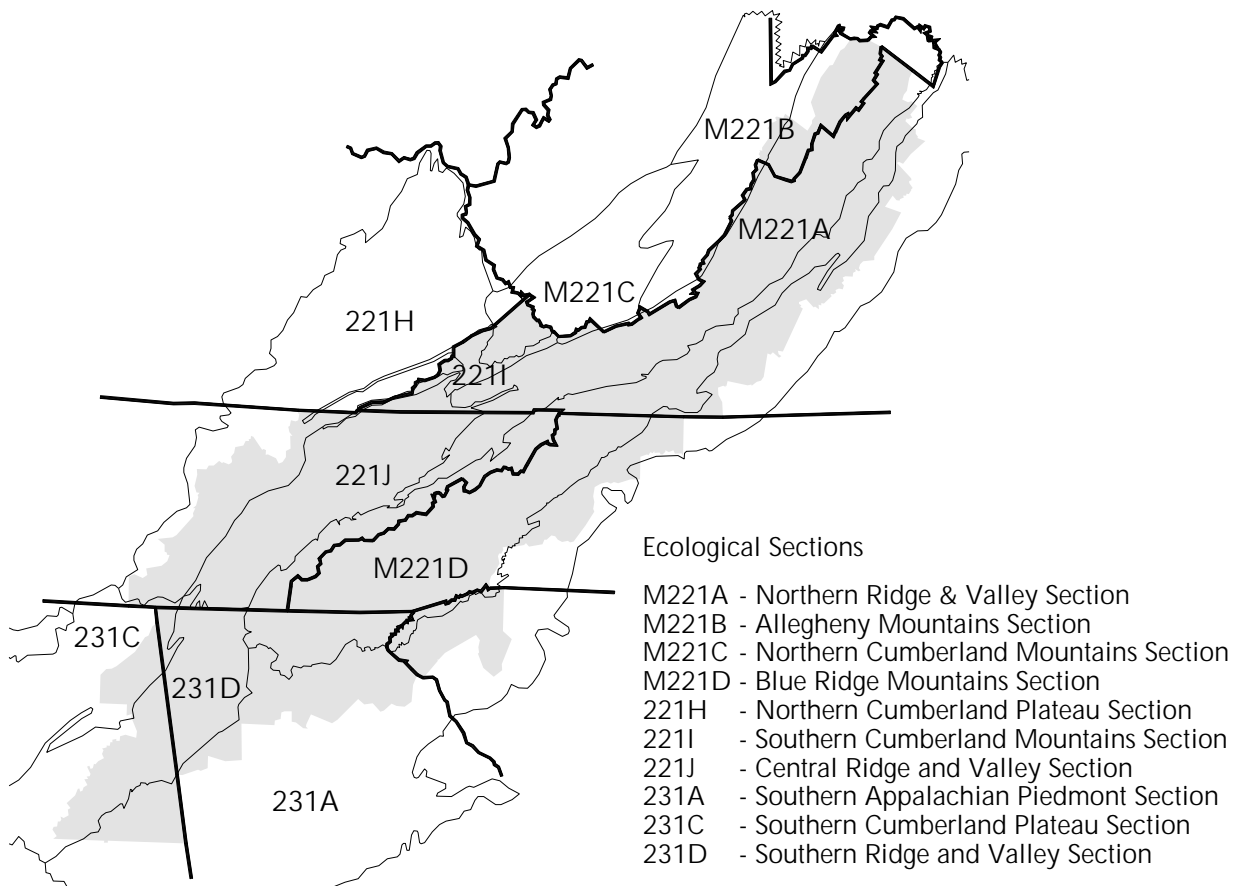
We checked the amount and distribution of settings by landform. Landform is characterized by ecological section (Bailey 1995). Landforms in the region range from gently rolling, open

hills to high-peaked mountains. About half of the region is in mountainous terrain with high ridges, mountain peaks, and low, narrow valleys. The other half of the region is in open hills and wide valleys. Brief descriptions of each section are provided in table 4.2, and locations

Table 4.2 Descriptions of ecological sections in the Southern Appalachian region.

Section Number	Name	Area Coverage		Landform	Elevation	Local Relief	Precipitation	Vegetation
		(million acres)	(%)					
M221-A/C	Northern Ridge & Valley & North Cumberland Mountains	8,028	22.3	Parallel Narrow valley & high ridges East-Great Valley Lowland West-Allegheny Front	300-4000'	500-1500'	30-45"	Appalachian Oak Oak/Hickory/Pine
M221-B	Allegheny Mountains	215	0.6	Plateau: high ridges, low mountains, narrow valleys	1000-4500'	1000-2500'	40-60"	Northeastern Spruce Fir Northern Hardwood Mixed Meso Oak/Hickory/Pine
M221-D	Blue Ridge Mountains	10,486	29.2	Low mountains (80%) High peaks (46>6000')	1000-6000'	500-1000'	40-50"	Appalachian Oak Southeastern Spruce Fir Northern Hardwood
221-H	North Cumberland Plateau	2,009	5.5	Open, low mountains (20%) High hills (80%) Tablelands (20%)	1270-2000'	50-100'		Appalachian Oak Mixed Meso
221-I	South Cumberland Mountains	511	1.4	Open, low mountains Low mountains Open hills	1200-3300'	100-300'		Appalachian Oak Mixed Meso
221-J	Central Ridge & Valley	4,383	12.2	Open hills	650-2000'	300-700'		Appalachian Oak
231-A	Southern Appalachian Piedmont	6,514	18.1	Irregular; Plains (70%) High hills Open low hills (30%)	330-1300'	100-300'	45-55"	Oak/Hickory/Pine Southern Mixed Forest
231-C	South Cumberland Plateau	735	2.0	Open hills (60%) Tablelands Open high hills (40%)	330-1300'	300-500'	50-55"	Oak/Hickory/Pine Southern Mixed Forest
231-D	Southern Ridge & Valley	3,083	8.6	Plains (60%) Open high hills (40%)	650-2000'	300-500'	36-55"	Oak/Hickory/Pine Southern Mixed Forest

(Source: Descriptions of Ecoregions of the United States, 1995)



PA12

Figure 4.11 Ecological Sections.

are shown on figure 4.11. The amount of settings and their distribution by landform (sections) are summarized in table 4.3 and described below. The location of settings are shown in figures 4.12 through 4.15.

Approximately 45 percent of the region is in rural settings. Pastoral/agricultural settings are concentrated in valleys and on open hills. Over 65 percent of the pastoral settings are in the Central Ridge and Valley, Northern Ridge and Valley, and Southern Appalachian Piedmont sections. Rural partially forested and forested settings are concentrated in mountainous terrain, particularly in the Blue Ridge and Northern Cumberland Mountain section.

Nearly 24 percent of the region is in roaded natural settings. Most of these settings are in mountainous terrain. Nearly two-thirds of roaded natural settings are in the Blue Ridge Mountain, Northern Cumberland Mountain, and Northern Ridge and Valley sections.

Approximately 18 percent of the region is developed into urban, suburban, or transitional settings. Only 5 percent of the region is urban

or suburban, but 12 percent is transitional. That is, it is influenced by primary roads, development is emerging, and traffic is heavy. Transitional settings are mapped as strips or threads across the landscape; they represent an interconnected web of corridors with a high, constant flow of humans. Urban and suburban settings are concentrated on open hills, and 70 percent of them are in Ridge and Valley sections. With urban centers like Knoxville and Chattanooga, TN, the Central Ridge and Valley section has a high proportion of the urban and suburban settings.

About 8 percent of the region is considered remote or has the potential for remoteness. Areas classified as primitive or semiprimitive are concentrated at high elevations in the Northern Cumberland Plateau and Blue Ridge Mountain sections. The only primitive areas in the region are in the Great Smoky Mountains National Park.

Large rivers and lakes account for approximately 2 percent of the region. The concentration of lakes is highest in the Central Ridge and

Table 4.3 Percent of settings by ecological section.

Setting	Coverage (thousand acres) (%)	Ecological Section ¹									
		221-H NCP	221-I SCM	221-J CRV	N221-A/C NRV/ NCM	N221-B AM	N221-D BRM	231-A SAP	231-C SCP	231-D SRV	
URBAN	665	1.1	0.1	30.4	19.6	-	10.6	16.6	1.3	20.3	
SUBURBAN	1415	3.2	0.5	22.6	25.0	-	18.2	20.7	1.1	8.6	
TRANSITIONAL	4545	4.6	1.4	16.7	20.6	-	21.4	24.0	2.1	9.0	
RURAL											
Pastoral/Agricultural	4678	4.7	0.2	23.2	33.1	0.1	11.5	12.3	5.5	9.4	
Partially Forested	5962	4.9	0.6	15.6	19.1	0.4	23.7	25.1	2.0	8.5	
Forested	6212	3.9	2.0	7.9	16.4	0.5	29.8	26.9	1.4	11.1	
ROADED											
Natural Appearing	8865	8.5	2.7	4.1	25.6	1.1	38.1	11.7	1.2	7.0	
Naturally Evolving	250	-	0.1	-	5.5	-	91.1	0.2	1.1	1.2	
SEMI-PRIMITIVE											
Natural Appearing	2222	10.7	1.4	2.3	2.5	2.1	48.3	4.7	0.7	4.5	
Naturally Evolving	628	-	0.8	-	5.8	-	91.3	-	1.2	0.7	
PRIMITIVE	78	-	-	-	-	-	100	-	-	-	
WATER	532	1.6	0.3	36.4	7.2	-	14.0	26.2	2.0	12.0	
Not classified	1385	-	-	-	-	-	-	-	-	-	

¹Ecological Sections:

- NCP = North Cumberland Plateau
- SCM = South Cumberland Mountains
- CRV = Central Ridge & Valley
- NRV = Northern Ridge & Valley
- NCM = North Cumberland Mountains
- AM = Allegheny Mountains
- BRM = Blue Ridge Mountains
- SAP = Southern Appalachian Piedmont
- SCP = South Cumberland Plateau
- SRV = Southern Ridge & Valley

Figure 4.12 Highly developed settings.

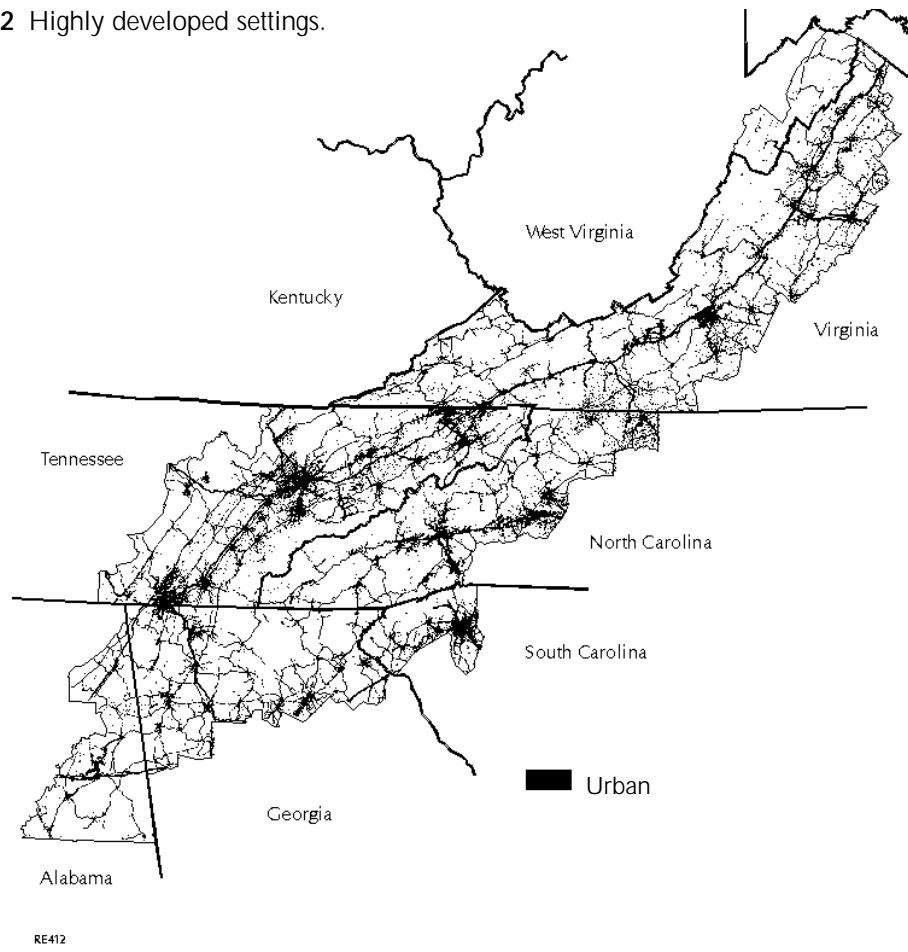


Figure 4.13 Rural settings

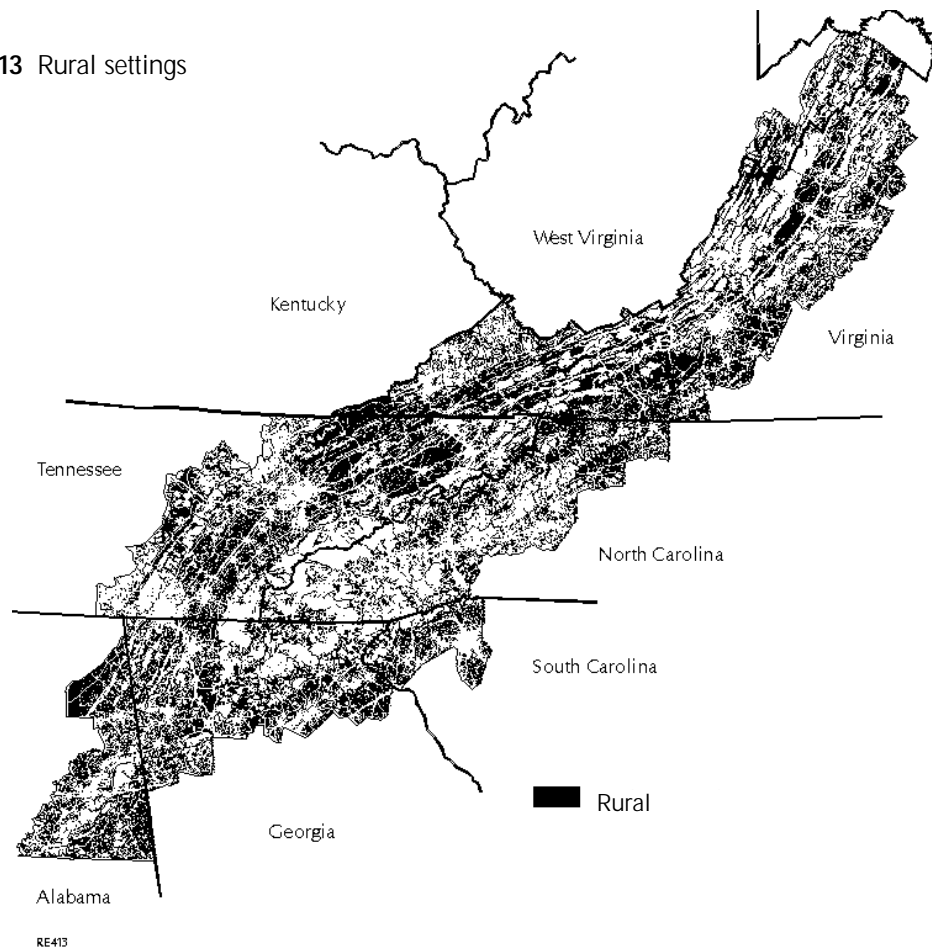


Figure 4.14 Routed natural appearing settings

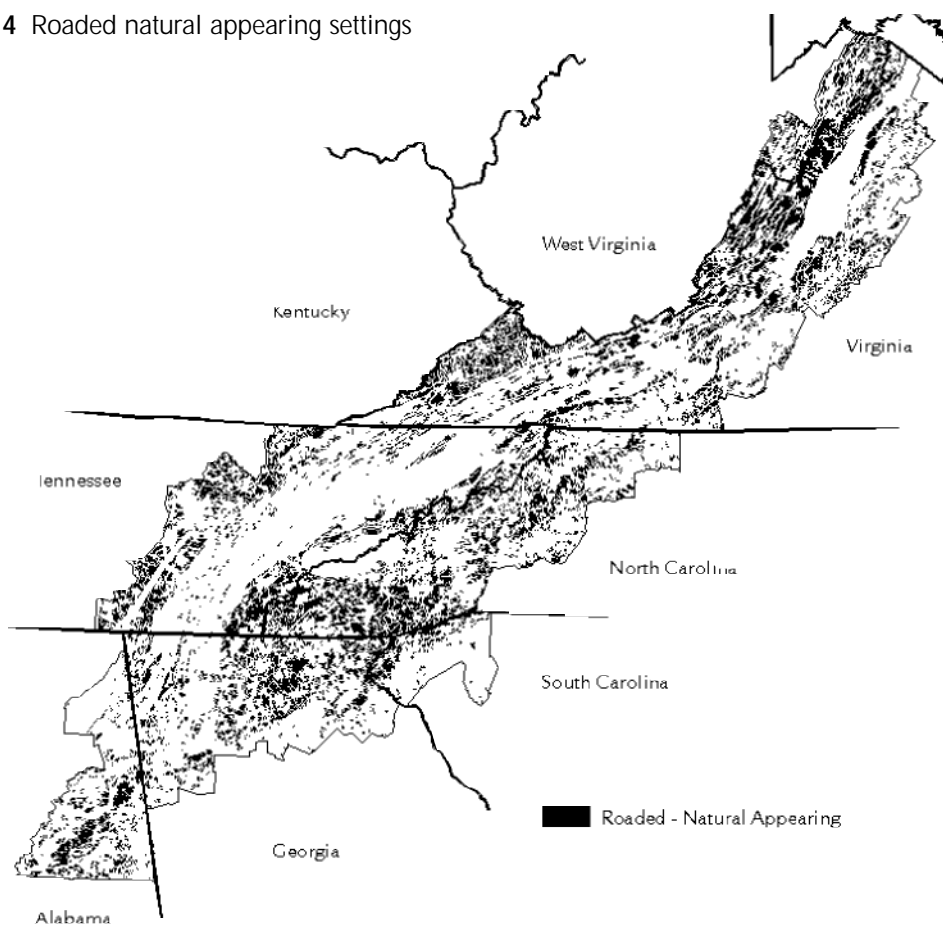


Figure 4.15 Remote settings

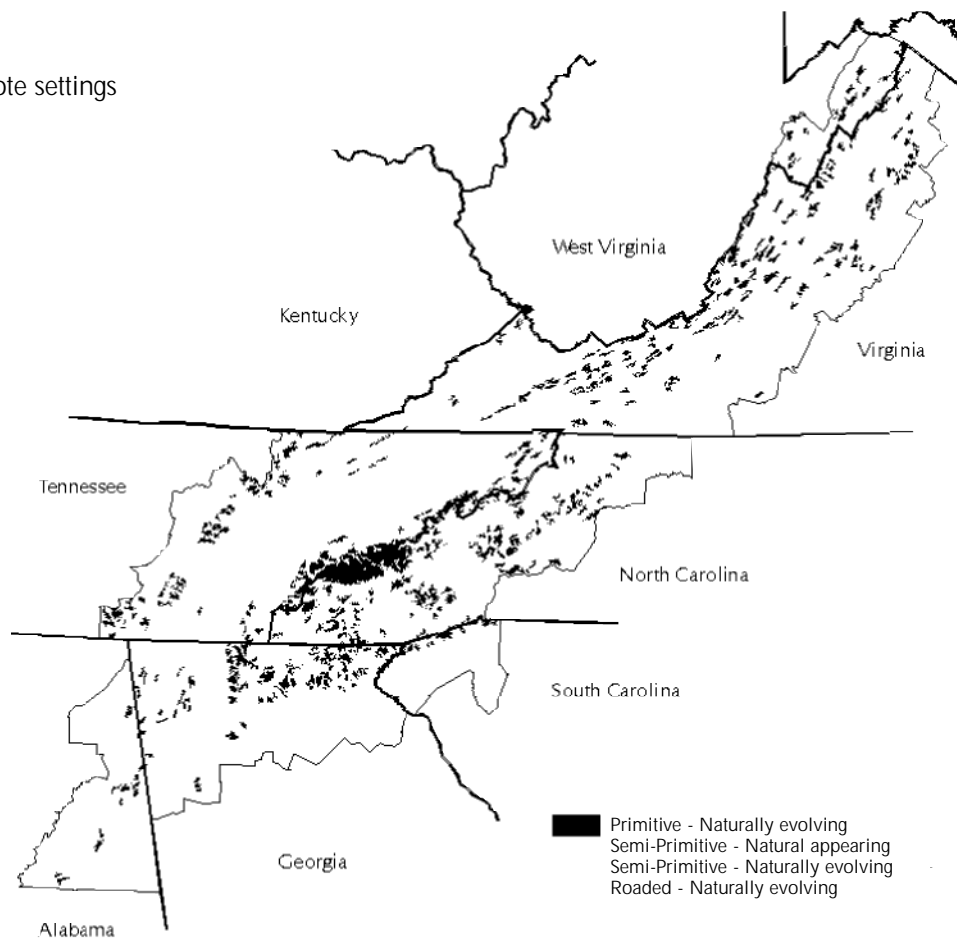


Table 4.4 Activity opportunities by setting.

Activity	Spectrum of Settings				
	PRIMITIVE/SEMI-PRIMITIVE	ROADED-NATURAL APPEARING	RURAL	TRANSITIONAL	URBAN
Camping	Backpacking/primitive camping	Developed camping			
Day use		Picknicking			
		Walking			
		Family gathering			
		Bicycling			
		Running			
Hunting	Big game				
	Small game				
Fishing	Stream Fishing		Lake fishing		
Driving (viewing)	Scenic driving				
Nature study	Photography				
	Wildlife viewing				
Cultural resource study	Caving		Visiting Historic and Prehistoric sites		
Motorized boating			Motorboating		
			Water skiing		
			Jet skiing		
Non-motorized boating			Canoeing/kayaking		
			Sailing		
			Rowing		
Motorized trail use			OHV driving		
Non-motorized trail use	Orienteering				
	Horseback riding				
	Mountain biking				
Winter Sports			Hiking		
	Cross country skiing				
			Downhill skiing		

Valley section. Most of the lakes were built by the Tennessee Valley Authority to generate power and control floods.

About 3 percent of the data from satellite imagery could not be interpreted with confidence, and therefore, no settings descriptors were mapped for these lands.

Activities and Facilities

Activities were considered in context with settings. Twelve activity opportunities were chosen for this analysis. Table 4.4 shows the kind of activities typically experienced in each setting.

Facilities provide access to settings where recreation occurs. Two types of facilities are used by recreationists: corridors and places. Corridors provide for transporting humans through the setting. Most corridors are human-made, such as roads, trails, and lakes. Some natural systems, such as rivers and trout streams, also provide corridors. Places are areas where people spend time, such as campgrounds, picnic areas, beaches, favorite spots along river banks, and special groves of trees.

Corridors by Setting

We examined several corridors that match the activities and settings chosen for this report. Motorized access is provided by roads, scenic byways, and off-highway-vehicle (OHV) trails. Nonmotorized access is provided by trails, trout streams, and greenways.

Roads. There are over 160,000 miles of road in the region. Primary roads are interstates or two-lane roads with high traffic volume. They are in urban, suburban, and transitional settings, and they permit rapid movement over long distances. Traffic flows, measured in traffic counts on Class 1 roads, are shown in figure 4.16. High flows of vehicles occur in valleys, traveling north/south and toward the western portion of the study area. Lower traffic volumes occur traveling in east/west directions, which require mountain crossings.

Class 3 roads provide opportunities for high-quality viewing. There are approximately 60,000 miles of Class 3 roads and over 70 percent of them are in rural landscapes (table 4.5). These roads generally have two lanes and pass through almost equal amounts of pastoral,

Figure 4.16 Traffic flow

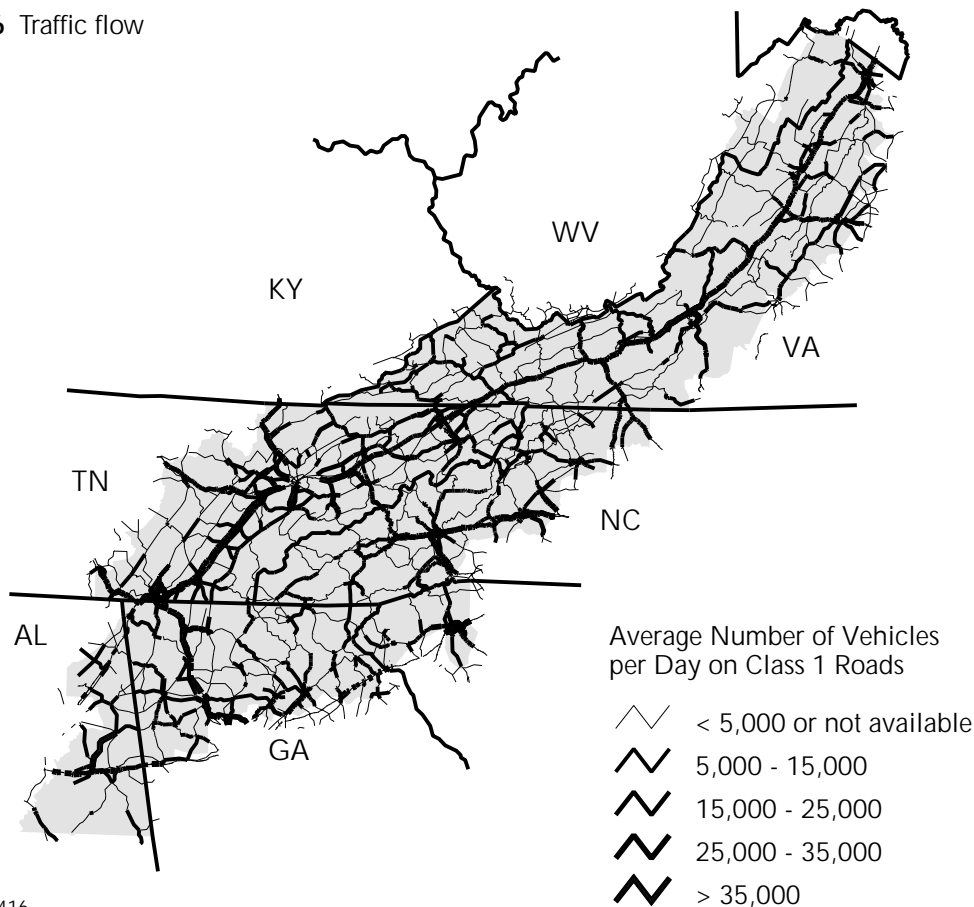


Table 4.5 Corridors and recreation places by setting (percent).

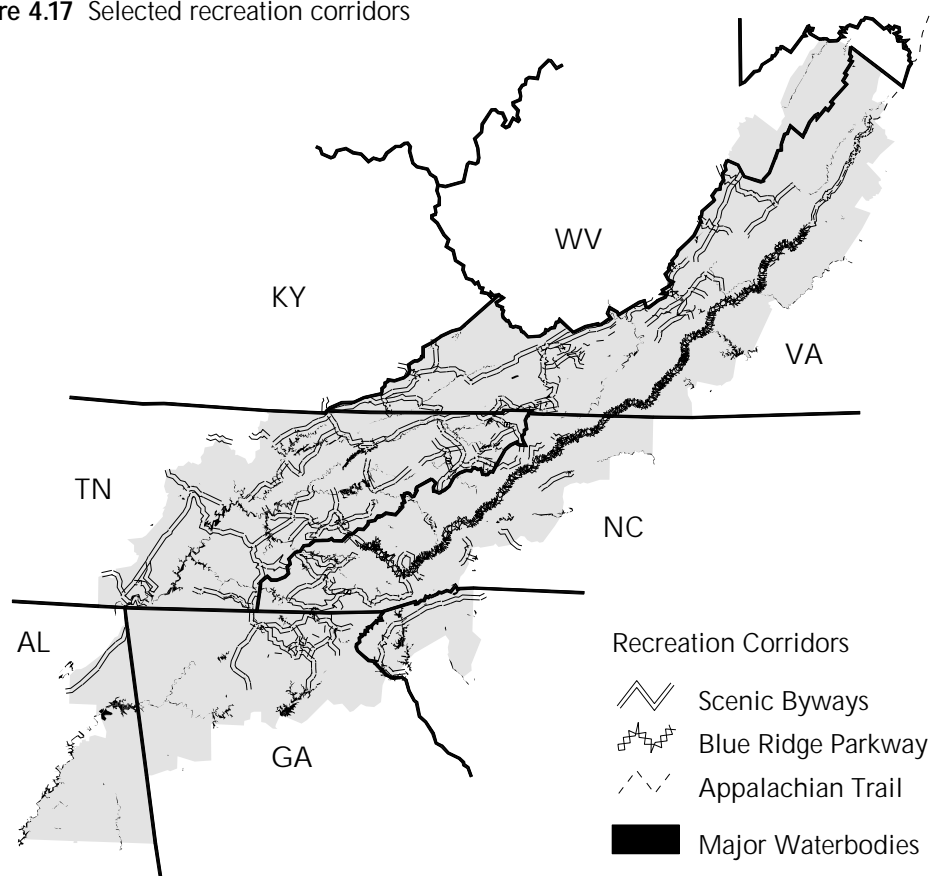
Setting	Trails	Class 3 Road	Scenic Byways	Campsites	Trout Streams	Gamelands ¹	Lakes/Rivers	OHV Trails ²	Day Use ³	Distinctive Landscapes
	miles	miles	miles	number	miles	million acres	million acres	miles	areas	acres
Total	10,621	61,000	3,500	35,825	34,000	4,600	532	675	17,000	875,000
URBAN	0.1	1.7	3.9		0.6					
SUBURBAN	0.3	6.7	9.4		2.9	0.1				3.1
TRANSITIONAL	2.9	16.5	43.6	70.0	11.2	2.6		3.5		11.3
RURAL										
Pastoral/Agricultural	2.1	20.0	5.3		8.5	0.1				2.7
Partially Forested	6.8	23.4	9.1		16.7	2.3		1.2		3.1
Forested	12.0	28.0	27.0	30.0	17.8	1.1		10.8		30.0
ROADED										
Natural Appearing	43.4	3.0	0.4		26.1	63.0		67.9		26.0
Naturally Evolving	2.5	-	0.1		1.3	2.3		2.0		0.4
SEMI-PRIMITIVE										
Natural Appearing	19.4				7.7	22.7		14.4		10.2
Naturally Evolving	7.2				3.7	5.3				2.6
PRIMITIVE	0.8				0.5					
WATER	0.2		1.2		2.9	0.4	100.0			10.5
Unknown	2.3	0.5	0.1							

¹Includes gamelands on national forests only.

²Includes designated ORV trails on national forests only.

³Includes picnic and swimming areas from data on each state.

Figure 4.17 Selected recreation corridors



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partially forested, and forested rural landscapes.

Scenic byways are roads designated by federal or state governments to permit viewing of outstanding scenery. There are approximately 3,500 miles of designated scenic byways in the region. Over 40 percent are in transition settings, because several interstate highways have been designated under this classification.

The Blue Ridge Parkway is an obvious example of a scenic byway. It was designed solely to provide outstanding scenic views. It traverses more than 400 miles along the ridges of the Blue Ridge Mountain section. The distribution of the Blue Ridge Parkway and other scenic byways are shown in figure 4.17.

There are more than 60,000 miles of Class 4 roads. On private land, Class 4 roads are in developed settings, such as subdivisions or rural settings near farms and pasture. On national forest land, Class 4 roads are in rural forested and roaded natural settings.

Trails. The region has over 10,000 miles of trails. Trails provide the bulk of nonmotorized access through settings. Over 70 percent of trails occur in natural-appearing or remote

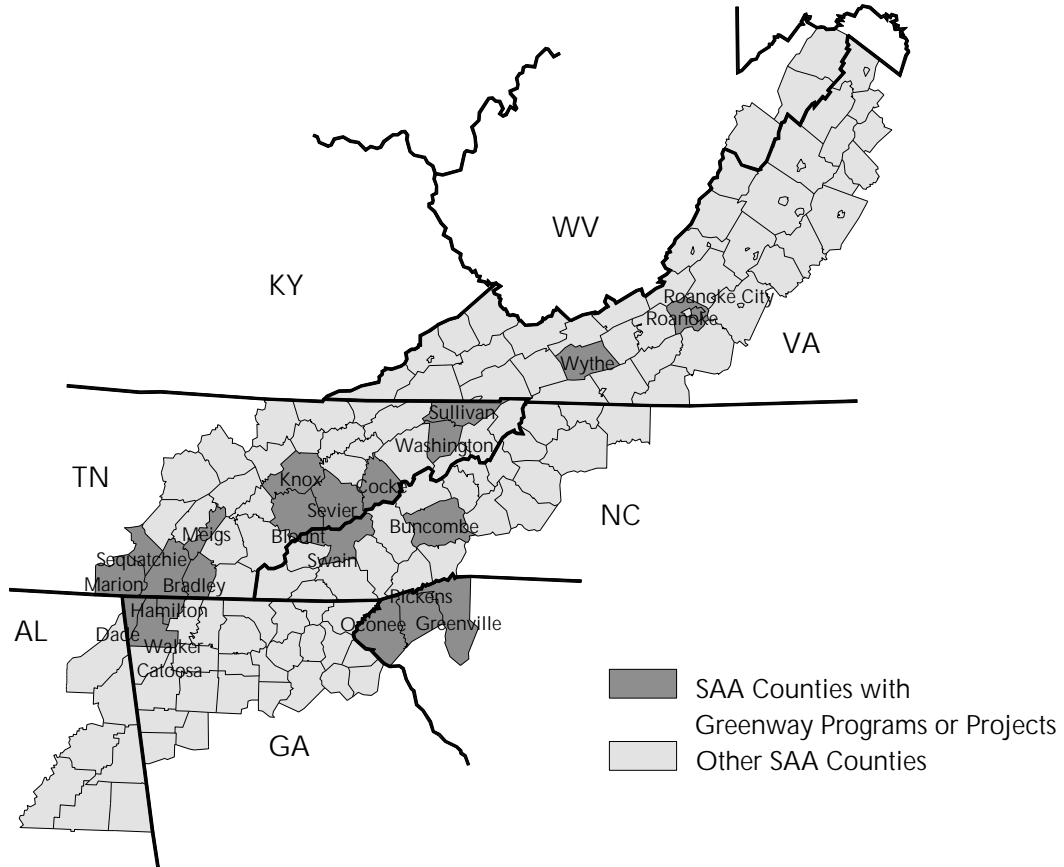
settings (table 4.5). Most of these trails are in mountainous terrain, with high peaks, that offer outstanding scenic views.

The region's best known trail is the Appalachian Trail. It was designated by Congress as a National Scenic Trail, and can be hiked from Georgia to Maine. The location of the Appalachian Trail is shown in figure 4.17.

Some trails are used for motorized access, and designated as OHV trails. The area's national forests have 675 miles of OHV trails. About 70 percent are in roaded natural-appearing settings. About 15 percent of OHV trails offer a semiprimitive motorized experience (table 4.5). OHV opportunities are limited. National and state parks generally do not have designated OHV trails. Use of OHV's is permitted on some trails in state wildlife management areas and state forests.

Greenways. A greenway is a linear park or corridor that protects and connects important natural, cultural, and recreational resources. A greenway may provide access or it may simply protect a sensitive resource. Most greenways follow natural corridors, such as streams

Figure 4.18 Counties with Greenway Programs or Projects.



RE418

or mountain ranges, but they can also lie along man-made features such as abandoned railroad corridors, power or sewer lines, scenic roadways, canals, or even long-forgotten trails. A greenway can be as narrow as 3 feet or as wide as 2 miles.

In 1987, President Reagan's Commission on Americans Outdoors proposed a nationwide system of greenways to link public lands such as state parks, state forests, national parks, and national forests with open space in cities, communities, and rural areas. A number of cities and counties in the SAA region already have or are starting greenway programs. Figure 4.18 shows the counties that have started greenway programs.

Trout Streams. There are over 33,000 miles of trout streams in the region. Fishing, camping, swimming, picnicking, and other recreation activities occur along them. These riparian environments offer unique blends of vegetation, relaxing sounds, and the other special attractions of moving water. Trout streams meander mostly through forested environments. However, a high proportion (40 percent)

are in rural settings. We attribute this unexpectedly high percentage to the high density of roads next to streams. About 27 percent of trout streams are in roaded natural-appearing settings, and about 11 percent are in remote settings.

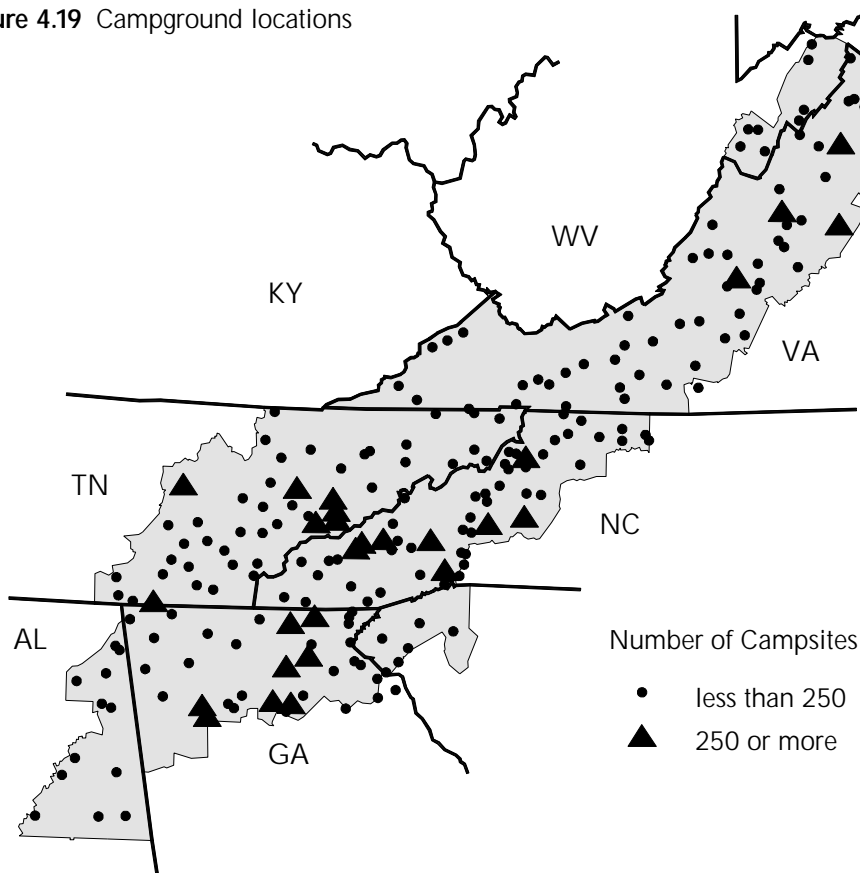
Recreation Places in the Region

A recreation place is where people spend some period of time engaged in an activity. Examples are campgrounds, picnic areas, beaches, and hunting grounds. Information about key places of interest were gathered for this report.

Campsites. Approximately 36,000 campsites are provided in 218 campgrounds throughout the region (Woodall's Campground Directory 1994). Some 70 percent are privately owned (table 4.5). A high proportion of private campsites are near the Great Smoky Mountains National Park.

Most private campgrounds cater to recreational vehicle (RV) users, provide amenities, and have a high density of campsites per acre.

Figure 4.19 Campground locations



RE419

We estimate that about 70 percent of these campsites are in transitional settings. In contrast, most publicly owned campgrounds are more spacious and are in forested or natural-appearing settings. We estimate that about 30 percent of campsites provide a rural-forested experience. The approximate locations and density of campsites are shown in figure 4.19.

Gamelands. The region has over 4 million acres of gamelands. Hunting is allowed on national forests and state wildlife management areas. Most gameland is in roaded natural-appearing or remote settings (table 4.5). We did not map the exact locations of wildlife management areas for this assessment, but table 4.5 displays the amount of settings on national forests. The location of national forest land is shown in figure 4.20.

Picnic and Swimming Areas. Over 17,000 day-use areas exist in the region. Information about picnic areas and swimming beaches was gathered from state recreation planners.

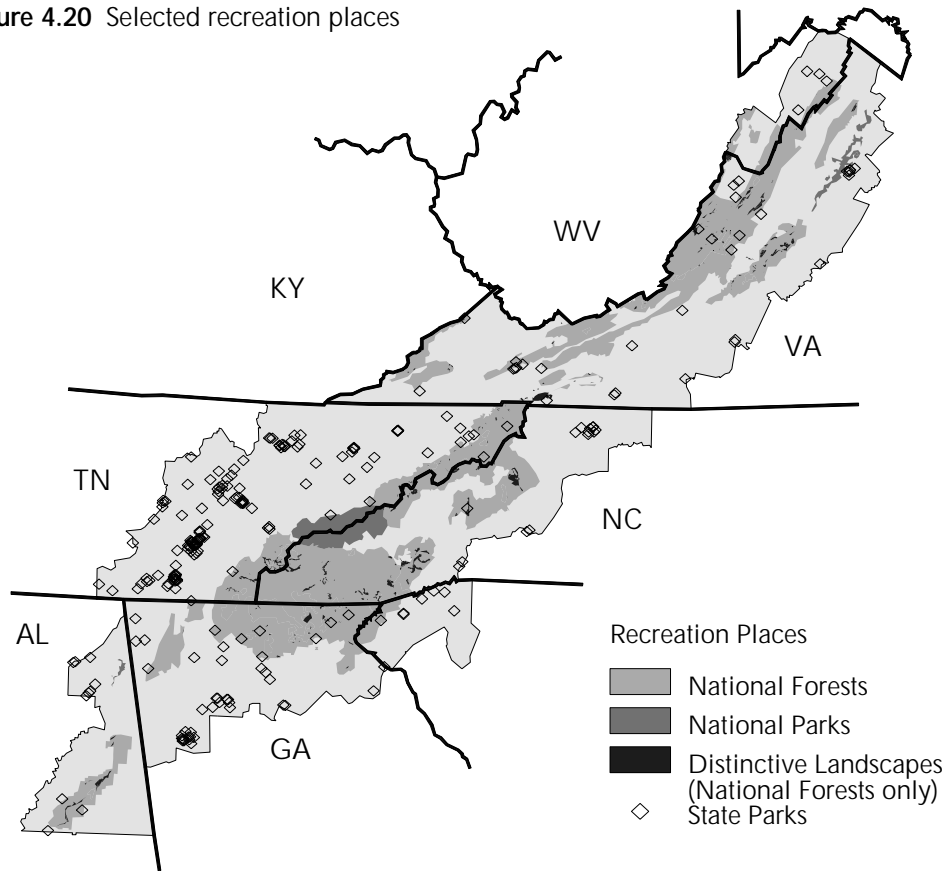
Distinctive Landscapes. Each landscape expresses its own unique and inherent scenic qualities and attractiveness. The Southern

Appalachian region is widely recognized for its attractive scenery. The combined effects of various natural and cultural forces sometimes produce landscapes with outstanding scenic attributes. These distinctive landscapes are of high importance to many people. Where they are easily accessible, distinctive landscapes usually attract a high level of recreational use.

Beginning in the mid-1970s, national forest landscapes in the Southern Appalachians were inventoried in three classes – distinctive (A), typical or common (B), and undistinguished (C). In this assessment, each of these classes was evaluated in the context of an ecological unit (generally the section).

Distinctive landscapes have landforms, vegetative patterns, water characteristics, and cultural features that combine to provide unusual, unique, or outstanding scenic quality. These landscapes have strong positive attributes of variety, unity, vividness, mystery, intactness, coherence, harmony, uniqueness, pattern, and balance.

Figure 4.20 Selected recreation places



RE420

In the Blue Ridge Mountains section, for example, the criteria for distinctive landscapes are:

Landform: Characterized by 60 percent or greater slopes with geological features that are unusual and outstanding in appearance.

Vegetation: High degree of patterns and/or an unusual diversity of trees, shrubs, or ground cover plants.

Waterform: Streams and rivers have features such as cascades, waterfalls, and rapids. Wetlands and water bodies are distinguished by adjacent Class A vegetation and/or landform.

Inventories are available only for national forests. Figure 4.20 shows the distribution of distinctive landscapes on Southern Appalachian national forests. There are approximately 875,000 acres of distinctive landscapes on national forests. Many are adjacent to existing travelways, such as the Nantahala Gorge, and therefore a high percentage are classified as rural-forested settings (table 4.5). There are about 625 of these landscapes on national forests in the study area.

Distinctive landscapes are present on

private land. Grandfather Mountain is one example of a privately owned landscape with outstanding scenic attributes. Inventories of distinctive landscapes on private land are not available, but may be modeled using a Geographic Information System (GIS) in the future.

National and State Parks. National and state parks are often designated around distinctive landscapes and other significant recreation resources. For example, Virginia's Claytor Lake State Park has outstanding boating, swimming, and camping opportunities in a natural-appearing setting with a lake. South Carolina's Table Rock State Park features an outstanding scenic rockform in a remote setting.

About 845,000 acres are in national parks, and nearly 580,000 acres are in state land and parks. National and state parks complement each other: national parks are usually large land areas (although there are several small historic parks in the region), while state parks are smaller and well dispersed throughout the region. Figure 4.20 shows the location of these significant recreation places.

Table 4.6 Ownership of settings (percent).

Setting	Thousand Acres	Share of Total	Private/Other	Public
URBAN	665	1.8	98.2	1.8
SUBURBAN	1415	3.8	98.7	1.3
TRANSITIONAL	4545	12.1	96.2	3.8
RURAL				
Pastoral/Agricultural	4678	12.4	99.5	0.5
Partly Forested	5962	15.9	98.0	2.0
Forested	6212	16.6	88.6	11.4
ROADED				
Natural Appearing	8865	23.7	67.8	32.2
Naturally Evolving	250	0.7	3.1	96.9
SEMI-PRIMITIVE				
Natural Appearing	2222	5.9	52.9	47.1
Naturally Evolving	628	1.7	2.6	97.4
PRIMITIVE	78	0.2	-	100.0
WATER	532	1.4	93.6	6.4
Not classified	1385	3.7	100.0	

Ownership of Settings

Public Land. Of 37 million acres of land in the region, approximately 16 percent is publicly owned. Most public land is in a roaded natural-appearing or remote setting. As a result, about one-third of the region's roaded natural-appearing settings are on public land. Most of the nature-based recreation activities addressed here are enjoyed in these settings, with the exception of hunting and ORV use in national and state parks.

At least 62 percent of all remote settings are on public land. These provide opportunities for active, strenuous, recreation pursuits with high probability of solitude. The percent of settings owned by the public is shown in table 4.6.

Other Land. Most "other" ownerships are private. Since the maps and data used in this

analysis did not capture all public land, the "other" category also includes some isolated tracts of public land.

Other landowners hold nearly all developed and rural settings and they control about 97 percent of urban, suburban, and transitional settings and about 95 percent of all rural settings.

About two-thirds of roaded natural-appearing and one-third (over 1 million acres) of remote settings occur on other ownerships. We do not know how much of this land is available for public use.

According to the National Private Landownership Survey (Wright and others 1988), at most, 23 percent of private landowners allowed access for recreation to people they did not know (table 4.7). Over 65 percent only allowed family and friends to use their land.

Table 4.7 Percent of landowners who allow others to use their land for recreation in the Southern Appalachian Assessment (SAA) area and in the entire Southeast.

User Group	SAA Area	Southeast
Family members (who live elsewhere)	69.1	70.4
Friends/neighbors	67.3	64.2
Others (whether know them or not)	23.0	18.0
None of the above	21.7	23.2

(Source: National Private Land Ownership Survey, 1985)

Table 4.8 Percent of landowners who allowed recreational activities on their land in the Southern Appalachian Assessment (SAA) area and the entire Southeast.

Recreational Activity	SAA Area	Southeast
Photography	57.7	47.2
Hunting	57.5	59.8
Hiking	54.3	44.1
Nature study	49.4	40.6
Berry picking	49.0	41.9
Bird watching	47.9	43.0
Picnicking	42.8	37.3
Horseback riding	33.4	30.8
Fishing	29.2	28.0
Target shooting	26.7	26.3
Camping	22.3	20.0
ORV driving	12.6	13.6
Swimming	11.8	9.4
Canoeing	8.1	6.8
Boating/waterskiing	1.8	3.4

(Source: National Private Land Ownership Survey, 1985)

What kind of recreational activities do private landowners allow? Table 4.8 shows the percentages in the National Private Landownership Survey that allow specific activities. Generally, passive types of recreational activities, such as photography, hiking, nature study, and bird watching, are allowed more frequently than active types. Private owners often do permit hunting, which may be more compatible with their objectives than are other active recreational pursuits.

Ownership Objectives. Personal recreation and enjoyment rank very high as objectives for owning land. Table 4.9 shows that about 74 percent of private landowners consider personal recreation an important reason for owning land in the Southern Appalachians.

Trends in Visits

Visits to national forests and the Great

Smoky Mountains National Park are increasing. Figures 4.21 and 4.22 show trends for visitor-days on national forests and visits on the national park. Rates were higher in the 1970s and early 1980s on both of these public landholdings than in the recent past.

State and local government parks appear to capture a large portion of public land use. Preliminary estimates from the National Survey for Recreation and the Environment show that about 60 percent of people whose last recreation trip was on public land used state or local government parks. We suggest using this estimate with caution because it is based on a sample size of only 485 people.

We asked managers of 23 state parks in the Southern Appalachians about visitor trends. Of these 23 state parks, the facilities at 19 were filled to capacity (or near capacity) on peak season weekends. Spring and fall are peak seasons

Table 4.9 Important and very important reasons for owning rural land in the Southern Appalachian Assessment (SAA) area and the entire Southeast.

Reason for Owning	SAA Area (%)	Southeast (%)
Personal recreation and enjoyment	73.5	75.0
Living in a rural environment	69.4	70.0
Estate for heirs	63.9	66.8
Livestock	53.7	41.9
Timber	51.0	56.8
Investment	33.4	39.3
Crops/agriculture	29.8	46.6
Fee hunting or fishing	3.1	4.9

% = percentage of survey respondents who listed reason as "important" or "very important"

(Source: National Private Land Ownership Survey, 1985)

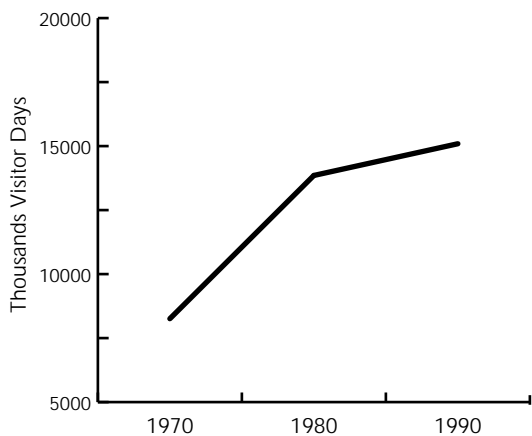


Figure 4.21 Visitation trends on national forests in Southern Appalachian Assessment region. (Region 8 Information Management System)

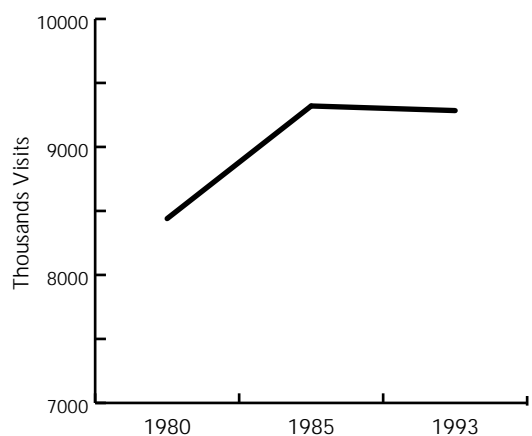


Figure 4.22 Visitation trends on Great Smoky Mountains National Park.

in the southern part of the region; spring, summer, and fall are peak seasons in the central and northern parts of the region. We attribute the high use of state parks to their high-quality facilities, their attractions, and their convenient locations (fig. 4.20).

Use Patterns on Federal Land

We selected the national forests and the Great Smoky Mountains National Park to investigate use patterns on federal land. Recreation managers identified locations where they observed that capacities are reached during peak weekends. These locations were called “hotspots.”

The highest density of hotspots follow the outer edge of the southern portion of the Blue Ridge Mountain section. The location and relative density of hotspots are shown in figures 4.23 and 4.24. We suspect that people from large urban areas, such as Atlanta, Charlotte, and Knoxville, recreate in the mountain areas closest to their homes. The outer edge of the Blue Ridge section also holds several small cities, such as Asheville, which contribute to higher density of hotspots. Some people may travel further into the mountains to find more solitude and resource attributes that do not exist on the outer edge, such as rivers for whitewater rafting, and higher quantities of fish and game.

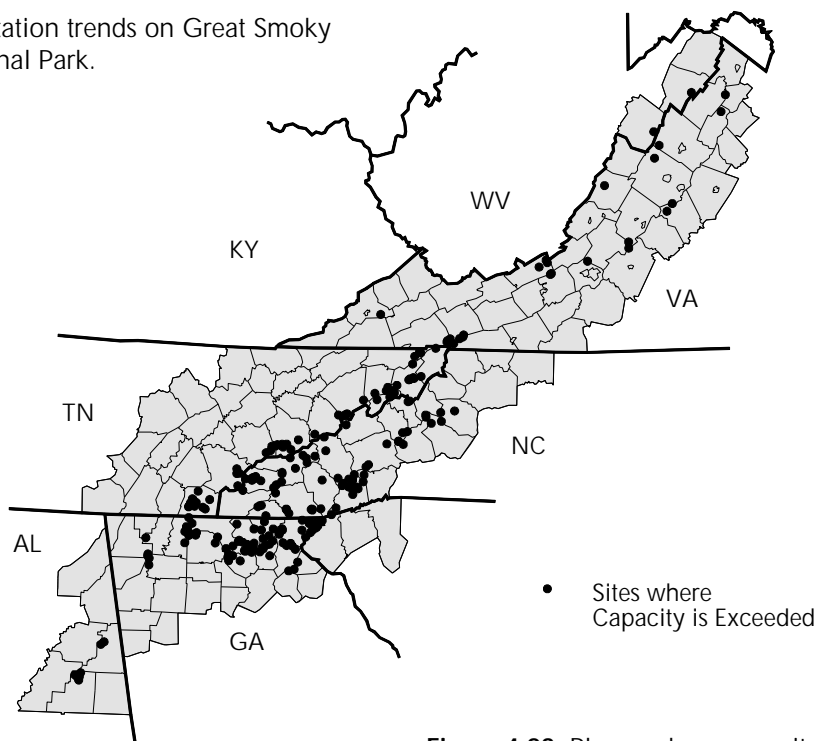
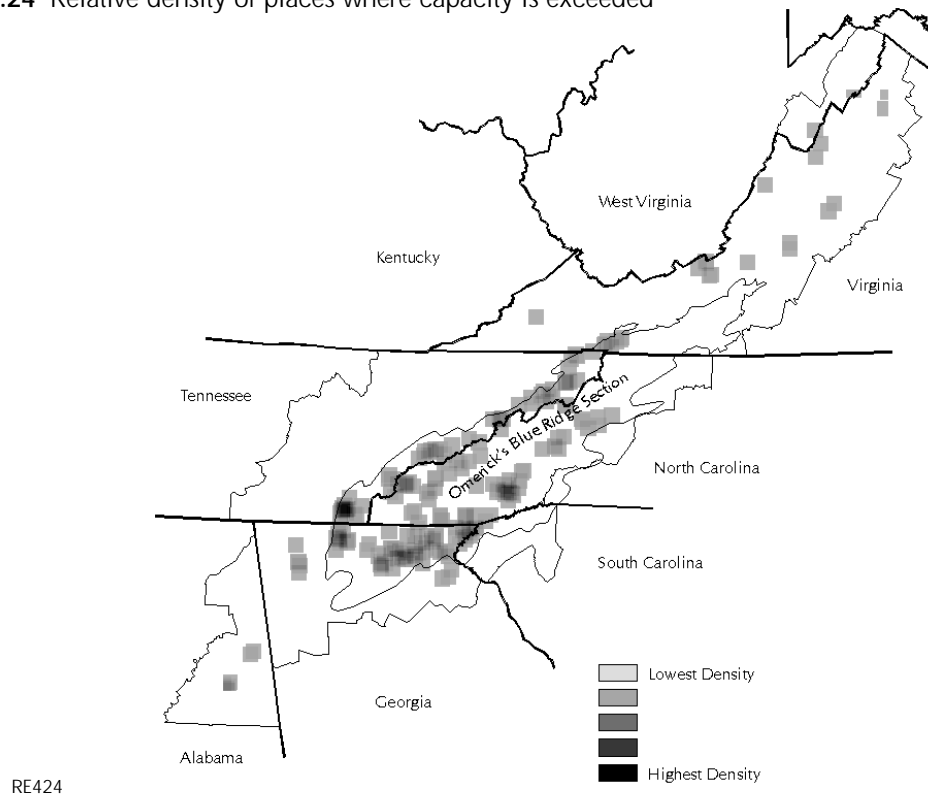


Figure 4.23 Places where capacity is exceeded

Figure 4.24 Relative density of places where capacity is exceeded

People are drawn to areas with special resource attributes or facilities that accommodate their needs for specialized activities. The places where recreation managers report use near capacity are listed below.

Trail Corridors. Recreation use nears capacity where trails are well-developed and interconnected to allow travel in loops with minimal car shuttling. Trails that lead to key attractions, such as waterfalls, generally exceed capacity during peak weekends. So do OHV trails in the southern portion of the study area. Where horseback riding and mountain biking are allowed, areas reach capacity during peak weekends. Some traditional hiking trails are being allocated for mountain bikers and horseback riders.

River Corridors. Where whitewater rafting is offered, capacity is reached on peak weekends.

Road Corridors. Road segments that parallel streams or rivers (usually within 150 feet) are used heavily for dispersed camping and fishing. Road segments where hunters park to enter preferred areas often are overcrowded. Similarly, overcrowding occurs on road corridors where several key attractions are clustered within short distances.

Camping Areas. Campgrounds near lakes or

rivers consistently meet capacity during peak season weekends. Capacity is often exceeded on dispersed camping spots adjacent to streams. The same is true for campgrounds popular with local residents. The capacities of group camps are consistently met or exceeded on peak season weekends. Primitive campsites in remote areas near scenic overlooks are often overcrowded.

Day-Use Areas. Lakeside settings, riverside picnic areas, and trail and stream intersections frequently are overcrowded. The same is true for places in close proximity to distinctive natural landscapes with frequent scenic overlooks.

Mapping of hotspots shows that some portions of settings are fully utilized while others are underutilized.

Use Patterns in Remote Settings

Recreation planners from national forests generated a set of coefficients for estimating recreation capacity (table 4.10). The threshold coefficients take into account settings, the activities that occur in settings, and the type of facilities that support the activity.

We derived capacity for remote opportunities using GIS. Primitive and semiprimitive settings are used primarily along specific trails.

Table 4.10 Thresholds estimated by settings and activities.

Activity	PRIMITIVE/SEMI-PRIMITIVE	ROADED-NATURAL APPEARING	RURAL	TRANSITIONAL/SUBURBAN/URBAN
Camping	# Sites Max sites < 1/2 mi. trail Group size = 6	# Roadside campsites Rustic group campsites Roadside campsites = Forest Service land where roads parallel streams Group size = 10 Miles of trails Day hike to attraction Parking = 20 cars	# Campsites in campgrounds (public) Group size = 5	# Campsites in campgrounds (private) Group size = 5
Day use	# Overlooks (observation sites) Parking = 2 vehicles Group size = 4 Public land open to hunting	Public land open to hunting Stage 1 – Groups = 5 Stage 2 – Disperse @ 1/2 spacing	Visitor Centers # Beaches # Picnic Areas Parking = 50-200 Private land (access by private landowner)	#City parks #Pools # Sport fields, etc. Parking = 50-200+ N/A
Fishing	Trout streams and trail intersection 1 group/2 intersections Group size = 1 N/A	Stream or river with road parallel within 150' Group = 1 @ 300' Lakes with gravel road access Public land/roads ADT = 50-80 2 persons per ADT	Road and stream intersection Group size = 6 Lakes with paved access	Trout ponds Rivers in urban areas
Driving (viewing scenery)				
Nature study	Self directed	Self directed		
Cultural resource study	Self directed only	# sites open to public		Museums # sites open to public
Motorized boating	N/A	Lakes 10 acres/boat	Lakes 5 acres/boat 3 persons/boat	2 acres/boat
Non-motorized boating	Rivers 1 group/2 miles Group size = 5	Rivers 1 group/1/4 mile Group size = 5-15	Rivers 3 groups/1/4 mile Group size = 10-25 Lakes @ 2 boats/acre	Lakes 2 boats/acre
Motorized trail use	SPM miles Designated OHV trails 1 group/5 miles Group size = 4 Parking = 2 vehicles	1 group/4 miles Group size = 4 Parking = 20 vehicles	3 groups/mile Group size = 6 Parking = 50 vehicles	N/A
Non-motorized trail use	Miles of trail 2 groups/mile Group size = 6 Parking = 3 vehicles Occasional cross-country skiing	Miles of trail 4 groups/mile Group size = 10 Parking = 10 vehicles 4 groups/mile Group size = 8 Parking = 10 vehicles	Miles of trail (to major attractions) Parking = 100 vehicles	Trails in city/county parks
Winter sports	2 groups/mile Group size = 4 Parking = 3 vehicles	Group size = 8 Parking = 10 vehicles	Downhill skiing Parking = 200 vehicles	Downhill skiing Parking = 200+ vehicles

Users generally hike or horseback-ride in groups of three to six. Primitive camping generally takes place beside the trail where the terrain flattens out. The experience of solitude is lost if encounters along trails are frequent. We estimated that groups should be separated by one-half mile to derive solitude in primitive areas. By calculating the number of trail miles in primitive and semiprimitive areas and multiplying the average group size by two, we estimated an upper use threshold.

There are about 3,340 miles of trail in primitive and semiprimitive settings in the region. Thus, the use threshold is about 40,000 people per day. Allowing 28 weekends per year (April through October), the annual use threshold is over 2 million people per year.

About 2,100 miles of trails are in primitive and semiprimitive areas in the Great Smoky Mountains National Park and the region's national forests. For 28 peak season weekends during the year, use of these trails should not exceed about 1.4 million people per year.

The intent here is to quantify use patterns for each remote setting, and compare these with capacity estimates. This step must be completed later and at finer scales. Planners did provide broad estimates of percent of capacity used for some remote settings. Of 145 remote settings that were reviewed, 19 were estimated to have use within 50 to 100 percent of capacity. All others were less than 50 percent of capacity.

Data and Methods

Settings Mapping Methodology

Settings were derived from satellite imagery and Geological Survey digital line graph data. The satellite imagery provided land cover data for classifying land use and scenic character. Digital line graph data (USGS 1:100,000) permitted mapping of access and estimation of relative remoteness. Traffic counts were obtained from state departments of transportation. Several intricate steps were used to model landscape patterns for settings. For more information about deriving landscape settings, see Ritters (1995).

Matching Settings with Other Landscape Characteristics

The settings map provided the framework for subsequent analysis of supplies of recreation

opportunities. Other map-based products were merged with the settings map to depict the amounts of recreation corridors and places in settings.

For these analyses, data on hiking trails, OHV trails, Class 5 roads, and land ownership were taken from USDA Forest Service files. Data on scenic byways were obtained from the National Park Service. Locations of trout streams were obtained from the SAA Aquatics Team. Officials in individual states provided information on day-use in state parks. Locations of campsites were obtained from Woodall's Campground Directory (1995). It was chosen because it is the one known consistent source of data. In this source, information about private campgrounds is somewhat more detailed than that about public campgrounds.

Question 2:

How has the recreating public within traveling distance of public land changed in the past 10 years and what are the predicted future changes?

Key Findings

Perhaps the most significant trend is that the recreators who live near public land in the SAA region have increased in both number and diversity. The region's population has grown and, for almost all activities except hunting, the percentage of the population that participates has grown or remained stable. Increasingly, older Americans and nonwhites are recreating outdoors. Growth rates for these population subgroups are above the regional average. Thus, the proportion of participants belonging to these groups has increased. Retirement communities in the southern part of the study area have attracted many seniors with high incomes and good health.

However, use by individuals who account for a majority of outdoor recreation activity has remained constant when measured in days, trips, or recreation visitor days (RVDs). The most active one-fourth of participants, who account for over two-thirds of RVDs, is still predominantly white, male, and under age 60. In the last 10 years, however, more women have become avid participants.

For most activities, the average number of days or trips per participant per year has increased in the last 10 years. In addition, technological changes have made more activities available to more people. For example, mountain biking, jet skiing, and sailboarding did not appear as activity options in the 1982 national survey. As a result, people in the region who participate in any recreation activity participate in a greater number of activities per year than they did 10 years ago.

We can expect these trends to continue in the region. The population will continue to grow, as will participation by women and minorities. The proportion of participants over the age of 60 also is likely to continue to increase as the first wave of "Baby Boomers" retires in 10 to 20 years. As a result, we expect major growth in less physically demanding activities, including pleasure driving, sightseeing, nature and cultural resource study, and developed camping.

Demand for recreation can be expected to increase faster in developed and roaded settings than in primitive or semiprimitive settings. All of the groups predicted to become larger parts of the participant pool – minorities, women, and seniors – participate primarily in activities in developed settings.

Measuring Demand

In this section, we use actual participation as the measure of demand for outdoor recreation activities. We examine the proportions of the population participating in individual activities, and we examine how often per year participants actually engage in activities.

Participation

Trends in recreation participation. Analysis of trends in participation are complicated by two factors. First, previous reports (U.S. Department of Interior 1973, 1983) presented most of their results for the nation as a whole, while our interest is in the Southern Appalachian region. Second, over time certain activities have been redefined and either split into more detailed component activities or aggregated with other activities. Insofar as possible, consistent activity definitions were used.

Table 4.11 shows trends in the percentage of the population participating at least once in each of 16 activities in 1992. For most activities, the percentage of Southerners participating is below the national average for both 1972 and 1982. However, participation has significantly increased in the South over the last 10 years.

For all activities, the percentage of SAA residents who participate is nearly identical to the percentage of southern-census-region

Table 4.11 Trends in percentage of people participating in recreation activities in the Nation, the South, and the Southern Appalachian Assessment (SAA) region in 1972, 1982 and 1992.

Activity	1972 ¹		1982 ²		1992 ³	
	Nation	South	Nation	South	SAA Region	South
Primitive camping	5	3.6	10	7	12.9	12.9
Developed camping	11	8.0	17	14	17.4	18.6
Picnicking	47	44.1	48	40	49.3	49.5
Sightseeing	37	35.2	46	41	56.1	54.3
Off-road driving	5	3.3	11	9	17.0	18.2
Hunting	3	2.8	12	15	13.8	14.3
Fishing	24	26.7	34	39	35.3	37.0
Bicycling	10	9.3	32	27	27.8	30.6
Horseback riding	5	6.1	9	8	9.5	10.4
Day hiking	5	2.8	14	9	20.1	19.7
Pleasure walking	34	28.4	53	49	62.2	62.7
Sailing	3	2.0	6	4	4.6	4.8
Canoeing/kayaking	3	2.2	8	5	7.5	7.7
Nature study	17	13.4	12	8	37.2	38.7
Non-pool swimming	34	32.2	32	30	36.7	37.7
Water skiing	5	5.9	9	10	11.1	10.4

¹(Source: Outdoor Recreation Survey, 1973)

²(Source: Nationwide Recreation Survey, 1983)

³(Source: National Survey for Recreation and the Environment, 1992)

Table 4.12 Trends in intensity of participation.

Activity and Unit of Measure	Number/Participant ¹	
	1982	1992
Primitive camping (days)	8.4	8.3
Developed camping (days)	9.3	11.4
Developed camping (trips)	4	9
Off-road driving (days)	23.7	27.9
Off-road driving (trips)	12	23
Hunting (days)	13.2	26.8
Small game hunting (trips)	9	9
Fishing (days)	15.0	33.3
Freshwater fishing (trips)	9	6
Bicycling (days)	41.4	42.4
Horseback riding (days)	19.2	25.8
Day hiking (days)	15.9	15.6
Day hiking (trips)	5	9
Sailing (days)	8.4	5.2
Canoeing/kayaking (days)	5.1	6.2
Canoeing/kayaking (trips)	3	5
Nature study (days)	26.6	89.4
Non-pool swimming (days)	14.4	13.6

¹Data for 1982 are national, and for Southern Appalachian Assessment states only in 1992.

residents who participate. For all activities except hunting and fishing, a greater percentage of southern residents participated in 1992 than in 1982. For hunting and fishing, percentage declines were small. Participation increase is consistent with results from the 1982 survey and findings from English and Cordell (1985).

Another dimension of recreation participation is how many times an individual participates. Table 4.12 compares the average numbers of activity-days per participant per year for study area residents to the national 1982 averages for 18 activities. Participants living in the area engaged in their activity as often as the 1982 national average for 17 of the 18 activities listed. The sole exception was sailing.

Participants in activity aggregates. For most of 12 general types of activities, males make up between 50 and 63 percent of participants (table 4.13a). For nature study and cultural resource study, slightly more than half of the participants are female. Only for hunting do men comprise more than two-thirds of participants. For half of the activity groups, nonwhites account for fewer than 10 percent of participants. For the remainder, including fishing, hunting, nature study, cultural resource study, sightseeing, and day-use activities, between 10 and 20 percent of participants are nonwhite.

People with no more than a high school education make up nearly three-fifths of hunters in the Southern Appalachian region, and over 45 percent of fishermen. Individuals with this education level make up the smallest proportion of participants in cultural resource study and winter activities. People with post-graduate education comprise only about 2 percent of the region's hunters, but nearly 15 percent of those who pursue cultural resource activities. With the exception of hunting, people with more than a high school education account for roughly half of the participants.

A majority of participants in winter activities, nonmotorized boating, and motorized trail use are under 30 (table 4.13b). However, this same age group comprises less than one-third of people who engage in nature study, cultural resource study, and day-use activities. In our example, no one over 60 reported engaging in any of the winter activities. In addition, fewer than 5 percent of nonmotorized boaters fell into this age category. But older individuals make up at least 15 percent of participants in less physically demanding activities, such as day-use, cultural resource study, nature study, and pleasure driving.

Individuals with household incomes below \$25,000 per year make up nearly 30 percent of hunters, and over one-fifth of fishermen, day-users, and motorized trail users. People in

this economic stratum make up only a little more than 10 percent of participants in winter and nonmotorized boating activities. Individuals with household incomes between \$25,000 and \$75,000 generally account for about two-thirds of participants, but the percentage is somewhat higher for camping and nonmotorized boating, and slightly lower for hunting. People in the highest income group (over \$75,000 per year) generally comprise 12 to 17 percent of participants. The exception is winter activities, for which the highest income group accounts for over one-fourth of all participants.

The demographic groups with the highest levels of participation in these activity aggregates were white men and women aged 16 to 30 with not more than a college education, and white men and women aged 31 to 45 with a college degree. Although these people make up about one-third of the population in Southern Appalachian states, they account for at least 38 percent of participants in all activities, and over half of participants in 7 of the 12 activity types (table 4.14). For winter activities, these people comprise over 71 percent of all participants.

Number of participants. How many people in the study area actually participate in outdoor

Table 4.13a Gender, race, and education of participants in aggregated activities.

Activity	Gender (% male)	Race (% white)	Years of Education		
			<12 (%)	12-16 (%)	>16 (%)
Camping	57.8	92.4	42.6	48.4	9.0
Day-use	50.9	82.2	41.1	47.9	11.0
Hunting	87.3	89.4	59.8	38.4	1.8
Fishing	63.5	84.9	46.6	46.2	7.2
Winter	61.6	92.1	33.8	53.6	12.6
Cultural	49.7	84.3	32.4	52.8	14.7
Nonmotorized boating	62.5	95.5	37.0	48.9	14.1
Motorized boating	52.9	94.5	37.5	53.0	9.5
Nonmotorized trail use	55.6	91.6	35.9	50.5	13.6
Motorized trail use	56.3	91.6	44.4	48.4	7.2
Nature study	49.1	84.2	37.8	50.1	12.1
Sightseeing	50.2	82.9	36.9	50.1	13.0

(Source: National Survey for Recreation and the Environment, 1992)

Table 4.13b Age and income of participants in aggregated activities.

Aggregated Activity	Age in years			Annual Income		
	<30 (%)	30-60 (%)	>60 (%)	<\$25M (%)	\$25-75M (%)	>\$75M (%)
Camping	44.7	47.4	7.9	16.3	71.8	11.9
Day-use	32.1	52.5	15.4	21.6	64.4	14.0
Hunting	41.8	49.9	8.3	28.7	57.7	13.6
Fishing	36.5	52.9	10.6	23.9	65.0	11.7
Winter	62.4	37.6	0.0	12.2	60.6	27.2
Cultural	30.6	54.3	15.1	16.8	67.3	15.9
Nonmotorized boating	55.5	39.6	4.9	11.9	72.8	15.3
Motorized boating	38.0	52.0	10.0	16.8	67.7	15.5
Nonmotorized trail use	42.1	49.2	8.7	18.3	64.5	17.2
Motorized trail use	54.2	37.0	8.8	20.6	66.3	13.1
Nature study	32.3	52.7	15.0	19.4	65.9	14.7
Driving	29.9	53.9	16.2	17.2	67.7	15.1

(Source: National Survey for Recreation and the Environment, 1992)

Table 4.14 Participation in aggregated activities by white men and women, aged 16 to 30 with college education or less, and aged 31-45 with college education or more (percent).

Aggregated Activity	Proportion of All Participants	Proportion of Group Participating	Proportion of SAA ¹ Residents Participating
Camping	56.6	42	25.0
Day-use	39.3	90	76.6
Hunting	54.4	22	13.8
Fishing	46.0	49	35.3
Winter	71.1	20	9.4
Cultural	39.0	54	45.8
Nonmotorized boating	66.3	30	15.2
Motorized boating	55.0	47	28.3
Nonmotorized trail use	60.8	32	26.3
Motorized trail use	56.1	44	17.8
Nature study	39.0	67	56.9
Sightseeing	37.5	62	56.1

¹Southern Appalachian Assessment
(Source: National Survey for Recreation and the Environment, 1992)

recreation activities? Using data from the National Survey of Recreation and the Environment, we developed models relating the likelihood of participation in each of the 12 aggregate activities to the individual's demographic characteristics of age group, race, gender, income group, and education level. Models and results of these regressions are available upon request from the authors. Summary discussion of models is available in a report by English (1995).

Resulting estimates of the number of activity participants over the age of 16 are presented in table 4.15. Over 2 million people living in the Southern Appalachians engage in day-use, nature study, and sightseeing activities, and between 1 and 2 million participate in fishing, camping, cultural resource study, motorized boating, and nonmotorized trail activities.

The entire Southern Appalachian states contain over 20 million people who participate in day-use activities, and over 14 million who participate in sightseeing or nature study. However, less than half a million participate in winter activities.

The importance of living near recreation resources is evident in the ratio of participants living in the study area to the number of participants in the entire seven-state region. Although the SAA region contains only about 18 percent of the population over age 16, it contains over one-fourth of all participants in motorized trail use (27 percent) and camping (26 percent). In addition, between 21 and 25 percent of participants in hunting, nonmotorized trail use, and boating activities live in the SAA region.

Frequent participants. For each activity aggregate, we selected the most active 25

Table 4.15 Estimated numbers of participants (thousands) in the Southern Appalachians, and in the remainder of Southern Appalachian Assessment (SAA) states by aggregated activities.

Aggregated Activity	In SAA Area	In Remainder of SAA	Total
Camping	1,444	4,209	5,653
Day-use	3,882	16,930	20,812
Hunting	529	1,865	2,394
Fishing	1,757	7,152	8,909
Winter	36	323	359
Cultural	1,979	9,128	11,107
Nonmotorized boating	501	1,950	2,451
Motorized boating	1,417	4,759	6,177
Nonmotorized trail use	1,294	4,472	5,766
Motorized trail use	965	2,628	3,593
Nature study	2,789	11,622	14,411
Sightseeing	2,678	11,661	14,339

(Source: National Survey for Recreation and the Environment, 1992)

Table 4.16 Cutoff level of participation and proportion of activity days accounted for by most active participants.

Activity	Cutoff Level of Participation (number of days)	Proportion of Activity-Days (%)
Camping	14	72.3
Day-use	214	58.6
Hunting	30	71.3
Fishing	40	74.2
Winter	5	66.4
Cultural	6	66.7
Nonmotorized boating	6	73.4
Motorized boating	20	78.6
Nonmotorized trail use	20	83.7
Motorized trail use	20	86.8
Nature study	75	88.0
Sightseeing	20	74.6

(Source: National Survey for Recreation and the Environment, 1992)

percent of participants, according to the reported number of days of participation per year. For example, frequent campers all had at least 14 days of camping in the past year (table 4.16). For hunters, the most active one-fourth of participants all went hunting at least 30 days, and for OHV users, 20 days of participation marked the cutoff.

For every activity group, the most active 25 percent of participants accounted for well over half of the total activity-days. People who camped at least 14 days per year accounted for 72.3 percent of all reported camping days.

Activity was most concentrated for nature study and OHV use, where the most active one-fourth of participants accounted for 88.0 percent and 86.8 percent of activity days, respectively. The demographic characteristics

of these frequent activity participants are presented in table 4.17.

Population trends. Over the last 10 years, the proportions of older individuals and non-whites in the Southern Appalachian population have been increasing. In 1980, about 8.78 million people living in the seven SAA states were over the age of 59. They made up about 14.5 percent of the total population. By 1990, there were almost 10.66 million people in that age group, accounting for 15.9 percent of the population. In 1980, whites accounted for about 77.3 percent of the population in SAA states. In 1990, that proportion had declined to 76.3 percent. Information for the preceding section was derived from the National Survey for Recreation and the Environment. Refer to English (1995) for more detail.

Table 4.17a Gender, race, and education of frequent participants in activities.

Activity	Gender (% male)	Race (% white)	Years of Education		
			<12 (%)	12-16 (%)	>16 (%)
Camping	64	99	49	43	8
Day-use	39	86	36	55	9
Hunting	92	100	60	38	2
Fishing	79	83	43	57	0
Winter	65	88	35	53	12
Cultural	59	90	20	60	20
Nonmotorized boating	65	96	31	54	15
Motorized boating	58	98	37	62	1
Nonmotorized trail use	55	97	36	55	9
Motorized trail use	65	100	47	47	6
Nature study	47	88	36	56	8
Sightseeing	47	87	34	53	13

(Source: National Survey for Recreation and the Environment, 1992)

Table 4.17b Age and income of frequent participants in activities (percent).

Activity	Age in years			Income		
	<30	30-60	>60	<\$25k	\$25-75k	>\$75k
Camping	44	40	16	21	66	13
Day-use	35	46	19	21	61	18
Hunting	45	45	10	34	46	19
Fishing	41	48	11	22	68	10
Winter	58	42	0	5	65	30
Cultural	29	51	20	7	70	23
Nonmotorized boating	60	35	5	4	81	15
Motorized boating	44	48	8	11	68	21
Nonmotorized trail use	37	53	9	19	65	16
Motorized trail use	52	37	11	32	63	5
Nature study	18	58	24	22	59	19
Driving	27	48	25	15	69	16

(Source: National Survey for Recreation and the Environment 1992)

Review of Visitor Surveys

Approximately 75 visitor surveys were reviewed to determine the characteristics, motives, and preferences of Southern Appalachian recreators. About 20 surveys were conducted in wilderness areas, 15 on rivers, and 20 in the Great Smoky Mountains National Park. Other surveys were conducted in the Shenandoah National Park and in general forest areas of national forests. No surveys were reported on private land.

Reported motives for recreating included: "to get away from it all," "to be with family" (Chipman and Helfrich 1988), "to enjoy the place itself," "to learn about the land" (Clonts 1994), and "to do nothing – read or watch the river" (Franz and others 1980). Attributes that attracted people were: close proximity (80 percent), low cost (68 percent), easy access (59 percent), presence of wildlife (53 percent), trails (48 percent), experience forest cover (44 percent), and campgrounds (42 percent) (Clonts 1994).

Two consistent reasons for visiting the Great Smoky Mountains National Park were: viewing scenery (100 percent) and presence of wildlife (92 percent) (Hastings and Hammitt 1985). Most visitors in the park stop at facilities (96 percent), such as visitor centers, rather than going directly to interact with resources (4 percent) (Cornell, O'Leary, and Peine 1988; Peine and Renfro 1988).

Wilderness users rank their motives for visits in the following order: (1) scenery, (2) learning about nature, (3) exercise, and (4) escape everyday pressures (Roggenbuck 1980).

Overnight users tend to recreate to test skills and to boost self-image compared to day users, who recreate more for family togetherness and companionship.

Highly preferred activities in general forest areas are fishing and hiking (Clonts 1994). In one study, anglers ranked catching fish as fourth in priority behind scenery, quietness, and social interaction with friends (Kosanke 1987). In general, hunters ranked "seeing a large number of game animals" higher than actually bagging the game (Leuschner and others 1989).

Resource conditions contribute to the satisfaction of recreation users. Clean and safe environments rank highest among users (Cordell and English 1988). Conditions that users do not like are (1) presence of litter, (2) human-caused damage to trees in campsites, (3) vegetation loss and bare ground (Roggenbuck, Williams, and Watson 1993). Trail erosion is another negative attribute for users (Roggenbuck, Widner, and Williams 1994).

In general, social encounters in remote areas do not detract from the experiences. One study revealed that encounters with other groups enhanced the experience for 42 percent of respondents and detracted from the experience of 32 percent (Hammitt and Patterson 1989). Specific detractors are noise and camping within sights and sounds of others (Roggenbuck, Williams, and Watson 1993). Despite some detractors, most visitors are highly satisfied with their remote experiences (Roggenbuck, Widner, and Williams 1994). Sizes of groups in remote areas are getting smaller (3.5 average), and length of stay is getting shorter (Roggenbuck, Widner, and Williams 1994).

One survey compared a commodity view of recreation places with an emotional and symbolic view. It showed that people tend to form an attachment to recreation places through a history of use and a focus on the place (Williams, Patterson, and Roggenbuck 1992). When an attachment develops, people are less willing to substitute other settings because the meaning of a special place is not interchangeable or reproducible. People who form place attachments tend to be frequent, repeat visitors, overnighters, and hunters. Roggenbuck (1995) provides more detail about these surveys.

In a study of OHV users, Shields (1992) showed that group size averaged about 2.75, and length of stay averaged 5 hours. Nearly twice as many groups from surrounding counties used the area compared to county residents. About one-seventh of users hailed from another state. The equipment used was evenly divided between dirt bikes (39 percent) and 4-wheel OHVs (42 percent).

Review of Fish and Wildlife Survey Data

Data sources for wildlife-related recreation were the 1982-83 Nationwide Recreation Survey and the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation summaries for individual states. These data sources roughly categorized "settings" as private, public, residential, and nonresidential. Rural and urban settings were available for some of the activities. Wildlife recreation activities can be divided into consumptive and nonconsumptive. Consumptive wildlife recreation in the Southern Appalachians includes hunting and fishing. Nonconsumptive wildlife recreation includes viewing and nature study. Nature study includes observing, feeding, and photographing wildlife.

The data show that there is an increasing demand for nonconsumptive wildlife activities because participation rates are increasing. Increases are particularly large for wildlife observation. Numbers of fishermen and hunters are also increasing, but not as rapidly. Consumptive wildlife recreation occurs most on private land in rural settings. Nonconsumptive wildlife recreation occurs most in suburban and urban settings.

Review of State Comprehensive Outdoor Recreation Plans

We reviewed plans from six states. The general population characteristics for the states were similar. In all these states, the aging "Baby Boomers", have more leisure time, more discretionary dollars, are interested in passive recreation activities, are more politically active, show a growing concern for the protection of natural resources, and are interested in cultural and historical sites.

Some states also have growing populations of children under 10 years old. Young families often have two wage earners or a single parent. In either case, they have little leisure time and look for recreational opportunities close to home. There is also an increase in the frequency of long weekend trips rather than traditional 2-week vacations. The most popular recreation activities for the states that include the SAA area are fishing, beach swimming, walking for pleasure, bicycling, cultural site visits, pool swimming, picnicking, driving for pleasure, zoo visits, basketball, and camping.

The top 10 recreation activities vary slightly by state, but the activities just listed are popular activities throughout the region. Minority group members are more likely to favor team sports and individual fitness. Stremple (1995) provides more detailed information.

Question 3:

What are the supplies of and the demands for major types of recreation settings and activities within the area?

Key Findings

Many components of supply and demand for outdoor recreation were described in answers to previous questions. That information will not be reported here. Information on values is provided in this section.

Economic Valuation

Three economic measures were typically used to indicate the importance and value of a given activity or resource: (1) total revenue or total expenditure, (2) employment, and (3) net

economic value or consumer's surplus. Total expenditure is the product of market price and quantity. For example, an individual with a demand curve for camping as depicted in figure 4.25 would take five camping trips per year if the cost per trip were \$50. The individual's total expenditure on camping trips would be \$250 (area abde of fig. 4.25). Adding the annual expenditures on camping trips across all individuals in a region determines the total camping expenditures for the region. This information could be combined with an employment multiplier from a regional input-output model to determine the amount of employment supported by camping in the region.

Generally, total expenditures and employment are used by policy makers to assess economic growth and development in a region.

For example, consider a long-term public investment like a campground in a rural setting. Suppose further that most visits are by nonlocals. One could argue that most of the benefits of the campground accrue to nonlocals, and therefore, that a campground is not a wise local public investment. However, this is only part of the story. Nonlocal spending during camping trips in the area may increase income and create jobs for locals, imparting merit to the investment.

Net economic value in the above example is a measure of the benefit received by campers, and equals the difference between what a consumer must pay for a good or service and what the consumer is willing to pay. In figure 4.25, the consumer's willingness to pay for camping is line cdf. At a price of \$50, the consumer will purchase five camping trips. The consumer is said to be at an equilibrium point, that is, where willingness to pay is equal to price. The consumer does not purchase more than five trips, since at such quantities the \$50 price exceeds the amount the consumer is willing to pay. Similarly, the consumer does not purchase fewer than five trips, since he/she is willing to pay more than the price. Because willingness to pay is at or above price for trips 1 through 5, there is a positive net economic value associated with each of these trips. Adding these values up to the consumer's equilibrium point results in a net economic value or consumer's surplus per year of \$125 (area bcd). Again, this measure reflects the net benefit the individual receives from camping because it is

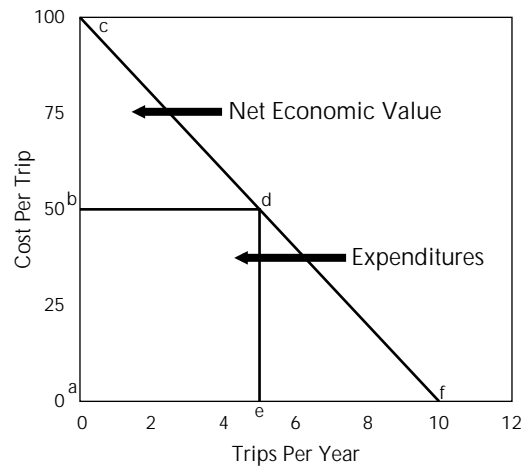


Figure 4.25 Theoretical demand curve for camping.

the difference between what the individual would give up to camp less what the individual must give up.

As with expenditures, net economic value can be summed across all campers in a region to obtain an aggregate measure of the net economic value of camping as a main activity in the region. In the case of national parks and forests, accrual of net economic benefits to locals versus nonlocals is generally less important than consideration of the benefits from a national perspective. These net economic values per day are often multiplied by annual participation to obtain estimates of the contribution to national welfare resulting from demand and use of a region's recreation resources.

Net Economic Value

We used primary and secondary sources to estimate net economic value (NEV) per trip and per day for 14 main outdoor recreation activities in the study area. Main activity does not imply the only activity taken on a trip. Many trips include several activities, but in most cases the desire to participate in a main activity is the primary behavioral influence. Net economic values were estimated via travel cost method using visitor data from a variety of recreation sites in the Southeastern United States. English and Bowker (1995) describe the concepts and methods used to derive our results in detail.

In general, our reported values per day and per trip for the activities fall within the bounds reported by Walsh and others (1992) in their

review of recreation valuation research from 1968 to 1988. Our results are also very similar to the national averages for activities reported by Bergstrom and Cordell (1991).

Water-based activities (table 4.18) are consistently among the most highly valued per recreation day. Whitewater rafting is the highest valued of all activities with benefits of \$126.04 per day. It is also the most restrictive; opportunities are limited to a few sites in the region and only during certain times of the year. Motorboating and water skiing are more highly valued at \$33.89 per day than sailing at \$11.79 per day. Pool and outdoor swimming are also quite highly valued at \$28.54 per day.

Cold water fishing (primarily trout) and bass fishing (smallmouth and largemouth) provide about the same amount of benefit to anglers per day at \$27.02 and \$32.40, respectively. It should again be noted that the bass fishing value is a seven-state average which includes fishing outside the study area. General warm-water fishing for bass, panfish, and catfish is valued considerably lower at \$10.06 per day.

The two land-based wildlife activities are deer hunting and wildlife viewing. These activities provide average per day benefits of \$40.29 and \$29.00, respectively. As with bass fishing, these values are drawn from state averages and should be viewed with some caution in that the quality of the activity may be different in the Southern Appalachians than in the

remainders of the states. For example, it is generally accepted that hunting quality is higher on the Piedmont and Coastal Plain than in the Mountains and Foothills.

General land-based activity benefits range from \$5.79 per day for day hiking and trail walking to \$73.90 per day for a composite picnic and family gathering. Camping, like day hiking, carries a relatively low value, \$6.05 per day. Another composite activity of relaxing with no main activity is relatively highly valued at \$35.52 per day. Finally, sightseeing and scenic driving provide average benefits of \$14.04 per day. While camping and day hiking have low values as primary activities, they are often parts of more general activities like relaxing as well as specific activities like hunting and coldwater fishing. Overall, the results can be combined with numbers of visits to various sites to indicate the aggregate benefits provided by recreation in the region.

Only a little research has been done on how these values may be changing. However, there are indications that the value of recreation has been increasing (Peterson, Loomis, and Sorg 1985; Peterson, Stynes, and Arnold 1985). Increases in participation intensity may indicate an outward shift in recreation demand, which generally leads to increased value per participant given adequate supply. Higher participation rates for most activities usually mean more people with positive economic values, and thus

Table 4.18 Net economic values for selected outdoor recreation main activities in the Southern Appalachians.

Activity	Sample Size (number)	Net Economic Value	
		Per Day (dollars)	Per Trip (dollars)
Camping	756	6.05	27.62
Cold water fishing	147	27.02	54.04
Day hiking/trail walking	107	5.79	11.58
Family gathering/picnics	276	73.90	73.90
Pool/outdoor swimming	323	28.54	28.54
No main activity	295	35.52	71.03
Sail boating	153	11.79	22.37
Sightseeing/driving	294	14.04	14.04
Warm water fishing	614	10.06	20.12
Motorboating/skiing	248	33.89	33.89
River rafting/canoeing	156	126.04	252.08
Bass fishing ¹	903	32.40	
Deer hunting ¹	1068	40.29	
Wildlife watching ¹	943	29.00	

¹These values were obtained from Waddington and others using the 1991 U.S. Fish and Wildlife survey and the contingent valuation method.

(Source: Public Areas Recreation Visitor Survey, 1985-1987)

greater societal net economic value, since societal net economic value is the sum of all individuals' values. It should be noted that without adequate supply, problems of overcrowding and quality deterioration negatively affect people's recreation values.

Future Research

The values reported in this analysis are a good first attempt, with limited data. Most of the improvements we recommend are focused on improving the data because even the most sophisticated econometric model is limited by the quality of the underlying data.

Essentially, the focus should be on two items. One is to improve the value estimates. A first step would be to sample across settings as well as activities. Many settings provide more than one activity. Moreover, managers can control and alter settings to optimize net economic value. Sampling at setting and activity levels would also provide opportunities for cross validation of model results. Ideally, the sampling plan would account for variations in both place and time.

Estimates of numbers of visits also need improvement. Sampling of use is expensive, however, and it is most useful if it is done on carefully selected, representative sites. Nevertheless, it is essential information on which to base improvements in the management of public resources.

Scarcity of Settings

The amounts and types of settings appear to be adequate to meet most current demands for nature-based recreation opportunities. About 45 percent of the area is rural, nearly one-fourth is roaded natural and nearly one-tenth is remote. Settings are fully utilized in some areas and underutilized in others, suggesting that capacity could be increased to accommodate more users on both private and public land.

With 84 percent of the region's land, private owners are expected to provide at least one-third of all nature-based recreation. Private land accounts for nearly all rural settings, about two-thirds of roaded-natural appearing settings, and one-third of remote settings. Personal recreation use is one significant reason for owning land. In addition, about one-fourth of private landowners allow public access. Some nature-based activities compatible with private

landowner objectives are hunting, nature study, and hiking.

Public land provides recreation opportunities in roaded natural and remote settings. With 16 percent of the land, public holdings provide one-third of roaded-natural appearing settings and nearly two-thirds of remote settings in the region.

Public land provides key resource attributes for future generations while providing enjoyment now. Attributes highly demanded include scenic landscapes, wild rivers, high-quality trout habitat, and historic sites. Nearly one-fourth of the area in national forests is in landscapes categorized as "outstanding" or "distinctive." Most national and state parks were established because of their unique resource attributes. Those attributes also must be protected.

Scarcity of Activity Opportunities

Activity opportunities in rural settings appear to be abundant. Activities such as nature study, sightseeing, motorboating, and developed camping are supplied on both private and public land. Supplies can be increased as needed. In contrast, settings with significant cultural resources on public land such as historic sites, are overcrowded and future supplies may be tight.

Recreation opportunities in roaded-natural appearing and remote settings are abundant. Exceptions are the limited opportunities for whitewater boating, mountain biking, off-road driving, horseback riding, dispersed roadside camping, and group camping on public land. Where open roads are parallel with streams, fishing and camping capacities are usually exceeded. With fewer opportunities on public land, mountain bikers, OHV users, and horseback riders are likely to seek private sources of supply.

Crowding occurs on trails to waterfalls, campgrounds at lakes, put-ins at whitewater rivers, road corridors along key hunting grounds, and historic sites at parks.

Question 4:

How is the changing social context within the Southern Appalachians likely to affect future recreation demands on public lands?

Key Findings

In the last 20 years the social context of the Southern Appalachians has changed in several ways. Population, in-migration, average age, and numbers of retirees and minorities have increased. The economy has diversified, and the percentage of households below the poverty level has decreased. The percentage of people participating in every type of nature-based recreation has increased. These changes have caused rising demands for a wide variety of nature-based outdoor recreation opportunities. The ability of recreationists to diversify their activities has been increased by improving equipment and by training participants. Startling improvements have been made in OHVs, large recreational vehicles, jet skis, outdoor clothing and gear, and literature and materials on nature study and historical sites. Nature and the outdoors are being aggressively and successfully marketed. In addition, telecommunication from remote sites allows people greater freedom to work away from home, even in natural appearing settings. This trend will likely continue, putting increasing pressure on nature-based recreation settings and facilities.

Public land has a large share of nature-based recreation opportunities and natural scenery, but private land makes significant contributions. The National Private Land Ownership Survey (Wright and others 1988) indicates that at most 23 percent of the owners of tracts larger than 100 acres in the region allow people other than their immediate family to use their land for outdoor activities such as hunting, fishing, hiking, and trail riding. We expect urban, suburban, and transitional settings to increase at the expense of existing rural or natural-appearing settings. Without better cooperation between the public and private sectors, key natural and cultural settings on private and public land may be negatively affected by increasing density of development near "gateway" communities.

Because of these likely changes, settings, and opportunities for nature-based recreation will decline on private land. Public land will have to supply a larger share of nature-based outdoor recreation opportunities. No major increase in public holdings is anticipated, and some corridors on public land are already used to capacity. Many places near travel corridors with scenic, recreational, and cultural attri-

butes are overcrowded on peak weekends. Demands on these places will continue to grow unless the capacity of supporting facilities is increased or use is dispersed to other areas to alleviate the pressure.

In the last 10 years, over 600,000 acres of cropland and pasture have been developed into suburban settings. Privately owned roaded-natural appearing and remote settings are gradually being converted to rural-forested settings.

Large urban areas are expanding to the edges of public land in the Blue Ridge Mountain section. One result is a high density of use at the outer edges of public forests and parks. As the population centers grow, high-density use patterns will creep toward the center of the mountain ranges.

Question 5:

How do recreation opportunities affect the lifestyle and local culture of the area?

Key Findings

In general, outdoor recreation opportunities and scenery enhance a community. They give community members a strong sense of place by providing a strong connection with the outdoor environment. In many cases, economically and aesthetically compatible opportunities can be developed to offer a variety of activities while maintaining the integrity of the place. Lodges, restaurants, high-quality craft stores, and outfitters on private land can complement hiking, horseback riding, hunting, fishing, whitewater boating, motor boating, or other such opportunities on public land. A diversity of opportunities tends to keep visitors in the area longer, increasing economic benefits.

Outdoor recreation developments that serve outsiders can negatively affect the sense of place for existing residents. People moving into an area increase economic activity, but they also may increase congestion, and the development they foster may degrade landscapes. Property values may increase, but tax burdens of residents may also increase to pay for roads and utilities to support new development. Some natural and cultural attributes of an area may be lost. Some communities in the Southern Appalachians are searching for ways to

encourage economic development while maintaining desirable traditional attributes.

Southern Appalachian people have traditionally been characterized as independent and family oriented, with a strong attachment to the land. While valleys and coves were usually devoted to agricultural pursuits, the highlands were often thought of as community property for traditional uses such as hunting, fishing, and gathering of forest products. Many of these traditional uses have continued on national forests. Increased tourism, in-migration, and recreation by urban and suburban users have caused some conflicts among recreation users on public land. This trend is likely to continue.

While the social context is changing and traditional values are becoming somewhat diluted, a strong attachment to the land is still a significant value in communities near public land. Many such communities want economic diversification, but they also want to preserve the natural and cultural attributes of their communities. Nature-based outdoor recreation opportunities and scenery are key ingredients for enhancing a sense of place in the Southern Appalachians.

Relating Outdoor Recreation and Sense of Place

Rural sociologists, cultural geographers, recreation planners, landscape architects, and others are collaborating to explore the human concept of place. The objective is to learn how people relate to their environment to explain the bond of attachment people form with the land. Resource managers are interested in the concept of place to help understand the meanings that people attach to places in their administrative jurisdictions.

The perception of a place or the physical area where people interact gives that area special meaning to them, their community, or their culture. These perceptions are images and expectations of an area that are developed through personal memory, community history, landscape appearance, and emotional attachment (Ryden 1993). Movies, t.v., art, community events, recreation activities and other experiences help form images and give special meaning to places.

A place can be remembered from personal experiences or from shared experiences with other people in the community (Galliano and

Loeffler 1995). Shared community perceptions of place give rise to more focused study. Although individual perceptions are important, every place has importance to somebody. Virtually any physical place has the potential to symbolize many different things. While individuals in a community interpret a place somewhat differently, people frequently share a communal interpretation of place (Galliano and Loeffler 1995). We call this shared community perception a "sense of place."

When a community's shared sense of place can be articulated, the characteristics and attributes that have meaning can be identified. Special attention can be given to these attributes during planning for development to preserve meaningful attributes.

Therefore, the concept of place is useful to sustain economic development. Some communities are using place-based concepts to guide future development. The East Tennessee Community Design Center and the Tennessee Valley Authority are working in Pittman Center, Tennessee, to introduce a new way to have sustainable economic development while maintaining natural and cultural attributes. The process, called Future/Scapes, hinges on community participation and empowerment in deciding what to build and what to save. The underlying principles of the process should endure because they are based on a carefully constructed and shared community vision of the future. Other efforts in the Southern Appalachian region have been initiated by the Southern Appalachian Highland Conservancy and the Ocoee Valley Alliance.

A community's shared sense of place is often defined by the place's uses and by the activities that occur there. Local definitions of a place are sometimes dominated by the economic or recreational pursuits of resources nearby (Galliano and Loeffler 1995). The rural, agricultural landscapes usually suggest livelihoods, whereas natural landscapes suggest recreational pursuits, such as hunting or scenic viewing. Therefore, the concept of place can be used to identify the importance of recreation opportunities as an attribute highly valued by a community.

Research is needed to develop methods for articulating a community's sense of place. Survey techniques and visioning processes are currently being tested. Since each community would identify and interpret places differently,

it was impossible to obtain sense of place measures for the SAA. However, one can begin to grasp how a community would interpret places by using existing data.

As a first step toward assessing a community's sense of place, we suggest developing information about natural and cultural attributes, opportunities to access them, and the factors affecting their use and meaning. We also suggest that information be compiled for the community itself and for a region with a 50-mile radius around the community. Research indicates that people prefer diverse landscapes (Galliano and Loeffler 1995). The degree of contrast between places is an indicator of the uniqueness of interrelated places. For example, an urban area in a valley surrounded by mountain peaks provides an extraordinary contrast between two types of landscapes.

Kinds of information that may help in understanding the meanings that communities attach to places include natural and cultural attributes, demographic factors, and economic factors.

Natural scenery and recreation opportunities seem certain to contribute to a positive sense of place. The differences among mountains, deserts, prairies, and forests are obvious and compelling to any traveler (Hough 1990). It seems equally obvious that these kinds of things contribute to a shared sense of place in a community, but the mental and social processes are not well understood.

In the past, a community's landscape evolved slowly. Today, technology permits the changing of landscapes almost overnight. If planners, designers, and social scientists can understand the effects of the changes on people, adverse effects of development can be minimized.

Topographic relief, presence of water bodies, and acres of distinctive landscapes indicate the scenic interest and variety of an area. Historic sites indicate culturally distinctive physical elements and ties to the past. All are recommended as starting points for measuring natural and cultural attributes of a community.

Certain characteristics of the people in a community seem likely to affect their development of a shared sense of place. Factors that come to mind are durations of residence in the community, life stages of the families that are present, ethnic make-up, and degree of organization.

The way in which community members respond to a change depends heavily upon the effects of that change on the pocketbooks. Recreation on public land creates jobs in surrounding communities. The economic effects are hard to measure because visiting recreators spend much of their money on the same sorts of things that local residents buy in their everyday lives.

We attempted to estimate the numbers of jobs in counties that are directly dependent on recreation on federal land. Employment data came from the U.S. Bureau of the Census' 1992 County Business Patterns report and from lists of businesses that advertise in the Yellow Page directories. Analytical details are reported by English (1995).

In the Southern Appalachians, an estimated 30,602 jobs are directly related to recreation on federal land. Since the analysis did not include state land, this total is conservative. Nearly one-half of the counties in the study area have fewer than 100 recreation-dependent jobs, but 16 counties have over 500 such jobs, and 5 counties have over 1,000 (fig. 4.26). In general, the counties with the greatest number of jobs that depend on recreation on public land are close to the area's two national parks and to the large concentration of national forests in western North Carolina.

Recreation-dependent jobs account for just over 1.1 percent of total employment in the study area. As just indicated, however,

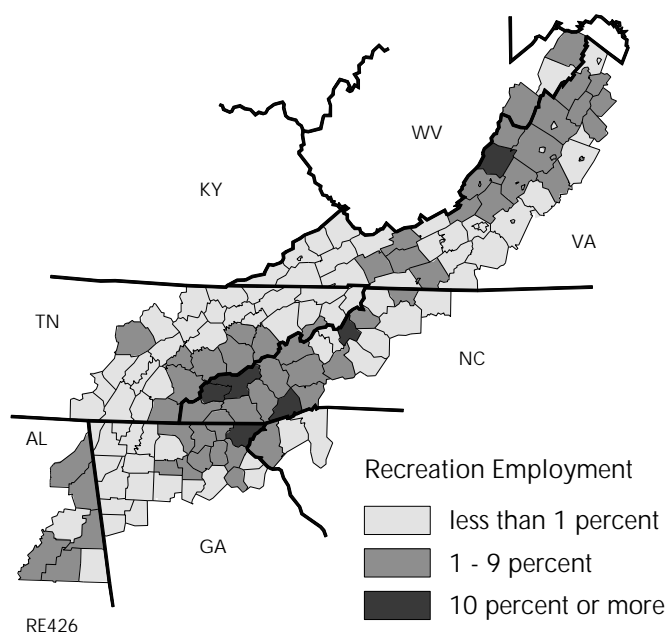


Figure 4.26 Economic contribution of federal recreation facilities

importance varies widely by county. In Rabun County, GA; Bath County, VA; and Avery, Graham, Swain, and Transylvania Counties, NC, recreation-dependent employment is more than 10 percent of total employment.

Example Indicators of Place

Table 4.19 displays some of the dramatic social differences that occur among communities in the SAA region. Metropolitan areas have distinctly different orientation to natural resources than do retirement communities and low income rural communities.

The socio-economic data displayed in table 4.19 are from the 1990 census. Over 90 percent of the population of Knoxville lives in an urban setting as opposed to 5 percent in Franklin, NC, and none in Bryson City, NC. Almost one-half of the residents of Knoxville had moved within 5 years (1985-1990). The populations of Franklin and Bryson City are significantly more stable. On the other hand, over 30 percent of the housing in Franklin is vacant, suggesting a high percentage of seasonal residences. Only 7 percent of Knoxville housing is unoccupied. Population density is almost 10

times greater in Knoxville than Franklin. The median income is \$10,000 higher in Knoxville than in Bryson City. Almost 30 percent of the jobs in Knoxville are professional. The percentage of the population that is in a minority group is four times greater in Knoxville than in Franklin. Almost 25 percent of the people in Franklin are over 65 years old as opposed to little over 10 percent in Knoxville. Not surprisingly, the percentage of families with children is significantly greater in Knoxville. The cumulative elevational change shows a very high scenic interest and variety in Bryson City, slightly less in Franklin, and even less in Knoxville.

The regional context shows Bryson City and Franklin have higher percentages of natural-appearing and remote settings than Knoxville, along with more public land. Therefore, more open land surrounds Bryson City and Franklin, and these residents have much more access to outdoor recreation opportunities. Due to a concentration of distinctive landscapes on the Cherokee National Forest, Knoxville has a slightly higher percentage than Franklin and Bryson City. Employment in Swain County (39 percent) is strongly related to proximity of federal recreation facilities.

Table 4.19 Sample indicators of place for three communities.

Characteristics	Franklin	Bryson City	Knoxville
Community Context			
Percent urban population	5	0	90.5
Mobility			
Same house since '85	68.7	66.0	53.3
Percent housing vacant	17.8	30.7	7.0
Population density (per square mile)	331.8	173.5	1095.0
Median income	\$15,000–17,500	\$20,000–22,500	\$25,000–27,500
Ethnicity (non-white)	5.4	2.6	11.4
Family structure			
Percent over 65 years	21.7	23.0	12.8
Percent families with children under 18 years	53.0	61.7	75.3
Occupation			
Percent professional	20.8	19.2	29.6
Cumulative elevation change	4,500	3,600	1,000
Regional Context			
Settings (50 mile)			
Percent rural	35.0	33.0	37.0
Percent roaded natural	26.0	29.0	16.0
Percent remote	18.0	18.0	13.0
Percent water	2.0	2.0	3.0
Percent public land (50 mile)	31.0	35.0	29.0
Percent distinctive landscapes (50 mile)	3.0	3.0	5.0
Percent of total employment (county) related to federal recreation facilities	39.0	4.0	6.0

(Source: Census Data 1990, and the Southern Appalachian Assessment database)

Roadless Areas and Designated Wilderness

Introduction

People are interested in the number, size, location, and status of roadless areas in the Southern Appalachians. This is the first step in the evaluation of potential wilderness, which is to identify and inventory all roadless, undeveloped areas that satisfy the definition of wilderness found in Section 2 (c) of the 1964 Wilderness Act (FSH 1909.12, Chpt. 7, item 7.1). Roadless areas are places that have regained or are regaining a natural, untrammeled appearance; any signs of prior human activity are disappearing or being muted by natural forces. Criteria provide for an individual roadless area to include no more than one-half mile of improved road for each 1,000 acres.

Roadless areas are thought to comprise the last remaining large tracts of natural appearing land in the region, other than wilderness. Some people want to know where roadless areas occur because of their interest in protecting natural areas from development. Others are interested in identifying future potential wilderness.

Public land is viewed as the chief provider of roadless areas in the Southern Appalachians. This assessment reports the current status of these areas on public land. In national forests, roadless areas are the tracts that are evaluated for potential wilderness designation during the forest land management planning process.

People are also interested in the current condition of wildernesses. Wilderness as defined by the 1964 Wilderness Act is a congressionally designated area of undeveloped federal land which generally appears to have been affected primarily by the forces of nature, without permanent improvements or human habitation, which possesses outstanding opportunities for solitude or a primitive and unconfined type of recreation and which is protected and managed so as to allow natural ecological processes to operate freely.

For this assessment, three major questions about roadless areas and wilderness were developed from public input:

- 1. Where are roadless areas on the national forests in relation to existing wildernesses on national forest and national park land and primitive areas on state and private land in the Southern Appalachians?**
- 2. What is the Forest Service doing to maintain or enhance the health and integrity, including scientific, educational, scenic or historic values, of roadless areas and wildernesses?**
- 3. Are major population centers and the culture, background, beliefs and values of the people affecting wilderness areas? If so, how?**

These questions were modified to clarify intent and to facilitate our analysis. For Question 1, it was not feasible to include private, county, city and other municipal land in the inventory process. For Question 2, wilderness and roadless areas were addressed separately because they have different status and management objectives. "Health" was interpreted to apply to natural processes. This interpretation is especially germane to wilderness. Area integrity is interpreted to apply to the attributes that affect identification as wilderness or roadless. For the assessment, this concept seems most applicable to roadless areas because the public is interested in how these areas are affected by USDA Forest Service management. For Question 3, data were not available to correlate wilderness use with the cul-

ture, background, beliefs and values of urban populations. However, we did examine the relationship between use of wildernesses and their proximities to population centers. A fourth question was added to examine the spatial relationships of roadless areas and wilderness to selected resources. These relationships will aid in the evaluation of roadless areas in individual forest plan revisions.

The four questions addressed in this report are:

1. **Where are roadless areas on national forests in the Southern Appalachian Assessment area? What are the spatial relationships of these roadless areas to units of the National Wilderness Preservation System and to areas with general roadless character on state and other federal land?**
2. **What is the Forest Service doing to maintain or enhance natural processes in national forest wildernesses? What is the Forest Service doing that affects the integrity of roadless areas on national forests?**
3. **Is there a relationship between the amount of use wildernesses are receiving and their proximity to major population centers?**
4. **What are the spatial relationships of wilderness and roadless areas to other assessment resources, including, but not limited to, old growth, critical habitat, tentatively suitable acres for timber management, recreation settings and use patterns, special classification areas, and land-type associations on national forests?**

This assessment primarily addresses roadless areas and wilderness on national forests in the Southern Appalachians. General information about wildernesses and areas with roadless character on other federal and state land is provided. The analysis focuses on the location of

these areas and their spatial relationships to each other and to selected resources in the study area.

Question 1:

Where are roadless areas on national forests in the Southern Appalachian Assessment area? What are the spatial relationships of these roadless areas to units of the National Wilderness Preservation System and to areas with general roadless character on state and other federal land?

The assessment primarily addresses roadless areas and wilderness on national forest lands in the Southern Appalachian Assessment (SAA) area because the status of these areas is chiefly a national forest issue. Data were taken from roadless area inventories developed by each national forest. General information about wilderness and about roadless areas on national parks are also considered. State land is included only where areas generally meet roadless criteria and state officials agreed to their inclusion.

Key Findings

Roadless areas are a limited resource in the Southern Appalachians. One hundred forty-four areas occur in national forests, national parks, and state parks throughout the region (fig. 5.1). They include 1,231,961 acres and account for about 3 percent of all land in the study area (table 5.1).

Roadless areas or portions of them are found in each state in the study area. Virginia has the most roadless areas with 66. North Carolina is second with 35 areas. Georgia and Tennessee follow with 20 areas each. Alabama and South Carolina have the fewest areas, but they also have the fewest acres among states in the study area. There are five areas in each of these states.

The majority of roadless areas occur in national forests. Only one area is in a national park. Four areas are in state parks in North Carolina, South Carolina, and Tennessee.

The largest roadless area identified is in the Great Smoky Mountains National Park. Some 464,544 acres of roadless area are found there.

Except for one roadless area that adjoins wilderness, all roadless areas in the Southern

Appalachians qualify on their own merits rather than on location. The one exception is the small roadless area in Mt. Mitchell State Park, NC. It is included on the inventory because it adjoins a larger roadless area on the Pisgah National Forest.

There are 139 roadless areas on national forests in the Southern Appalachians. They include 752,654 acres and comprise 61 percent of all roadless acres in the study area.

Sixty-three national forest roadless areas are larger than 5,000 acres. They account for 45 percent of the roadless acreage on national

forests. Forty-seven of these 63 range from 5,000 acres to 10,000 acres. Another 13 areas are between 10,000 and 20,000 acres. Three areas are larger than 20,000 acres. The largest area, Little River in Virginia, covers 27,293 acres.

Twenty-three national forest roadless areas are smaller than 5,000 acres and do not adjoin wilderness. Of these areas, 6 are smaller than 4,000 acres. The smallest area, The Friars in Virginia, includes 2,035 acres.

Fifty-five national forest roadless areas adjoin wilderness. The sizes of 53 of these are

Figure 5.1 Roadless areas in the Southern Appalachians.

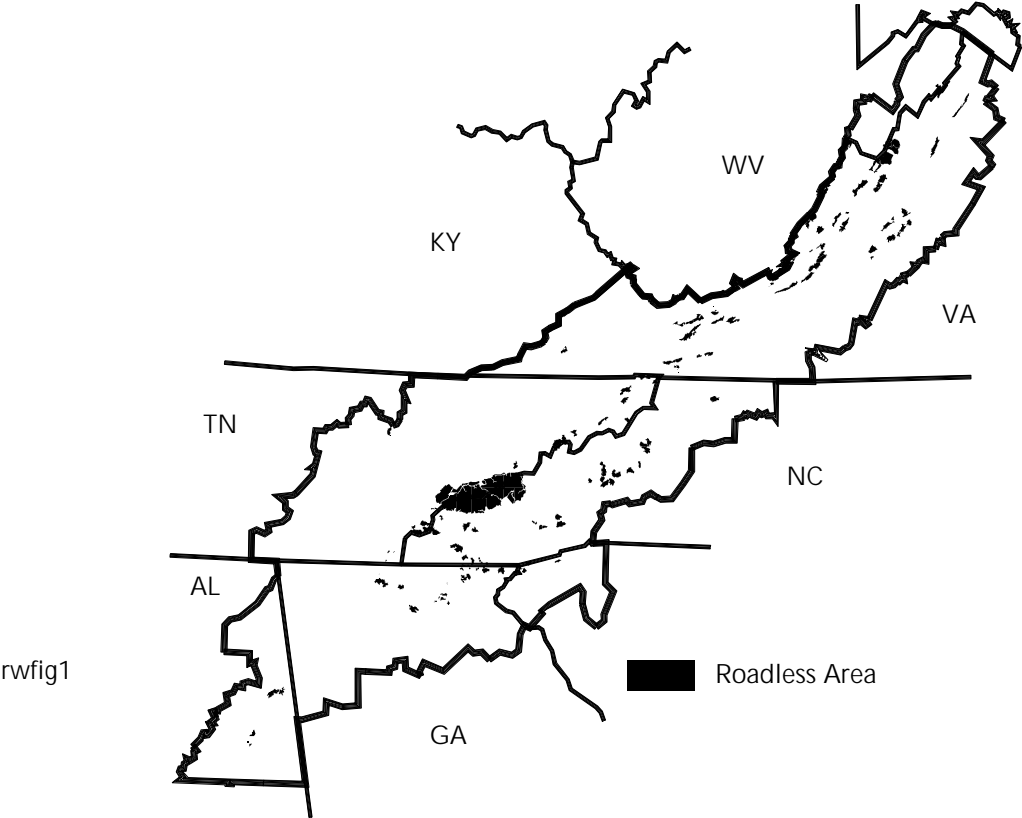


Table 5.1 Roadless areas on national forests, national parks, and state parks in the SAA area.

Managing Agency, Forest or Park, and Specific Area Name	Acres	Managing Agency, Forest or Park, and Specific Area Name	Acres
National Park Service		USDA Forest Service	
Great Smoky Mountains National Park	464,544	George Washington National Forest	
Total	464,544	Adams Peak	7,137
State of North Carolina		Beards Mountain	7,509
Mt. Mitchell State Park	630	Big Schloss	20,752
Stone Mountain State Park	7,142	Crawford Mountain	9,892
Total	7,772	Dolly Ann	7,854
State of South Carolina		Dry River	7,332
Table Rock State Park	2,191	Elliott Knob	9,379
Total	2,191	Gum Run	12,609
State of Tennessee		Hoop Hole ¹	836
Frozen Head State Park	4,800	Jerkentight	16,688
Total	4,800	Kelley Mountain	7,634
USDA Forest Service		Laurel Fork	9,966
Chattahoochee National Forest		Little Alleghany	10,214
Ben Gap (Add.)	1,291	Little River	27,293
Big Mountain ¹	2,757	Mill Mountain	10,850
Boggs Creek (Add.)	2,071	Mt. Pleasant	8,940
Cedar Mountain (Add.)	374	Northern Massanutten	9,443
Duck Branch (Add.)	195	Oak Knob	10,887
Ellicott Rock Add.	707	Oliver Mountain	13,090
Foster Branch (Add.)	176	Ramseys Draft Add.	12,780
Helton Creek (Add.)	2,414	Rough Mountain Add.	1,142
Joe Gap	5,340	Saint Marys Add.	1,453
Kelly Ridge	8,359	Skidmore	5,641
Lance Creek	9,064	Southern Massanutten	11,970
Miller Creek (Add.)	704	The Friars	2,035
Patterson Gap (Add.)	1,203	The Priest	5,742
Pink Knob	12,121	Three Ridge	4,748
Rocky Mountain	4,283	Three Sisters	8,169
Sarah's Creek	6,895	Total	261,985
Shoal Branch (Add.)	403	USDA Forest Service	
Tate Branch (Add.)	1,087	Jefferson National Forest	
Tripp Branch (Add.)	627	Audie Murphy Monument	4,957
Turner Creek (Add.)	1,486	Barbours Creek Add.	806
Total	61,557	Bear Creek	18,253
USDA Forest Service		Beartown Add. A	1,361
Cherokee National Forest		Beartown Add. B	3,131
Bald Mountain ¹	12,017	Beaver Dam Creek ¹	1,072
Bald River Gorge Add.	1,737	Broad Run	10,994
Beaver Dam Creek ¹	5,130	Brush Mountain	6,004
Big Frog Addition	365	Brushy Mountain	4,185
Big Laurel Branch Add.	5,589	Devil's Fork	4,460
Brushy Ridge	7,389	Garden Mountain	3,945
Devil's Backbone	4,283	Hickory Flats	5,182
Flint Mill Gap	9,511	Hoop Hole ¹	4,608
Joyce Kilmer-Slickrock Add.	1,425	Hunting Camp/Little Wolf Cr.	8,932
Little Frog Addition NE	335	James River Face Add.	1,284
Little Frog Addition NW	642	Kimberling Cr. Add.– A	86
London Bridge Branch ¹	3,431	Kimberling Cr. Add.–B	195
Rogers Ridge ¹	4,753	Lewis Fork Add.	722
Sampson Mountain Add.	4,524	Little Dry Run Add.	2,184
Slide Hollow ¹	4,195	Little Horse Heaven	4,989
Stone Mountain	5,373	Little Walker Mountain	9,763
Sycamore Creek	6,994	Little Wilson Cr. Add.– A	60
Upper Bald River	9,112	Little Wilson Cr. Add.– B	1,705
Total	86,805	London Bridge Branch ¹	798
		Long Spur	6,721

Table 5.1 (cont.) Roadless areas on national forests, national parks, and state parks in the SAA area.

Managing Agency, Forest or Park, and Specific Area Name	Acres	Managing Agency, Forest or Park, and Specific Area Name	Acres
Mottesheard	6,521	Bald Mountain ¹	10,971
Mountain Lake Add.–A	1,455	Balsam Cone	10,663
Mountain Lake Add.– B	4,242	Bearwallow	4,116
Mountain Lake Add.– C	495	Craggy Mountain	2,659
North Fork Pound	4,766	Dobson Knob	6,128
North Mountain	8,404	Graveyard Ridge (Add.)	1,973
Patterson Mountain	4,942	Harper Creek	7,351
Peters Mtn. Add. A	1,612	Jarrett Creek	7,500
Peters Mtn. Add. B	2,911	Laurel Mountain	5,683
Price Mountain	9,090	Linville Gorge (Add.)	2,800
Raccoon Branch	4,437	Lost Cove	5,954
Rogers Ridge ¹	181	Mackey Mountain	5,934
Seng Mountain	6,383	Middle Prong (Add.)	1,852
Shawver's Run Add.	2,058	Sam Knob (Add.)	2,583
Total	163,894	Slide Hollow ¹	200
USDA Forest Service		South Mills River	8,629
Nantahala National Forest		Wilson Creek	4,990
Barkers Creek (Add.)	976	Woods Mountain	9,606
Big Indian (Add.)	1,154	Total	99,592
Boteler Peak	4,221	USDA Forest Service	
Cheoah Bald	7,810	Sumter National Forest	
Cherry Cove (Add.)	844	Bee Cove	2,999
Chunky Gal (Add.)	3,475	Big Mountain ¹	2,332
Deep Creek/Avery Creek (Add.)	1,896	Ellicott Rock 1	300
Little Indian (Add.)	647	Ellicott Rock 2	530
Overflow	3,509	Total	6,161
Sharptop Ridge (Add.)	594	USDA Forest Service	
Snowbird	8,504	Talladega National Forest	
Tusquitee Bald	13,791	Blue Mountain	3,896
Wesser Bald	4,094	Cheaha Addition A	228
Yellowhammer Branch (Add.)	1,271	Cheaha Addition B	706
Total	52,786	Dugger Mountain	9,027
USDA Forest Service		Oakey Mountain	6,017
Pisgah National Forest		Total 19,874	
		Grand Total	1,231,961

¹Indicates an area shared by two national forests.

less than 5,000 acres, and the majority are smaller than 3,000 acres. The other two areas adjoining wilderness are large. Big Laurel Branch in Tennessee includes 5,589 acres and Ramseys Draft Addition in Virginia includes 12,780 acres.

The George Washington National Forest contains the largest amount of roadless acres at 261,985 acres or 35 percent of all roadless acres on national forest land (fig. 5.2).

There are 39 units of the National Wilderness Preservation System in the Southern Appalachians (fig. 5.3). These wildernesses account for 428,545 acres or about 1 percent of the study area (table 5.2). All occur on national

forest land except for one area in the Shenandoah National Park in Virginia.

National forest land accounts for 81 percent of existing wilderness within the Southern Appalachians. Some 347,990 acres of designated wilderness are found there.

The Chattahoochee has the largest number of wilderness acres of any national forest. It contains 114,789 acres or 33 percent of all wilderness on national forests in the Southern Appalachians (fig. 5.4).

Wilderness and roadless acres account for 16 percent of all federal land, 19 percent of all national forest land, and 4 percent of all land in the Southern Appalachians.

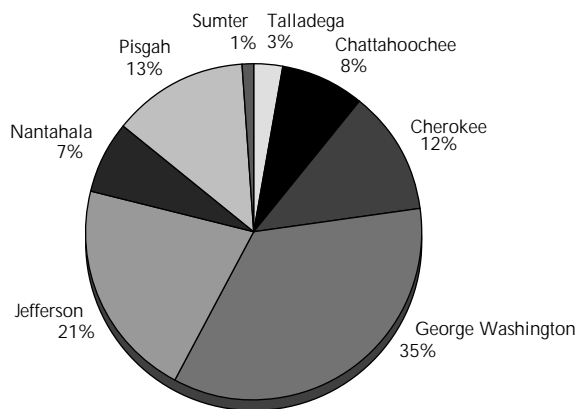


Figure 5.2 Percentage of roadless acres by national forest based on a total of 752,654 acres of forest service roadless areas.

Table 5.2 Acres of officially designated wilderness in the Southern Appalachian mountains.

Managing Agency, Forest or Park, and Specific Name	Acres	Managing Agency, Forest or Park, and Specific Name	Acres
National Park Service		USDA Forest Service	
Shenandoah National Park	80,555	Jefferson National Forest	
Total	80,555	Barbours Creek	5,378
USDA Forest Service		Beartown	5,609
Chattahoochee National Forest		James River Face	8,886
Big Frog	89	Kimberling Creek	5,542
Blood Mountain	7,800	Lewis Fork	5,618
Brasstown	12,975	Little Dry Run	2,858
Cohutta	35,268	Little Wilson Creek	3,613
Ellicott Rock	2,021	Mountain Lake	11,113
Mark Trail	16,400	Peters Mountain	3,328
Raven Cliffs	9,115	Shawvers Run	3,366
Rich Mountain	9,649	Thunder Ridge	2,344
Southern Nantahala	11,770	Total	57,655
Tray Mountain	9,702	USDA Forest Service	
Total	114,789	Nantahala National Forest	
USDA Forest Service		Ellicott Rock	3,394
Cherokee National Forest		Joyce Kilmer-Slickrock	13,562
Bald River Gorge	3,721	Southern Nantahala	11,944
Big Frog	7,993	Total	28,900
Big Laurel Branch	6,332	USDA Forest Service	
Citico Creek	16,226	Pisgah National Forest	
Cohutta	1,709	Linville Gorge	12,002
Gee Creek	2,493	Middle Prong	7,460
Joyce Kilmer-Slickrock	3,832	Shining Rock	18,483
Little Frog Mountain	4,666	Total	37,945
Pond Mountain	6,929	USDA Forest Service	
Sampson Mountain	7,992	Sumter National Forest	
Unaka Mountain	4,496	Ellicott Rock	2,859
Total	66,389	Total	2,859
USDA Forest Service		USDA Forest Service	
George Washington National Forest		Talladega National Forest	
Barbours Creek	4	Cheaha	7,245
Ramseys Draft	6,518	Total	7,245
Rich Hole	6,450	Grand Total	428,545
Rough Mountain	9,300		
Shawvers Run	101		
St. Marys	9,835		
Total	32,208		

Data Sources and Methodology

The process and criteria for identifying roadless areas on national forests is in Forest Service Handbook [(FSH) 1909.12 – Land and Resource Management Planning Handbook, Chapter 7, Items 7.1 – 7.14 USDA Forest Service]. Additional guidelines were developed by the team and the Southern Regional Office of the National Forest System to facilitate consistent application of the process. This process also was used for identifying roadless areas on state and national park land.

Processes used to identify roadless areas in each individual national forest in the assessment area are in the CD-ROM set of the SAA. Other federal and state tracts were first reviewed using 1:150,000 scale maps, general management plans and accompanying maps, state outdoor guides, and county atlases (Alabama Department of Conservation and Natural Resources 1994, 1995; DeLorme Mapping 1989, 1992, 1993; Georgia Department of Natural Resources 1984, 1986,

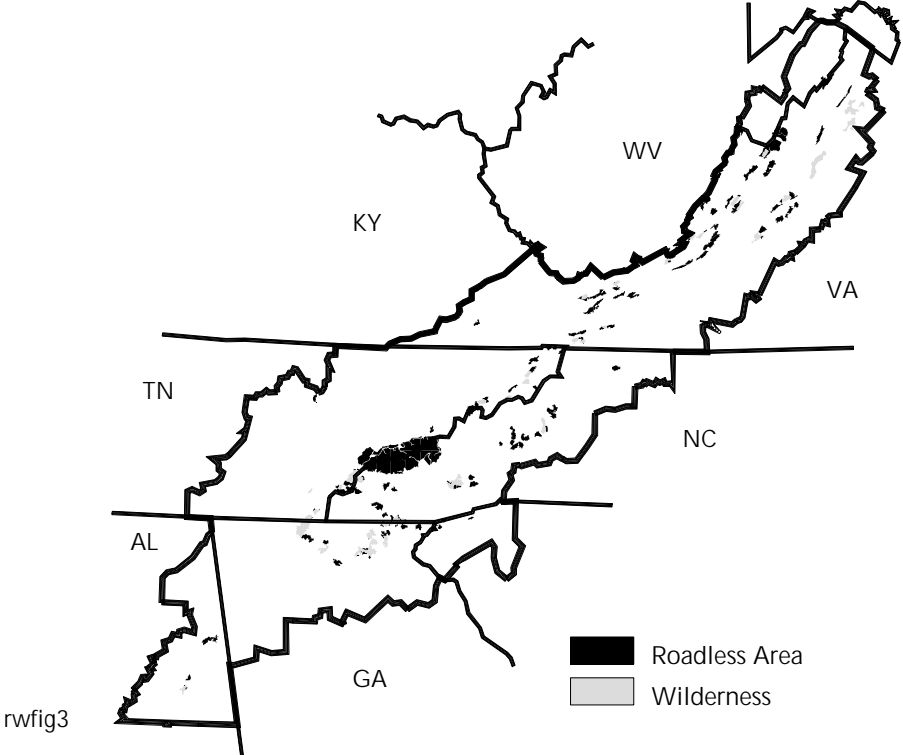


Figure 5.3 Roadless areas and wilderness in the SAA.

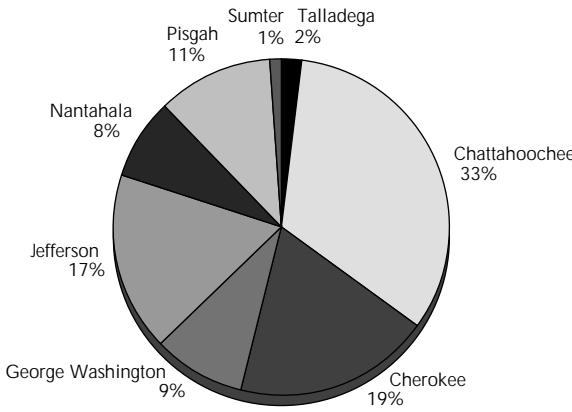


Figure 5.4 Percentage of wilderness acres by national forest based on a total of 347,990 acres of wilderness in national forests.

1994; North Carolina Wildlife Resources Commission 1989; South Carolina Department of Natural Resources 1994; South Carolina State Parks 1994; Tennessee State Parks 1993; Tennessee Wildlife Resource Agency 1994; USDI National Park Service 1982). State areas that initially qualified from this review were then studied in greater detail. Detailed reviews involved site-specific area maps, discussions with state officials, and, in some cases, on-site visits. Areas meeting the roadless criteria were then placed on the inventory. Federal areas other than those on national forests were reviewed by a similar procedure. Roadless areas were digitized at a 1:24,000 scale for mapping and calculation of acreages.

Existing wilderness was identified from Forest Service and National Park Service data. Maps were digitized at the 1:2,000,000 and 1:24,000 scales to show their locations. National forest wilderness acres were determined from legal descriptions or data maintained by the Southern Regional Office of the National Forest System. National park wilderness were digitized from maps of the Shenandoah National Park (Potomac Appalachian Trail Club 1992, 1994a,b).

Likely Future Trends

National forest roadless areas will be evaluated and considered for recommendation as potential wilderness as forest plans are revised. Since this evaluation involves the public and Congress, the results are uncertain at this point. However, the roadless area inventory can be expected to change as a result of this process. Roadless area acres may increase or decrease. Some areas will be allocated to management that will maintain their roadless character. Others will be allocated to multiple-use management. It seems likely that additional wilderness will be recommended from land now in the roadless area inventory.

Question 2A:

What is the Forest Service doing to maintain or enhance natural processes in national forest wildernesses?

Management objectives for the National Wilderness Preservation System are drawn from the 1964 Wilderness Act. One of these

objectives is to allow natural processes to operate freely within wilderness. Natural processes are synonymous with ecological processes. An ecosystem consists of a community of interacting populations and the physical environment they occupy (USDA Forest Service 1995b). An ecosystem may be a rotting log, an entire planet, or any level in between. In the case of a designated wilderness, its legally defined boundary is also considered the ecosystem boundary for purposes of management.

To understand ecological systems, it is useful to recognize their three major components: structures, functions, and the interactions among them. Structures are the physical, tangible elements of the systems – the things we can touch, see and feel. They can be living (biotic) or nonliving (abiotic); mobile or stationary. Biotic parts include plants, animals, microorganisms and humans. Abiotic parts include geology, climate, mineral soil and topography. Functions are the activities, roles or processes performed by structures. They can be classified in many ways, but the following five types are generally recognized:

Capture (input) – The bringing of resources (organisms, materials and energy) into the system. Examples are photosynthesis and migration of an organism into seasonal range.

Production – The “manufacture” of resources within the system. Examples are plant growth, animal reproduction, and snags becoming downed wood.

Cycling – The transport of resources within the system. Examples are animal migration within a system, nutrient cycling, and snow melting and becoming surface or groundwater flow.

Storage – The conservation of resources within the system. Examples are sediments retained in wetland, and carbon and other nutrient storage in down wood.

Output – The movement of resources out of the system. Examples are animals migrating out of their seasonal range, movement of the products of erosion, and the movement of products by people (Diaz and Apostol 1992).

The interactions among the structures and functions make a system dynamic. Functions may be interdependent. For example, capture

and cycling must occur for production to be sustained. Structures and functions also depend on each other, and ecological systems interact because no system is completely isolated.

Whether we recognize them or not, changes take place constantly in ecosystems. Physical, biological, and cultural/social processes are constantly at work, altering structures and functions (USDA Forest Service 1995c). A resilient ecosystem is one that can maintain its structures and functions in the face of change or disturbance (Diaz and Apostol 1992). In wilderness, the objective is to allow natural processes and events to dictate change or disturbance and to manage change from human activities within defined limits.

Key Findings

For the Forest Service to maintain or enhance natural processes in wilderness, the processes and their components must first be identified. Most efforts to date have involved inventorying and monitoring.

Many research and administrative activities are occurring or have occurred in 29 national forest wildernesses in the Southern Appalachians. Wilderness management activities are aimed at maintaining natural processes. Examples of these activities include campsite naturalization, wilderness education, trail maintenance and rehabilitation, removal of human-made structures, campfire bans, restrictions on type of use and limits on recreation use.

The following list consists of two sections: (1) research and (2) administrative activities, studies and monitoring that are ongoing or have taken place in national forest wildernesses in the Southern Appalachians. Each section is organized by wilderness.

Research

Big Frog (TN, GA)

Flora study by the University of Tennessee in 1977.

Cohutta (GA)

A 1994 conceptual and empirical analysis of visitors' relationship to wilderness by Williams of Virginia Tech. The purpose is to increase understanding of the attachment of visitors' experience for the wilderness resource.

A 1994 study measuring solitude achievement and examining trends in wilderness visitor characteristics by Watson of the USDA Forest Service and Hollenhorst of West Virginia University. Development and test of specific measures of solitude achievement, relating this achievement to potential indicators and examining trends in visitor reports about the importance of solitude and the ability to achieve it.

A 1994 study of wilderness recreation use estimation methods by Watson, Cole, and Turner of the USDA Forest Service. Development of a handbook on methods of describing wilderness recreation visit and visitor characteristics. Literature review and pilot testing of methods at Cohutta (GA), Lewis Fork, and Little Wilson Creek wildernesses (VA).

A 1994 study of wilderness visitor experiences by Hammitt and Shafer of Clemson University. Study of wilderness users on what influences the quality of visitor experiences, operationalizing privacy, primitiveness, and unconfinement.

Citico Creek (TN)

Flora of Citico Creek by the University of Tennessee in 1977.

Ellicott Rock (NC, SC, GA)

Scientific studies of vegetation in old-growth Appalachian forests by Bruce, Highlands Biological Station, University of North Carolina in 1989. Permanent plots were established and a scientific database was developed on vegetation for long-term assessment of environmental change. Information was gathered on plant diversity and biography in the Southern Appalachians and plant and animal populations were studied.

Threats to wilderness at the watershed scale are being studied by Wentworth, North Carolina State University. Purposes are to develop and test interactive computer software that provides visualization and descriptive statistics for drainage basins in wilderness.

Gee Creek (TN)

Vascular flora study by the University of Tennessee in 1992.

James River Face (VA)

A continuing study of trout stream sensitivity by the Virginia Department of Game and Inland Fisheries and the University of Virginia.

Since 1987 stream water chemistry, acid deposition, and fish and aquatic insect populations have been monitored.

Joyce Kilmer-Slickrock (NC, TN)

A comparison of the structure and composition of old-growth forests and younger managed stands by Lear and Kapeluck, Clemson University in 1992. Purposes are to determine the differences in biomass distribution, species composition, and nutrient retention in these ecosystems.

A study by Hedman to characterize riparian zones and to quantify woody debris loadings in Southern Appalachian old-growth forests.

Carbon cycling study by Vose of the USDA Forest Service, Coweeta Hydrologic Laboratory in 1995. CO₂ evolution in soil and CO₂ production in downed woody material are being studied.

A 1989 study of community patterns and mechanisms of biodiversity in old-growth and second-growth forest understory herbaceous plants by Duffy, University of Georgia. Community structure and processes of understory herbaceous plants were compared in second-growth forests and in surviving old-growth forests in the southeastern United States.

A 1988 study of forest canopy gap formation by Barden, University of North Carolina. Forest canopy gap formation and closure were measured in the hemlock/hardwood/rhododendron forest along Little Santeetlah Creek.

A 1993 study of long-term effects of disturbance on forest soil quality in the Southern Appalachians by Daniels, Virginia Tech. Purposes are to describe the morphological and physical properties of a virgin forest system and to determine the degree of change caused by disturbance history to similar soils in adjacent watersheds.

A 1992-1995 study of neotropical migratory birds by Franzreb, USDA Forest Service, Clemson. Responses of neotropical migratory birds to timber harvesting were measured in cove hardwoods forests of the Southern Appalachians. A wilderness plot in an 80+ year-old undisturbed area is the control.

A 1993 attempt to reconstruct past climatic conditions by Stahle, University of Arkansas. Tree-ring chronologies were developed from chestnut stumps in undisturbed forests to reconstruct past climatic conditions.

A 1989 study of hemlock genetic diversity

by the University of Minnesota.

Lewis Fork (VA)

Geological sampling by Sinha, Virginia Tech. Samples were taken in 1991-1992.

A 1993 salamander study by Wise, University of Southwestern Louisiana.

An ongoing study of spruce/fir mortality by Zedaker, Virginia Tech.

An ongoing study of spruce/fir mortality study by Hollingsworth, North Carolina State University.

An ongoing study of spruce/fir mortality study by McLaughlin, U.S. Department of Energy, Oak Ridge National Laboratory.

An ongoing study of trout stream sensitivity, by the Virginia Department of Game and Inland Fisheries and the University of Virginia. Stream water chemistry, acid deposition, and fish and aquatic insect populations have been monitored since 1987.

A 1994 study of wilderness recreation use estimation methods by Watson, Cole, and Turner of the USDA Forest Service. Development of a handbook on methods of describing wilderness recreation visit and visitor characteristics. Literature review and pilot testing of methods at Cohutta (GA), Lewis Fork, and Little Wilson Creek wildernesses (VA).

Linville Gorge (NC)

A 1994 study measuring solitude achievement and examining trends in wilderness visitor characteristics by Watson of the USDA Forest Service and Hollenhorst of West Virginia University. Development and test of specific measures of solitude achievement, relating this achievement to potential indicators and examining trends in visitor reports about the importance of solitude and the ability to achieve it.

Little Wilson Creek (VA)

A 1994 study of wilderness recreation use estimation methods by Watson, Cole, and Turner of the USDA Forest Service. Development of a handbook on methods of describing wilderness recreation visit and visitor characteristics. Literature review and pilot testing of methods at Cohutta (GA), Lewis Fork, and Little Wilson Creek wildernesses (VA).

Sampson Mountain (TN)

A 1993 survey of rare flora and application of a regional natural community classification

key, by the Tennessee Nature Conservancy.

Shining Rock (NC)

A 1984 study of black bear movements within and outside the wilderness by North Carolina State University.

A 1994 study of trends in wilderness visitor characteristics by Cole and Watson of the USDA Forest Service and Roggenbuck of Virginia Tech. A study to determine trends in visitor behavior, visitor characteristics, preferences, and support for management practices.

St. Mary's (VA)

An ongoing study of trout stream sensitivity study, by the Virginia Department of Game and Inland Fisheries and the University of Virginia. Stream water chemistry, acid deposition, and fish and aquatic insect populations have been monitored in the St. Mary's River since 1987.

Unaka (TN)

A 1993 salamander study by the University of Tennessee.

Administrative Activities, Studies and Monitoring

Barbours Creek (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Beartown (VA)

Ongoing monitoring of the northern flying squirrel by the USDA Forest Service and the U.S. Fish and Wildlife Service. Started in 1982.

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Big Frog (TN, GA)

Ongoing monitoring of temperature, pH, turbidity and fecal coliform bacteria in Rough Creek and Big Creek by the USDA Forest Service.

Blood Mountain (GA)

Visitor study by the USDA Forest Service completed in 1994.

Cheaha (AL)

Ongoing monitoring of ozone by the University of Alabama. Started in 1994.

Vegetative inventory by Alabama A&M University under challenge-cost agreement.

Citico Creek (TN)

Ongoing monitoring of temperature, pH, turbidity and fecal coliform bacteria monitoring in Crowder Branch, Mills Branch, Eagle Creek, and Grassy Branch by the USDA Forest Service.

Cohutta (GA, TN)

Ongoing gypsy moth monitoring by the USDA Forest Service.

Ongoing fish surveys by the USDA Forest Service.

Ongoing ozone monitoring by the USDA Forest Service.

Ongoing stream water quality monitoring by the USDA Forest Service.

Ellicott Rock (NC, GA, SC)

Monitoring of black bear populations using bait transects by the USDA Forest Service.

Visitor use study completed in 1994 by Clemson University under a cost-share agreement.

James River Face (VA)

Ecological classification based on geology, geomorphology, soils, and vegetative information. Ongoing study by the USDA Forest Service and Rowinski of the Natural Heritage Program.

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Ongoing monitoring and assessment of ozone injury to vegetation by the USDA Forest Service. Started in 1992.

From 1985 to 1995 visibility has been monitored using 35mm camera photographs by the USDA Forest Service and the University of California at Davis.

Joyce Kilmer-Slickrock (NC, TN)

A USDA Forest Service investigation of prior disturbances, both natural and human caused, to better understand current conditions.

A USDA Forest Service inventory of old-growth attributes to help develop a definition of old growth for the National Forests in North Carolina.

Order II soil surveys (inventory and mapping of major soil types).

Ozone bio-indicator surveys in 1992-1994 by the USDA Forest Service, Forest Health

Management. A pilot project to document percentage and degree of ozone damage to individual plant species in test plots.

Photographic monitoring of atmospheric conditions affecting visibility by the USDA Forest Service in 1988-1992.

USDA Forest Service study to identify the attributes of old growth mixed mesophytic forests in the southeastern United States.

USDA Forest Service survey in 1992-1994 of aquatic ecosystems, including fisheries and macroinvertebrates, to determine current conditions.

Vegetation classification. Inventories to describe all vascular plant communities. 1995.

Water chemistry survey to define current conditions. 1992-94.

Lewis Fork (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Ongoing monitoring of lichens by the USDA Forest Service. Purposes are to obtain baseline data and inventory populations.

Ongoing monitoring of macroinvertebrates by the USDA Forest Service.

Ongoing monitoring and assessment of ozone injury to vegetation by the USDA Forest Service.

Ongoing inventory and monitoring of salamanders by Organ of Virginia Tech since 1958.

Ongoing monitoring of streamwater quality by James Madison University since 1994.

Wilderness visitor use study completed in 1994 by Virginia Tech.

Linville Gorge (NC)

Ongoing *Hudsonia montana* recovery program by the USDA Forest Service, the USDI Fish and Wildlife Service, and the North Carolina Department of Agriculture. A 10-year program to recover and perpetuate federally listed threatened plant species.

Order II soil surveys (inventory and mapping of major soil types) by the USDA Forest Service.

Ozone bio-indicator surveys in 1992-1994 by the USDA Forest Service, Forest Health Management. A pilot project to document percentage and degree of damage to individual plant species in test plots.

Ongoing peregrine falcon restoration program by the USDA Forest Service, the USDI

Fish and Wildlife Service, and the North Carolina Wildlife Resources Commission. A project to reintroduce a resident population of peregrine falcons, a federally listed species.

Photographic monitoring by the USDA Forest Service of atmospheric conditions affecting visibility in 1988-1992 to determine if there was a visibility problem.

Research in 1990 by the USDA Forest Service and the USDI Fish and Wildlife Service to provide base data for the *Hudsonia montana* Recovery Program. Fire history of wilderness and test plots for treatment methods (fire, clipping, etc).

Little Frog (TN)

Ongoing monitoring of temperature, pH, turbidity and fecal coliform bacteria in Rock Creek by the USDA Forest Service.

Little Dry Run (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Little Wilson Creek (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Ongoing monitoring since 1982 of northern flying squirrel boxes by the USDA Forest Service and the USDI Fish and Wildlife Service.

Ongoing monitoring since 1994 of stream water quality monitoring by James Madison University.

Wilderness visitor use study completed in 1994 by Virginia Tech.

Kimberling Creek (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Middle Prong (NC)

A 1991 study of balsam wooly adelgid populations and damage to Fraser fir by the USDA Forest Service, Southern Forest Experiment Station.

Inventory, monitoring, and ongoing rehabilitation of wilderness campsites by the USDA Forest Service.

Mountain Lake (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Peters Mountain (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Ramseys Draft (VA)

Campsite inventory completed by James Madison University in 1993 under a cost-share agreement.

Ongoing monitoring of gypsy moth by the USDA Forest Service.

Ongoing study of woody debris and macroinvertebrate study by the USDA Forest Service, Southern Forest Experiment Station, and by Virginia Tech. Visitor use survey completed by James Madison University in 1992 under a cost-share agreement.

Rich Hole (VA)

Campsite inventory completed by James Madison University in 1993 under a cost-share agreement.

St. Mary's (VA)

Campsite inventory completed by James Madison University in 1993 under a cost-share agreement.

Ongoing monitoring of gypsy moth by the USDA Forest Service.

Ongoing monitoring and assessment of ozone injury to vegetation since 1992 by the USDA Forest Service.

Ongoing monitoring of the trout population in St. Mary's River by the USDA Forest Service and the Virginia Department of Game and Inland Fisheries. Visitor use survey completed by James Madison University in 1992 under a cost-share agreement.

Shining Rock (NC)

An ongoing investigation of prior disturbances, both natural and human caused, to better understand current conditions.

Ongoing visibility monitoring by the USDA Forest Service to determine what is causing visibility problems detected by previous photographic monitoring.

Order II soil surveys by the USDA Forest Service (to inventory and map major soil types).

Ozone bio-indicator surveys in 1989-1994 by the USDA Forest Service, Forest Health Management. A pilot project to document percentage and degree of ozone damage to individual plant species in test plots.

Ongoing ozone monitoring since 1994 of ozone levels by the USDA Forest Service in cooperation with local air pollution control agencies.

Photographic monitoring by the USDA Forest Service in 1988-1992 of atmospheric conditions affecting visibility to determine if there was a visibility problem.

Prototype study to determine public preferences for visibility.

Survey in 1992-1994 by the USDA Forest Service of aquatic ecosystems, including fisheries and macroinvertebrates, to determine current conditions.

Water chemistry survey to define current conditions. 1992-94.

Inventory, monitoring, and ongoing rehabilitation of wilderness campsites by the USDA Forest Service.

Southern Nantahala (NC, GA)

Ongoing monitoring of 1992 campsite rehabilitation.

Ongoing monitoring of visitor use by the USDA Forest Service and local ATC clubs.

Peregrine Falcon Restoration Program by the USDA Forest Service, the USDI Fish and Wildlife Service, and the North Carolina Wildlife Resources Commission. A project to reintroduce a resident population of peregrine falcons, a federally listed species.

Shawvers Run (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Thunder Ridge (VA)

Inventory and monitoring of wilderness campsite conditions in 1994 by Virginia Tech under a cost-share agreement.

Data Sources and Methodology

Information about research projects and administrative activities was obtained from Forest Service annual wilderness reports from 1993 to 1994 for the national forests in the

assessment area. Complete information on some of the research projects and studies is not available.

Likely Future Trends

Funding for research activities is limited at the present time, but the amount of research in designated wilderness is expected to continue. These areas can serve as ecological benchmarks for assessing human-induced impacts in more developed settings. They can be baselines for global monitoring studies and living laboratories to see how natural systems interact and evolve.

Question 2B:

What is the Forest Service doing that affects the integrity of roadless areas on national forests?

People are concerned about how national forest roadless areas are managed before their wilderness potential can be determined. The issue is that management actions could change the character of an area so that it is no longer suitable for wilderness consideration.

Key Findings

Resource management activities could affect the character of a roadless area. An area's inclusion on the Forest Service roadless area inventory does not preclude management activities from taking place there. Roadless areas are managed according to their allocation in the forest land management plans. Some areas currently are managed to maintain their undeveloped character while others are available for resource utilization. Management activities that could change the conditions in a roadless area so that all or portions of it no longer meet roadless criteria include:

- Timber harvesting, if more than 20 percent of the area is in acres less than 10 years old.
- Road construction or reconstruction, if the resulting density of improved roads exceeds 0.5 mile per 1,000 acres.
- Planting non-native vegetation on more than 15 percent of the area.
- Constructing pipelines, transmission lines

or utility corridors with cleared rights-of-way.

- Mining.
- Prospecting with mechanical earth-moving equipment.
- Building major recreation developments (campgrounds, visitor centers, etc).
- Changing recreation activities from non-motorized to motorized.
- Constructing buildings or other structures.
- Building high-standard surfaced trails.

When a proposed site-specific action is located in an identified roadless area, Forest Service policy, in compliance with the National Environmental Policy Act (NEPA), requires that the effects of that action be evaluated to determine whether it significantly affects the roadless character of the area. The responsible official determines the appropriate level of analysis and NEPA documentation. This decision is based on the potential effects of the proposed action on the area's unique characteristics and its suitability for future uses. The responsible official also decides whether to proceed with a proposed action that would affect the roadless character of the area. Project analysis is conducted with full public participation, including the opportunity to have a procedural review.

Data Sources and Methodology

Forest Service Handbook 1902.12, Chapter 7 was consulted to determine resource management activities that can affect roadless character.

The following documents were consulted to determine policy and direction for managing roadless areas:

- The National Environmental Policy Act (NEPA).
- The preamble to updated Forest Service Handbook 1909.15 published in the Federal Register, September 18, 1992, p.43182.
- The February 3, 1989, 1950/1920 letter from the Chief of the Forest Service about NEPA and project decisions.
- The June 3, 1993, 1950/2310 letter from the Regional Forester that outlines current direction for complying with NEPA requirements when considering projects

within roadless areas.

- The September 15, 1994, letter from the Region 8 Director of Planning and Budget about NEPA requirements in roadless areas.
- The October 21, 1994, 1920/2320 letter from the Region 8 Director of Planning and Budget about NEPA disclosure in roadless areas.

Likely Future Trends

Forest plans will continue to determine the activities that may occur within each roadless area. The management status of individual roadless areas may change as forest plans are revised. Some areas will remain in an undeveloped condition and others will be available for resource utilization. The current policy for evaluating and disclosing the effects of management activities described above will continue to be implemented.

Question 3:

Is there a relationship between the amount of use wildernesses are receiving and their proximity to major population centers?

Some wildernesses in the Southern Appalachians are close to large metropolitan areas. As population increases and urban areas expand, there is a concern that the wilderness resource will be adversely affected.

Key Findings

Proximity to a major city does not appear to explain the amount of use a wilderness receives (fig. 5.5). For example, 75-mile radii drawn around all of the metropolitan areas incorporate 78 percent of the wildernesses in the assessment area, but exclude four high-use areas. In addition, the high-use Cohutta Wilderness is outside the 50-mile radius of Atlanta, GA, where studies indicate the majority of use originates, but it is within the 50-mile radius of Chattanooga, TN, where little use originates. Also, the Cohutta is contiguous to the Big Frog Wilderness, which receives low use that originates from the local area (Carlisle 1992).

Large metropolitan areas are obvious sources of visitors to wilderness. However, there is no definitive evidence that a wilderness' proximity to a large metropolitan area is the sole factor or even a major factor influencing the amount of use it receives. Most likely, a combination of factors account for an area's

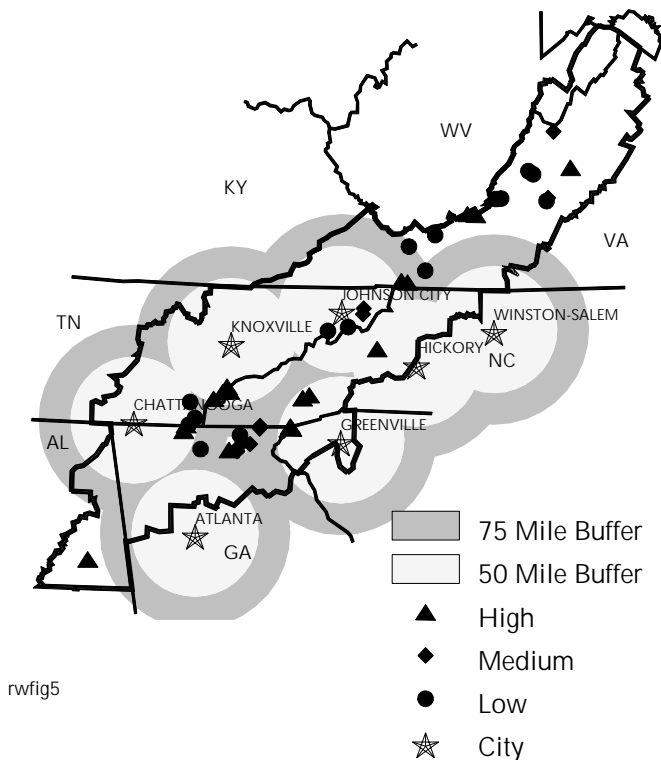


Figure 5.5 Proximity of large metropolitan areas and use levels within wilderness.

level of use. For example, use data seem to indicate that most of the wildernesses that were designated first, including Linville Gorge and Shining Rock (1964) and Joyce Kilmer-Slickrock, Ellicott Rock and Cohutta (1975), attract relatively high levels of use. High use there may be attributable to wide public knowledge. James River Face and Gee Creek are exceptions to this hypothesis. At Gee Creek, prohibitions on campfires and overnight stays limit visitor use. In some cases, scenic features or special destinations may draw users to an area. Examples of such attractions are the huge white quartz boulders in Shining Rock Wilderness or the summit of Blood Mountain in the Blood Mountain Wilderness. Often, streams are the key attraction. The heavily used Cohutta Wilderness has numerous streams and two major rivers, while the adjacent Big Frog has less water and is lightly used.

The amount of publicity a wilderness receives through the media and commercial publications may also play a key role in the area's level of use. Proximity to small cities such as Asheville, NC, and Roanoke, VA, may also influence use. Finally, the location of a wilderness within a larger, well-known unit of a national forest or park may be a primary factor in determining the level of use: Heavily used Lewis Fork and Little Wilson Creek Wildernesses are both in the popular Mount Rogers National Recreation Area.

Studies are needed to determine what factors draw users to individual wildernesses.

Data Sources and Methodology

Potential use pressure on each wilderness from nearby large metropolitan areas was analyzed by placing radii of 50 and 75 miles around each city that is near the study area. These radii represent driving times of less than a 1/2 day. Then each wilderness within a radius was reviewed for its level of use.

Large metropolitan areas were defined and identified from cities and towns in the Southern Appalachian Assessment area using census data (USDC Bureau of the Census 1994). Large metropolitan areas meeting the criteria are Atlanta, GA; Greenville, SC; Hickory and Winston-Salem, NC; and Johnson City, Knoxville, and Chattanooga, TN. Large metropolitan areas outside the study area were ignored even though they have the potential to

affect wilderness use there.

Wilderness use was categorized as low, medium, or high based on current use data and a visual comparison of these data for obvious breaking points between use levels.

Visitor use data for national forest wildernesses were obtained from annual reports prepared for each area. The Shenandoah National Park does not differentiate between wilderness and nonwilderness use. Park data, therefore, were not suitable for this analysis. Wilderness use data by area and category are displayed in table 5.3.

Likely Future Trends

Wilderness use will continue to be influenced by a combination of factors unique to each area. Proximity to large metropolitan areas may be one of these factors for certain wildernesses. Research will continue to explore the issue of wilderness use.

Question 4:

What are the spatial relationships of wilderness and roadless areas to other assessment resources, including, but not limited to, old growth, critical habitat, tentatively suitable acres for timber management, recreation settings and use patterns, special classification areas, and land-type associations on national forests?

The locations of selected resources with respect to roadless areas and wildernesses provide useful information for forest planning. These data may be used to evaluate individual roadless areas, guide roadless area allocations, and revise wilderness management direction. They also may help to provide a regional context for planning.

In this assessment, Question 4 is only partially addressed because some resource information was not available. This analysis includes the following resources: ecosystem sections and subsections; federally listed threatened and endangered species; possible old growth; potential suitable black bear habitat; recreation settings; and congressionally designated areas.

Refer to the terrestrial team report for definitions and discussions of ecosystem

Table 5.3 Annual recreation use of national forest wilderness in the Southern Appalachians.

Intensity of Use	Name of Area	Forest	1993 Recreation Visitor-Day
High Use	Cohutta	Chattahoochee	74,000
		Cherokee	850
	Subtotal		74,850
	Joyce Kilmer–Slickrock	Nantahala	22,500
		Cherokee	7,240
	Subtotal		29,740
	Lewis Fork	Jefferson	25,350
	Shining Rock	Pisgah	19,187
	Citico Creek	Cherokee	17,210
	Mountain Lake	Jefferson	15,600
	Cheaha	Talladega	14,600
	Middle Prong	Pisgah	13,558
	Little Wilson Creek	Jefferson	11,700
	Ellicott Rock	Sumter	10,150
		Chattahoochee	600
		Nantahala	500
	Subtotal		11,250
	Linville Gorge	Pisgah	10,700
	Peters Mountain	Jefferson	9,200
	Saint Mary's	George Washington	9,000
Bald River Gorge	Cherokee	8,650	
Blood Mountain	Chattahoochee	8,620	
Medium Use	Tray Mountain	Chattahoochee	5,700
	James River Face	Jefferson	4,466
	Ramseys Draft	George Washington	4,400
	Big Laurel Branch	Cherokee	4,400
	Mark Trail	Chattahoochee	4,400
	Southern Nantahala	Nantahala	2,374
		Chattahoochee	1,500
	Subtotal		3,874
	Raven Cliffs	Chattahoochee	3,280
	Pond Mountain	Cherokee	3,000
Low use	Barbours Creek	Jefferson	2,650
		George Washington	0
	Subtotal		2,650
	Big Frog	Cherokee	2,570
		Chattahoochee	0
	Subtotal		2,570
	Brasstown	Chattahoochee	2,500
	Rich Mountain	Chattahoochee	2,500
	Little Dry Run	Jefferson	1,950
	Beartown	Jefferson	1,540
	Shawvers Run	Jefferson	1,350
		George Washington	0
	Subtotal		1,350
	Thunder Ridge	Jefferson	1,334
	Kimberling Creek	Jefferson	1,320
	Unaka Mountain	Cherokee	600
	Rough Mountain	George Washington	600
Rich Hole	George Washington	500	
Sampson Mountain	Cherokee	400	
Little Frog Mt.	Cherokee	380	
Gee Creek	Cherokee	300	

Table 5.4 Ecosystem section occurrence in wilderness and roadless areas in the Southern Appalachians.

Ecological Province	Ecosystem Section	Section Occurrence	
		Wilderness	Roadless
(number of areas)			
Eastern Broadleaf Forest	Northern Cumberland Plateau	–	1
	Southern Cumberland Mountains	–	2
	Central Ridge and Valley	–	–
Central Appalachian Broadleaf Forest-Meadow		–	–
	Northern Ridge and Valley	12	52
	Allegheny Mountain	–	3
	Blue Ridge Mountain	29	90
Southern Mixed Forest	Northern Cumberland Mountains	–	–
	Southern Appalachian Piedmont	3	3
	Southern Cumberland Plateau	–	–
	Southern Ridge and Valley	1	5

classifications, federally listed threatened and endangered species, old growth, and black bear habitat. Refer to the recreation section of this report for definitions and discussions of recreation settings.

Key Findings

Ecosystem Classifications

The assessment area is comprised of 10 ecosystem sections in 3 provinces. Of the 10 sections, 7 are represented in wildernesses, roadless areas, or both (table 5.4). Individual roadless areas and wilderness ecosystem section tables are in the CD-ROM set of the SAA.

Six roadless areas contain a total of three ecosystem sections that do not occur in Southern Appalachian wilderness (table 5.5).

All of these areas are in Virginia except Frozen Head, which is in Tennessee.

Sixteen of thirty-five ecosystem subsections are present in at least one wilderness or roadless area (table 5.6). Individual roadless areas and wilderness subsection tables are in the CD-ROM set of the SAA.

Eleven ecosystem subsections occur in roadless areas but not in wilderness in the study area (table 5.7). Six of these roadless areas are on the George Washington and Jefferson National Forests in Virginia.

Federally Listed Threatened and Endangered Species

Nineteen federally listed threatened and endangered species are known now to occur or to have occurred in 16 roadless areas on national forests, national parks, and state

Table 5.5 Ecosystem sections that occur in roadless areas but not in wilderness in the Southern Appalachians.

Section Name	Roadless Area
Northern Cumberland Plateau	Frozen Head
	Devils Fork
Southern Cumberland Mountains	North Fork Pound
	Laurel Fork
Allegheny Mountain	Little Allegheny
	Oliver Mountain

Table 5.6 Occurrences of ecosystem subsections in wilderness and roadless areas.

Section and Subsection Names	Subsection Occurrence	
	Wilderness	Roadless
	(number of areas)	
Northern Cumberland Plateau Section		
Southwestern Escarpment	–	–
Sequatchie Valley North	–	–
Low Hills Belt	–	1
Southern Cumberland Mountain Section		
Cleveland	–	2
Central Ridge and Valley Section		
Rolling Limestone Hills	–	–
Sandstone Hills	–	–
Holston Valley	–	–
Southern Appalachian Piedmont Section		
Midland Plateau Central Uplands	–	–
Piedmont Ridge	–	–
Schist Plains	1	2
Lower Foothills	–	1
Schist Hills	2	–
Granite Hills	–	–
Opelika Plateau	–	–
Lynchburg Belt	–	–
Northern Piedmont	–	–
Triassic Basins	–	–
Southern Cumberland Plateau Section		
Table Plateau	–	–
Sandstone Mountain	–	–
Southern Cumberland Valleys	–	–
Southern Ridge and Valley Section		
Chert Valley	1	1
Sandstone	–	2
Sandstone Ridge	–	–
Quartzite and Talladega Slate Ridge	1	5
Shaley Limestone Valley	–	–
Northern Ridge and Valley Section		
Appalachian Ridges	11	43
Great Valley of Virginia	3	11
Appalachian Allegheny Ridge and Valley	–	–
Allegheny Mountain Section		
Northern High Allegheny	–	1
Eastern Allegheny Mountain and Valley	–	3
Blue Ridge Mountain Section		
Northern Blue Ridge Mountains	4	9
Central Blue Ridge Mountains	–	1
Southern Blue Ridge Mountains	19	62
Metasedimentary Mountains	11	21
Northern Cumberland Mountain Section		
Central Coalfields	–	–

Table 5.7 Ecosystem subsections represented in roadless areas but not in wilderness.

Subsection Name	State	Roadless Area
Low Hills Belt	TN	Frozen Head
Cleveland	VA	Devils Fork
	VA	North Fork Pound
Eastern Allegheny Mountain and Valley	VA	Laurel Fork
	VA	Little Allegheny
	VA	Oliver Mountain
Northern High Allegheny	VA	Little Allegheny
Central Blue Ridge Mountains	NC	Stone Mountain
Lower Foot Hills	SC	Table Rock
Sandstone	AL	Oakley Mountain
	AL	Dugger Mountain

parcs in the assessment area (table 5.8). These include 8 plant and 11 animal species. In some cases the same species, such as the peregrine falcon, is found in several areas. Only two roadless areas have occurrences of more than one species.

There are 45 known or potential occurrences of threatened and endangered species in roadless areas. Nine species account for 35 occurrences. They include peregrine falcons, carolina flying squirrels, shale-barren rockcress, red-cockaded woodpeckers, Indiana bats,

Table 5.8 Known and potential occurrences of federally listed threatened and endangered species in roadless areas. Species and their status and number of occurrences are indicated by roadless area, agency, and state. Status is indicated by E for endangered and T for threatened.

Roadless Area	State	Species–Common Name/Scientific Name	Status	Occurrence
National Forests				
Bald Mountain	NC	Peregrine falcon/ <i>Falco peregrinus</i>	E	1
Balsam Cone	NC	Peregrine falcon/ <i>Falco peregrinus</i>	E	1
Bearwallow	NC	Carolina flying squirrel/ <i>Glaucomys sabrinus coloratus</i>	E	1
Big Schloss	VA	Peregrine falcon/ <i>Falco peregrinus</i>	E	1
Cheoah Bald	NC	Noonday globe/ <i>Mesodon clarkinantahala</i>	T	1
Dugger Mountain	AL	Blue shiner/ <i>Cyprinella cairulea</i>	T	1
Gum Run	VA	Northeastern bullrush/ <i>Scirpus ancistrochaetus</i>	E	1
Jerkentight	VA	Shale-barren rockcress/ <i>Arabis serotina</i>	E	1
Joe Gap	GA	Small whorled pogonia/ <i>Isotris medeolides</i>	E	1
Kelley Mountain	VA	Swamp pink/ <i>Helonias bullata</i>	T	1
Laurel Fork	VA	VA northern flying squirrel/ <i>Glaucomys salorinus fusus</i>	E	1
Oliver Mountain	VA	Shale-barren rockcress/ <i>Arabis serotina</i>	E	1
Woods Mountain	NC	Mountain golden-heather/ <i>Hudsonia montana</i>	T	1
National Park				
Great Smoky Mountains	TN/	Peregrine falcon/ <i>Falco peregrinus</i>	E	2
	NC	Carolina flying squirrel/ <i>Glaucomys sabrinus coloratus</i>	E	4
		Red wolf/ <i>Canis rufus</i>	E	1
		Red-cockaded woodpecker/ <i>Picoides borealis</i>	E	6
		Spotfin chub/ <i>Cyprinella monaacha</i>	T	1
		Virginia spiraea/ <i>Spiraea virginiana</i>	T	1
		Spreading avens/ <i>Geum radiatum</i>	E	2
		Indiana bat/ <i>Myotis sodalis</i>	E	2
		Spruce-fir moss spider/ <i>Microhexura montivaga</i>	E	2
State Parks				
Mt. Mitchell	NC	Carolina flying squirrel/ <i>Glaucomys sabrinus coloratus</i>	E	1
		Rock gnome lichen/ <i>Gymnoderma linegre</i>	E	1
		Spreading avens/ <i>Geum radiatum</i>	E	1
Table Rock	SC	Eastern cougar/ <i>Felis concolor cougar</i>	E	1

spruce-fir moss spiders, mountain golden-heather, swamp-pink, and spreading avens. The other 10 species have one occurrence each.

The roadless area in the Great Smoky Mountains National Park contains the largest concentration of federally listed species. In that park, 9 species occur a total of 21 times. Six species have multiple occurrences.

Nine federally threatened and endangered species are known to occur or to have occurred in six wildernesses on national forests and national parks in the assessment area (table 5.9). These include six plant and three animal species. In some cases the same species, such as the Carolina flying squirrel, has more than one occurrence in the same wilderness.

Possible Old Growth

The 1,098,491 acres of inventoried possible old growth on national forest lands represent about 3 percent of all land in the Southern Appalachians. Roadless areas and wildernesses in the national forests account for 48 percent of this old growth.

Possible old growth is present in 125 of the 139 national forest roadless areas. These areas account for 173,641 acres or 16 percent of all national forest old-growth acres.

All acres within wilderness are considered possible old growth. The 38 national forest wildernesses in the Southern Appalachians include 347,990 acres or 32 percent of all national forest old-growth acres.

The amount of old growth in individual national forest roadless areas is generally low

(table 5.10). Of the 125 areas that include old growth, 116 or 93 percent have less than half their total acres in old growth. These areas are about equally distributed among areas larger and smaller than 5,000 acres. In addition, most of these 116 areas have less than 25 percent old growth.

Nine national forest roadless areas include more than 50 percent old growth. They are Bee Cove, Dry River, Ellicott Rock-1, Flint Mill Gap, Joyce Kilmer-Slickrock Addition, Ramseys Draft Addition, Rogers Ridge, The Friars, and Shoal Branch. All but Dry River, Flint Mill Gap, and Ramseys Draft Addition are smaller than 5,000 acres. Ellicott Rock-1 has 98 percent or the most old growth acres of any roadless area. It is also one of the smallest areas with 300 acres.

The fourteen roadless areas that do not contain any old growth acres are Cedar Mountain, Cheaha Addition-A, Cheaha Addition-B, Cherry Cove, Kimberling Creek Addition-A, Lewis Fork Addition, Little Frog Addition-NW, Little Wilson Creek Addition-A, Little Wilson Creek Addition-B, Patterson Mountain, Peter's Mountain Addition-A, Saint Mary's Addition, Sam Knob, and Tripp Branch.

Table 5.10 also shows the correlation between roadless area size and the amount of possible old growth. Amounts of old growth in roadless areas smaller than 5,000 acres ranges from less than 1 percent to 98 percent. In many of these small areas the proportion in old growth is 0 to 10 percent. All but three of the roadless areas larger than 5,000 acres have 0 to 50 percent old growth, with the largest number of areas in the 26 to 50 percent range.

Table 5.9 Known and potential occurrences of federally listed threatened and endangered species in wilderness. Species and their status and number of occurrences are indicated by wilderness, agency, and state. Status is indicated by E for endangered and T for threatened.

Wilderness	State	Species—Common Name/Scientific Name	Status	Occurrence
National Forests				
Ellicott Rock	NC	Rock gnome lichen/ <i>Gymnoderia lineare</i>	E	2
Ellicott Rock	SC	Small whorled pogonia/ <i>Isotria medeolides</i>	E	1
Linville Gorge	NC	Mountain golden-heather/ <i>Hudsonia montana</i>	T	1
Linville Gorge	NC	Peregrine falcon/ <i>Flaco peregrinus</i>	E	1
Linville Gorge	NC	Hellers blazing star/ <i>Liatris helleri</i>	T	1
Middle Prong	NC	Carolina flying squirrel/ <i>Glaucomys sabrinus coloratus</i>	E	2
Rough Mountain	VA	Shale-barren rockcress/ <i>Arabis serotina</i>	E	1
St. Mary's	VA	Swamp pink/ <i>Helonias bullata</i>	T	1
National Park				
Shenandoah	VA	Shenandoah salamander/ <i>Plethodon shenandoah</i>	E	1

Table 5.10 Amount of possible old growth in individual national forest roadless areas. Acres of old growth are shown as a percentage of total area acres.

Percent of Roadless Area in Old Growth	Total Number of Areas	Size of Area	
		Smaller Than 5,000 Acres	Larger Than 5,000 Acres
0-10	42	27	15
11-25	36	23	13
26-50	38	13	25
51-75	8	5	3
76-100	1	1	0

Potentially Suitable Bear Habitat

Approximately 56 percent of the land, or 20.9 million acres, in the Southern Appalachians is classed as potentially suitable habitat for black bears. Roadless areas and wilderness account for about 7 percent of these acres.

All 144 roadless areas and 39 wildernesses include bear habitat. Ninety-five percent of all roadless acres and 92 percent of wilderness acres are classed as potential bear habitat.

In all but a few wilderness and roadless areas, at least 75 percent of the total area is suitable habitat for bears. Exceptions are six roadless areas and three wildernesses (table 5.11). Hickory Flats and Mottesheard roadless areas in Virginia are the largest of these exceptions among roadless areas and contain the smallest percentages of bear habitat.

Recreation Settings

The recreation settings and roadless area inventories both used semi-primitive type settings as one of their criteria. However, the interpretation of this setting type and its application differed, as did the overall purpose, criteria, and process for each inventory. While the results show some similarities, a direct correlation cannot be made between the two data sets. The findings would lead to confusion and erroneous conclusions about roadless areas.

Congressionally Designated Areas

Congressionally designated areas include national recreation areas, scenic areas, wild and scenic rivers, and scenic trails. All or portions of 40 roadless areas and 18 wildernesses occur within congressionally designated special areas in the Southern Appalachians. They are distributed among five congressionally designated areas (table 5.12).

Table 5.11 Roadless areas and wildernesses in the Southern Appalachians with less than 75 percent of total acres identified as potentially suitable bear habitat. Areas are identified by name, state, size, and percent of acres in bear habitat.

Area	State	Total Area (acres)	Proportion of Habitat Suitable for Bears %
Roadless Area			
Devil's Backbone	TN	4,283	74
Graveyard Ridge	NC	1,973	45
Hickory Flats	VA	5,182	31
James River Face Addition	VA	1,284	60
Mottesheard	VA	6,521	38
Raccoon Branch	VA	4,437	72
Wilderness			
Middle Prong	NC	7,460	73
Raven Cliffs	GA	9,115	61
Thunder Ridge	VA	2,334	39

Table 5.12 Roadless areas and wildernesses that occur within congressionally designated areas in the Southern Appalachians.

Special Area	State	Roadless Areas	Wildernesses
Chattooga Wild and Scenic River	NC, SC, GA	3	1
Mount Rogers National Recreation Area	VA	10	3
Mount Pleasant National Scenic Area	VA	1	0
Springer Mt. National Recreation Area	GA	1	0
Appalachian National Scenic Trail	VA, TN, NC, GA	25	14

Data Sources and Methodology

Data for selected resources were obtained from other teams in the SAA. Terminology and definitions can be drawn from the respective team reports. No attempt was made to corroborate data received from these teams. The data were linked by the Geographic Information System to the roadless area and wilderness inventories for analysis. Inaccuracies exist in the derived products due to variability in data sources.

Likely Future Trends

Ecosystem Classifications: The number and the acreage of ecosystem sections and subsections represented in wilderness will likely increase as new areas are designated. Some sections and subsections do not occur on public land. Thus, all sections and subsections cannot be represented in either roadless areas or wilderness. As the refinement of ecological classification data increases, classes will offer greater utility in land allocation decisions.

Federally Listed Threatened and Endangered Species: Federally listed species will continue to be protected wherever they occur. Documented occurrences of these species in

roadless areas and wilderness will change. Known and potential occurrences of these species may influence allocation decisions for some roadless areas and management direction for some wildernesses. The degree of influence will depend upon factors such as the number and distribution of species and/or communities, their degree of sensitivity, and their habitat needs. Species that require undisturbed habitats are most likely to influence allocation decisions for roadless areas.

Possible Old Growth: The amount and location of old-growth forest types will be important in assessing the degree of naturalness of individual roadless areas. In turn, this information will influence land allocation decisions and management direction for these areas. Old-growth forest components in wilderness will continue to be valuable for obtaining baseline data for research and monitoring.

Congressionally Designated Areas: Congressionally designated areas are managed according to directions that are unique to each and are defined by the enabling legislation. Therefore, allocation decisions for a roadless area may be influenced by its location within a congressionally designated area.

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