Southern Forest Resource Assessment
Executive Summary

November 2001

The Southern Forest Resource Assessment was initiated in May 1999 to examine the status, trends, and potential future of southern forests and their various benefits. The USDA Forest Service has led the effort in cooperation with the U.S. Fish and Wildlife Service, Environmental Protection Agency, Tennessee Valley Authority, and Southern States represented by their forestry and fish and wildlife agencies.

The Assessment addresses topics regarding the sustainability of southern forests in light of increasing urbanization and timber harvests, changing technologies such as chip mills, forest pests, climatic changes, and other factors that influence the region's forests. The intent was to develop a thorough description of forest conditions and trends in the South that helps the public understand these complex and important topics.

The approach was question-driven, with public meetings and comments helping to frame the Assessment with 23 specific questions. A team of "question managers" was assigned to employ a rapid scientific approach in drafting the 23 chapters and two background papers of the Technical Report. Results will be used to help identify subregions within the South that could need additional analysis at a finer scale. A Summary Report was developed to compile and interpret some of the important findings contained in the encyclopedic Technical Report. This Executive Summary further distills the findings.

Forces of Change

We evaluated the forces of change that have and continue to reshape forests in five areas. They include:

Land Markets

History and Status: From 1700 to1930, land clearing for agriculture and timber production completely restructured southern ecosystems. Clearing for agriculture greatly diminished the area of forested wetlands, especially in the Mississippi River Alluvial Valley. Agricultural uses reached their zenith in the late 19th century. Wholesale land abandonment then set the stage for a long period of forest reestablishment and growth.

Since the 1940's there has been little net change in forest area in the South and current forest area is 214 million acres, about 91 percent of that recorded in 1907. However, there have been large offsetting changes: forest has been converted to urban and agriculture in some places and agricultural land has been converted to forests in others.

Future: Forecasting models indicate that 12 million forest acres will be lost to urbanization between 1992 and 2020. An additional 19 million acres are forecast to be developed between 2020 and 2040. Forecasts also indicate conversion of 10 million acres from agricultural land to forest between 1992 and 2020 and conversion of another 15 million acres by 2040. Most forest loss is expected to be concentrated in the eastern part of the region, with forest gains concentrated in the west.

Timber Markets

History and Status: Between 1953 and 1997, the South's timber production more than doubled, its share of U.S. production increased from 41 to 58 percent, and its share of world production increased from 6.3 to 15.8 percent. The region now produces more timber than any other country in the world.

The South produces a great variety of timber products, including softwood sawlogs (28 percent), softwood pulpwood (25 percent), and hardwood pulpwood (16 percent). Since 1953, hardwood pulpwood has experienced the greatest increase in product share, growing from 3 to 16 percent of output.

Future: Timber market models forecast that timber production in the United States will increase by about a third between 1995 and 2040. Nearly all of this growth will come from the South where production is forecast to increase 56 percent for softwoods and 47 percent for hardwoods.

Social Institutions

History and Status: Laws, regulations, and government programs are frameworks within

which forests are managed. The current income tax code has mixed impacts on long-term investments in forestry, while inheritance taxes encourage owners to liquidate or split up forest properties.

Forest incentive programs that subsidize tree planting have a long and successful history in the South, and recent programs focus on multiple values produced from forests.

Direct regulation of forestry is limited in the rural South. However, in urbanizing areas, a proliferation of local regulations affects land use and forest management—local regulations nearly doubled between 1992 and 2000.

Future: Funding of forest incentives is likely to vary depending on shifts in State and Federal priorities. The expansion of local regulations appears to be closely linked to population growth and urbanization. The number of regulations affecting forest treatments will likely continue to expand in high growth areas.

Biological Factors

History and Status: Biological forces ranging from natural succession to plant diseases continuously alter the structure of forests. Native plant diseases and insects affecting pines have become problematic in the South as the species composition and configuration of pine forests has changed—southern pine beetle and fusiform rust are economically significant pests.

Exotic diseases and insects have altered and are altering southern forests, especially hardwoods. Chestnut blight removed an important canopy species beginning in the 1930's. Several other species-specific diseases (including dogwood anthracnose, oak wilt, and butternut canker) and exotic insects, (including gypsy moth, balsam wooly adelgid, and hemlock adelgid) have been introduced to the South.

Exotic trees, shrubs, vines, birds, and mammals are having large impacts on southern ecosystems.

Future: Southern pine beetle is forecast to continue to cause substantial economic damage and ecological change in the South, especially on heavily stocked nonindustrial private forests and aging public forests. Multiple exotic diseases and insects affecting hardwoods will continue to spread from northern areas. Expansion of urban areas will likely increase the spread of exotic plants and animals and impact native plant and wildlife communities.

Physical Factors

History and Status: Many southern forest types are fire-adapted. Exclusion of fire has altered their species composition, flammability, and management. The ambient environment influences forest growth and vigor. Ozone pollution has reduced the growth of southern pines.

Future: Ozone pollution is forecast to increase anywhere from 20 to 50 percent between 1990 and 2025, and growth reductions in southern pines are expected as a result. Future changes in temperatures could positively or negatively affect forest growth and species ranges, depending on the extent of the change and availability of moisture. Acid deposition is not expected to significantly impact the region's forests, except in the Southern Appalachians. The reintroduction and continued use of fire will remain challenges as urbanization and air pollution concerns limit its use.

Southern Forest Conditions

We examined southern forest conditions from the four different perspectives: (1) social and economic systems, (2) forest area and condition, (3) terrestrial ecosystems, and (4) water quality, wetlands, and aquatic ecosystems.

Social and Economic Systems

Social Context

History and Status: The population of the South has grown at a faster rate than national averages. As a result the share of the U.S. population residing in the South has increased to more than 32 percent. Although growth was largely in urban areas through 1980, it is now spread across nearly all southern counties.

The demographic profile of the South has also changed toward a more urban population. These changes are reflected in values that have shifted away from strong commodity orientation to a more biocentric view.

Future: Population is forecast to continue growing in absolute terms and relative to the United States as a whole, putting increasing pressure on forests, especially in urbanizing areas.

People and Forests

History and Status: Comparing the distribution of population with forest distribution indicates areas where access to forests and their benefits is especially limited. These are concentrated in Florida, in northern Virginia and northern

Kentucky, and along interstate highway corridors: I-85 from Atlanta to Raleigh, NC, I-65 from Birmingham, AL to Nashville, TN, and I-81 from Chattanooga, TN to Wytheville, VA.

Future: Forecasts from 1992 to 2020 indicate outward growth and increased human impacts on forests surrounding urban centers including Atlanta, Nashville, and Charlotte, NC and along the Atlantic and Gulf of Mexico coastal areas. These wildland-urban interfaces influence many forest values.

Wood Products

History and Status: With expansion in forest production has come an expansion in jobs and income derived from the wood products industry. In 1997, timber harvests led to more than 700,000 jobs in wood products sector and more than $118 billion in total industry output. Total economic impacts of these activities were about 2.2 million jobs (5.5 percent) and $251 billion of total industry output (7.5 percent).

Timber harvesting and management of timber production are prevalent in all parts of the region, but especially concentrated on the Atlantic and Gulf of Mexico Coastal Plains.

Future: Timber production percentages are forecast to increase the most northward and westward from the traditional production core of the South—Tennessee, North Carolina, Arkansas, and western Virginia.

Increases in timber harvests are not expected to deplete inventories, but there is considerable variability among States and forest types. Softwood inventories are forecast to increase at a gradual rate between 1995 and 2040. Hardwood inventories are forecast to expand between 1995 and 2025, but will then fall slightly between 2025 and 2040. This reflects forecasts that show hardwood removals exceeding growth regionally by about 2025, sooner in some States.

Recreation

History and Status: Southern forests provide a broad array of recreation activities. Driven by a growing population and changes in income and other demographics, recreation uses of all types have increased. Recreation is an important source of employment and income in the South. In 1997 outdoor recreation-based tourism contributed between 0.64 and 2.88 percent of southern jobs. Public lands represented 56 percent of this contribution. Recreation pressures on public land are substantial. Much private land is unavailable for public recreation, and the trend is toward less access.

Future: Given current land ownership patterns, there appears to be limited capacity to expand forest-based recreation opportunities in the South. Recreation activities on public land are expected to be increasingly congested, and competition among various recreation groups will increase.

Quality of Life

History and Status: Forests contribute to quality of life in several ways including production of wealth through wood products and recreation, environmental quality, and aesthetics.

Future: Changes in the use of forests will likely affect the quality of life for local residents. Forecasts for increased harvests in areas outside the production core of the South may lead to increased wealth for some, but loss of aesthetic and environmental benefits for others. This will likely lead to debate over desired forest uses in these local areas.

Forest Area and Conditions

Forest Area and Ownership

History and Status: The South has more than 214 million acres of forest land, 60 percent of the total in 1630 and 91 percent of the total in 1907. Forest area has been relatively stable since the 1970's. Eleven percent of timberland (21.4 million acres) is managed by various government agencies. The remaining 89 percent is privately owned. Twenty two percent of private timberland is owned by forest industry, 21 percent by farmers, 12 percent by other corporations, and 45 percent by other individuals.

Ownership is changing, with a decrease in forest industry ownership between the 1980's and 1990's and an increase in other corporate owners, including timber investment management organizations.

Future: Total area of forest land is forecast to decline by only 2 percent between 1995 and 2040. Early results from the most recent forest inventories indicate that decreases in forest industry ownership are continuing.

Broad Forest Types

History and Status: While total forest area has remained relatively constant, the distribution of forest types changed from the 1950's to the 1990's. The area of upland forest increased gradually. The area of lowland hardwoods declined somewhat between the 1950's and 1970's but has leveled off since. The area of naturally regenerated pine stands decreased by about half as the result of natural succession to

upland hardwoods, harvesting of the pine component, or conversion to nonforest uses or planted stands following harvest. Planted pine increased from about 2 million acres in 1953 to 32 million acres in 1999. Between the 1980's and 1990's, pine plantations were established on land that was previously hardwood or mixed pine-hardwood forests (47 percent), natural pine forests (28 percent), and agricultural fields (25 percent).

Future: The area of pine plantations is forecast to increase by 67 percent to 54 million acres in 2040. Areas of all other forest types are expected to decline at gradual rates over this period. Forests of all types will be lost to urban uses and gains in planted pine will come mainly from planting agricultural fields.

Landscape Structure

History and Status: A satellite "snapshot" of forest cover in the early 1990's indicates areas where forest is highly contiguous. These areas include the Blue Ridge Mountains, the Cumberland Plateau, the Allegheny Mountains, the Ozark-Ouachita Highlands region, and some coastal areas.

Conversely, areas where forest cover is highly fragmented include the Piedmont, central Tennessee, and the Ridge and Valley ecoregion.

Future: Forecast population growth coupled with current conditions suggests that the Piedmont will be especially susceptible to increased fragmentation through 2040.

Forest Inventory

History and Status: Southern forests accumulated considerable volumes of timber between the 1950's and 1990's. Inventory grew by 73 percent from 148 billion cubic feet to 256 billion cubic feet, reflecting rapid growth of stands established since the 1930's. Recent inventories indicate a general slowing in the rate of accumulation for hardwoods and a leveling off of accumulation for softwoods.

Future: Forecasts indicate that softwood growth will overtake and exceed removals by a slight margin in the next few years. As a result, softwood inventories are forecast to increase steadily between 1995 and 2040. Hardwood removals are forecast to exceed growth by about 2025. Thus inventories are forecast to peak in about 2025, and then decline to levels just exceeding current amounts by 2040.

Timberland Productivity

History and Status: Intensive management has increased southern timber yields. High intensity management can increase yields by 65 percent over standard site preparation and planting and by more than 100 percent over naturally regenerated forests.

Future: Future productivity is a key to determining both future forest conditions and forecasts of timber markets. For example, models indicate that if anticipated productivity gains were not realized, the result would likely be more pine plantations to supply timber products. The effects of environmental and climate change and pest-related mortality on productivity are less certain.

Terrestrial Ecosystems

Abundant forest communities

History and Status: Upland hardwood and pine types remain plentiful in the South but are subject to several health concerns. Southern pine beetle has had the largest economic impact of any forest pest over the past 30 years. The chain of forest changes begun by the chestnut blight continues; the latest change agent may be a disease complex called oak decline, which is especially severe in the Southern Appalachians and the Ozarks.

Future: With pine types, southern pine beetle will continue to be an economically important pest. Epidemics are likely where pines have been planted outside their natural range and in the absence of active management. Spillover epidemics from public land may continue to be problematic in the South. The complex of exotic insects and diseases affecting hardwoods has the potential to restructure forests, especially in the northern part of the region.

Rare forest communities

History and Status: Many concerns about southern wildlife and plant species focus on rare forest communities. Fourteen critically endangered communities have lost more than 98 percent of their habitat since European settlement. Most are in seven classes: (1) old growth, (2) spruce-fir, (3) wetlands, bog complexes, and pocosins, (4) bottomland and floodplain forests, (5) glades, barrens, and prairies, (6) longleaf pine forests, and (7) Atlantic white-cedar swamps.

Future: Two of the seven classes—old growth and spruce-fir forests—are found largely on public land. The remainder is generally in private ownership, so their future depends on the decisions of numerous owners. Spruce-fir appears to be under the most stress, mainly from a combination of air pollution and an exotic insect. Remnant longleaf pine forests are threatened by development and fire exclusion.

Effects of land-use changes

History and Status: Urban land uses have impacts on sensitive forest wildlife including many Neotropical migrant bird species through loss and fragmentation of habitat and increased disturbances.

Future: Forecasts of land use change suggest that sensitive bird species may be subjected to the most change in heavily urbanizing areas such as the Piedmont, where declines due to habitat loss and degradation could occur for Neotropical migrants and to forest-interior and early-successional habitat specialists.

Effects of forest management

History and Status: Forest management can have important implications for wildlife. Impacts depend on specific site conditions and the management practices employed. Broader, landscape patterns can influence mobile wildlife species. Fragmentation effects of certain practices are likely to be lower in heavily forested areas than in areas where urban and agricultural uses predominate, such as the Piedmont, Interior Low Plateau, and Mississippi Alluvial Plain. Landscape configuration and impacts of management may be especially high for some species, especially certain amphibians. Across the South, more species are threatened by increased isolation of shrub-scrub and grassland habitats than are affected by scarcity or fragmentation of mature forests.

Future: The ultimate future challenge for forest management is to support the array of grassland, shrub-scrub, and mature forest species occurring within the same landscapes.

Wildlife species of concern

History and Status: Of the 1,208 vertebrate species known to exist in the South, 132 are considered to be of conservation concern, and 28 are classified as critically imperiled. The South is the center of amphibian biodiversity in the United States. Fifty-four amphibians are classified as species of concern, and 19 are critically imperiled. Areas where the concentration of endangered species is high include the Southern Appalachians, Atlantic and Eastern Gulf Coast Flatwoods, Gulf Coast Marsh and Prairie, and Peninsular Florida. Loss of habitat is the primary cause of endangerment.

Future: Habitat protection will be a challenge in the face of the rapid urbanization forecast for the South. Forestry operations can have impacts on certain amphibians, especially those that depend on both wet and upland habitats.

Conservation Issues

History and Status: Public land is relatively scarce in the South (11 percent of forests) but plays an important role in conservation for specific forest types and wildlife species. More often, the management of private land determines the future of imperiled species and rare forest communities. Effective conservation often requires collaboration, giving rise to multiple-owner consortiums.

Future: Although scarce, public land has unique ecological value because it can provide a dependable supply of interior forest habitat and older forests. In urbanizing areas, public tracts can serve as anchors for conservation strategies pursued by multiple owners. The effective reintroduction of fire to many forest ecosystems will remain a critical forest conservation challenge.

Water Quality, Wetlands, and Aquatic Ecosystems

Water Quality

History and Status: About 30 percent of the South has relatively good water quality, 36 percent has moderate water quality problems, and 15 percent has serious water quality problems. The leading causes of water quality impairment have been siltation, pathogens, and nutrients. Of the 11 major sources of water quality impairment, agriculture and urbanization have ranked highest, with silviculture ranking next-to-last. When properly implemented, best management practices (BMP's) are effective in controlling nonpoint source pollution from silvicultural activities. Twelve of the 13 States have monitored BMP compliance and reported results. Differing survey methods among States preclude reporting regional trends. Consistency among States is improving, however, as six have adopted similar procedures since 1997.

Future: As timber production increases in the South, effective BMP implementation will remain crucial for protecting water quality.

Wetlands

History and Status: Approximately 32.6 million acres of forested wetlands occur in 10 Southern States (Assessment area minus Virginia, Texas, and Oklahoma). They represent 64 percent of the total in the conterminous United States. Forested wetland losses have been widespread but concentrated in the Mississippi Alluvial Valley and the Coastal Plain of the Carolinas. Rates of

losses have declined since the 1970's but impacts and functional changes continue to occur.

Future: Land management practices and forecast urbanization are expected to continue to alter the function of wetlands. Wetland restoration efforts will continue, but their likelihood of success is not clear. Forest management practices will play an important role in the persistence of certain amphibian species.

Aquatic Species of Concern

History and Status: The South supports a great diversity of aquatic life. Several hundred species of concern are found among the amphibians, mussels, crustaceans, fish, snails, and aquatic insects of the region. Especially high concentrations of critically imperiled species occur in mussel, fish, and amphibian biota due to modifications of aquatic and wetland habitats.

Future: For many mussels and some other species, declines will continue due to the effects of essentially irreversible actions such as damming, agricultural conversions, and the introduction of exotic species. Many aquatic species of concern are narrow endemics. The effects of development and management may be disproportionately high for the small areas they occupy.

Discussion

Broad Findings

The findings of this Assessment have led to some broad observations about the status and future of southern forests:

Several forces are affecting the condition of southern forests. The South is an economically, culturally, and ecologically complex region, and multiple forces of change are simultaneously affecting forest conditions.

Urbanization presents a substantial threat to the extent, condition, and health of forests. Among forces of change, urbanization will have the most direct, immediate, and permanent effects on the extent, condition, and health of forests.

Population is growing, and the social context is changing. These changes have implications for the values and demands that people place on forests as well as the uses of forests.

Total forest area will remain stable, but subregional and compositional changes will continue. We forecast little net change in the total area of forests between 1995 and 2040 as losses of forests to urban uses are forecast to be offset by shifts from agriculture to forest. Urban development is forecast to be concentrated in the eastern and afforestation of agricultural land concentrated in the western parts of the South. Overall, the region will experience a westward shift in its forest area.

Timber production is forecast to expand but will not deplete forest inventories below current levels. Between 1995 and 2040, softwood outputs will expand by 56 percent and hardwood outputs by 47 percent. Softwood inventories will continue to expand throughout. Hardwood inventories will expand until 2025 and then decline slightly between 2025 and 2040.

Investment in pine plantations is forecast to expand to meet increased softwood demand, but this has implications for the ecological characteristics of southern forests. Pine plantations enhance timber productivity—for example, planted forests accounted for 15 percent of timberland but contributed 35 percent of annual softwood removals between the 1980's and 1990's. Increases in pine plantation acreage could also result in varying ecological changes, depending on stand origin and management. These effects are better documented at the forest stand level than at a broader landscape scale.

Changing land use and harvest patterns will have important impacts on people. The wood products industry currently accounts for about 6 percent of jobs and 8 percent of income. In some rural parts of the South, these percentages are much higher and the industry has represented a majority of the local base economy. Forests also contribute to the quality of life in the region by providing opportunities for recreation, visual backdrops, and environmental quality. Forecasts of increasing timber harvests imply more jobs in the wood products sector. However, abrupt changes in forest conditions could lead to costs for some people, benefits for others, and increased debate over forest uses in areas outside the traditional production core of the South.

Southern forests have proven resilient but some components are scarce and therefore at risk. Through the 20th century, the South has recovered from a largely cutover, exhausted, and eroded condition to become one of the most productive forest regions in the world. However, the presence of numerous imperiled animal species (28 terrestrial vertebrates are critically imperiled) and increasingly rare forest communities (14 communities have been reduced to less than 2 percent of their area at the time of European settlement) are reasons for concern.

Scarce forest types have high ecological value. To borrow the adage from economics, scarcity defines value. The rare forest communities in the South (above) have disproportionately high ecological value. Thus, much concern about biodiversity is focused on these relatively small shares of the forest landscape.

Subregions of Concern

We identified three areas where forces of change and their implications are concentrated in the South:

Southern Appalachians—This region will be influenced by a combination of human, biological, and physical factors over the next two decades. Population growth and land-use changes will increase the human presence in many forests. Demands for forest-based recreation are focused on the Southern Appalachians, and increased competition among recreation user groups is anticipated. A complex of forest health issues is affecting all forest types in this region and has the potential to restructure forest ecosystems.

Piedmont—Forecasts of land-use change suggest that the Piedmont, from Virginia to Georgia, will experience the greatest loss of forest area among ecological sections of the South. Already this heavily forested region has a very low ratio of interior forest to total forest, indicating a high degree of forest fragmentation. Fragmentation is likely to continue with growth of populations in urban counties and interspersed rural counties. Consequently, wildlife habitats will be altered for certain Neotropical migrant and other important bird species. Because populations will grow and forest area will decline, we also expect an increasing scarcity of forest-based recreational opportunities for city dwellers.

Lower Atlantic and Gulf Coastal Plains— Coastal flatwoods areas are forecast to lose large shares of forest to urban development. Forest loss combined with intensified forest management could have cumulative negative effects on coastal wetlands, through direct wetland loss and modification of hydrological regimes. The flatwoods, one of two areas in the South with the highest concentrations of endangered animal and plant species, contain many imperiled amphibians, crustaceans, and reptiles. These concerns are concentrated especially in the Florida Panhandle.

Scientific Uncertainties

Available information has allowed us to describe several emerging issues that could affect the sustainability of the South's forests, but more information is needed to clearly identify problems and solutions. The following are some key areas of uncertainty:

- Effects of population growth on forest ecosystems
- Influence of changing market and other values on land use and management choices
- Determinants of overall forest productivity for all benefits
- Forecasts of changes in ecological structure and functions
- Broadening the scale of forest research to better address questions at regional levels
- Role of fire in forests and the effective use of fire
- Influence of changing forest structure, especially pine plantations, on ecosystem function and wildlife
- Development of new forest management strategies for a variety of settings

Additional Information

www.srs.fs.fed.us/sustain

Visit the Southern Forest Resource Assessment online to review reports and provide written comments.