

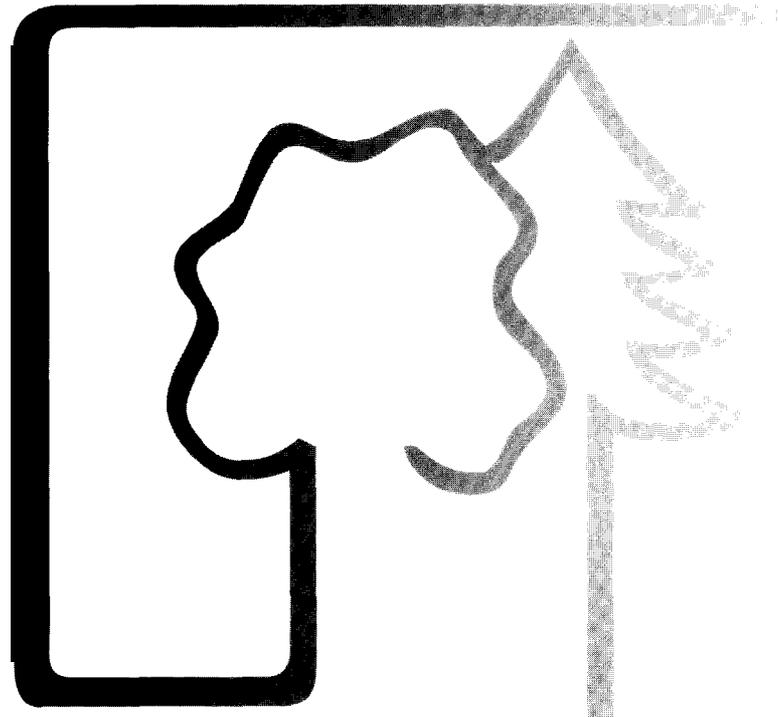
United States
Department of
Agriculture

Forest Service

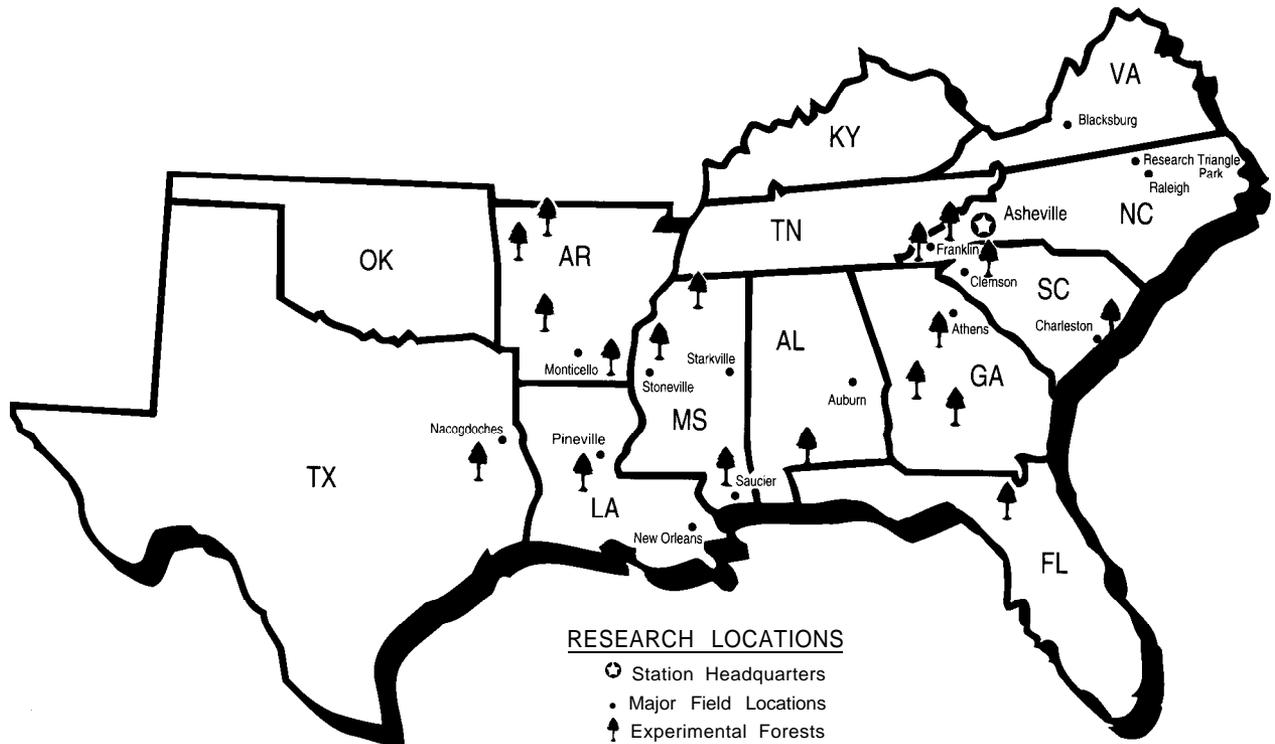


Southern
Research Station

Annual Report for 1997



Southern Research Station



Our Mission is to create the science and technology needed to sustain and enhance southern forest ecosystems and the benefits they provide.



USDA Forest Service
 Southern Research Station
 200 Weaver Boulevard
 P.O. Box 2680
 Asheville, NC 28802

June 1998



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Peter J. Roussopoulos
Director



Dear Reader:

This is the first Annual Report from the Southern Research Station, following the consolidation of the former Southeast and Southern Stations. Our headquarters is in Asheville, North Carolina, and we have research work units in 9 of the 13 southern states. The consolidation resulted in a reduction of units from 42 to 25. This streamlining increases our efficiency and enables us to address complex, multiple-resource issues across the entire South and beyond.

I am pleased that we completed our strategic plan in 1997, following a planning process that combined public involvement with the efforts of all of our employees. I feel that the framework set out in the strategic plan will guide us to conduct the research that will best meet the needs of our customers. Our Plan is completely integrated with the Forest Service's national research strategy.

A key component of our strategic plan is the designation of six "Cross-Cutting Themes" (CCTs). We expect the CCTs to help us communicate, prioritize, and integrate our scientists' work and develop products that meet customer expectations and result in improved resource management. Four of the CCTs reflect predominant resource characteristics: Southern Appalachians, Interior Highlands, pine ecosystems, and wetland/bottomland/riparian areas. The remaining two support the sustainable management of all forest ecosystems: inventory and monitoring, and large-scale assessment and modeling.

We renewed our commitment to exemplary customer service in 1997. As part of the world's largest forest research organization, we are committed to meeting people's needs through our work with public and private sector natural resource managers, in applying research findings to land and resource management. This year we filled requests for nearly 90,000 copies of research papers, technical reports, resource bulletins, and management guides—an indication of the value that our customers place on our research results.

This report includes many of our efforts for 1997. Much of our research takes place over the course of several years, so many studies are underway that are not discussed. The comprehensive list of publications in the Appendix reflects the scope of our accomplishments.

A handwritten signature in black ink, appearing to read 'P. Roussopoulos'.

summary
table

FY '97 Accomplishments

| | |
|--|--------------|
| Research Work Units | 25 |
| Publications in Refereed Journals | 237 |
| Publications Produced by Southern Research Station | 47 |
| Technology Transfer Devices (CDs) | 2 |
| Websites Established | 9 |
| Publication Requests Filled | > 90,000 |
| Site Tours | 265 |
| Invited Presentations | 148 |
| General Audience Presentations | 375 |
| Environmental Education Intern Program Contacts | 1806 |
| Total Employees | 434 |
| Scientists | 126 |
| Budget | \$34,588,000 |
| Grants to States/Universities | \$6,422,238 |



introduction

 Since the beginning of the 20th Century, the Southern Research Station's researchers have excelled in studies on temperate and tropical forests, forest resources, and forest products. These studies provide a wealth of long-term data sets and conclusions on the dynamics of plantations and natural stands, watershed management (including water yield and quality, climate, and vegetation), and wildlife habitats.

Working at laboratories, experimental forests, and university campuses throughout the South, our scientists produce research results that are useful to producers and consumers of forest products and services. These include scientists, educators, extension specialists, landowners, professional societies, commodity and industry associations, conservation groups, the National Forest System and other Forest Service units, regional and national research institutions, legislative bodies, and managers and officials from State, local, and Federal agencies.

Our status as a Federal research organization allows us to address complex issues across State and local political boundaries. We have well-equipped laboratories, many located at or near universities. We also have access to experimental forests, university forests, and national forests as well as private land and infrastructure for collaborative studies.

Our diversity of human perspectives, geographic scales, and technical capabilities allows us to offer:

- a stable, well-trained, diverse, and experienced staff
- expertise and experience in interdisciplinary, multiple-scale research
- the flexibility and creativity needed to build an array of science programs
- an unparalleled archive of long-term, region-wide data bases
- an extensive network of collaborators, research users, and supporters
- quick deployment of resources to address immediate and long-term questions (made possible by recent improvements in administrative processes).

The Southern Research Station employs a workforce of more than 120 scientists in disciplines ranging from genetics to social valuation-the largest concentration of natural resource research in the United States-and another 300 employees in technical and administrative support. We are part of a community of dedicated professionals, which includes researchers and managers from forest industry, universities, consulting companies, public agencies, and conservation groups.

forestry in
the south



The 13 States of the South contain a wide diversity of climates, landscapes, and forest types. Temperatures range from subtropical on the coast to cool and humid in the Appalachian Mountains. The 60 forest types fall into eight physiographic regions: Coastal Plains, Piedmont, mountains, flood plains, Great Plains, sandstone uplands, limestone uplands, and southwestern arid areas.

Part of the economic strength of the South comes from its history of contributing forest products for use by people throughout the Nation and the world. The forest land in the region is highly productive; trees regenerate and grow quickly where there is good soil and plentiful rainfall. About 40 percent of the Nation's productive timberlands are in the South.

Nearly all of the South's forest land is privately owned, with only about 11 percent in public ownership-including the 7 percent that is in national forests. Forest products companies own about 20 percent of the region's 212 million acres of forest land.

By far the largest type of ownership (almost 70 percent) is nonindustrial private forest landowners (NIPF) who own from an acre or two up to 100 acres. NIPF owners have diverse objectives which may include farming, timber production, vacationing, or long-term investment. This ownership pattern is the characteristic that sets the South apart from other forested regions of the United States.

The U.S. economy depends on the South for 67 percent of its pulpwood, 50 percent of its plywood, 40 percent of its hardwood lumber, and 33 percent of its softwood lumber. Timber is the highest valued crop in the region, representing an annual economic value of \$90 billion. The average annual removal of wood products in the South is 8.9 billion cubic feet; only about 4 percent of that comes from national forests.

In addition to being an invaluable source of wood products, these forested lands support a vast recreation business; contribute to clean air for the region; supply abundant water for domestic, agricultural, and industrial use; and provide diverse habitats for plants, mammals, fish, reptiles, and birds.

Supplying knowledge to meet the increased demands for forest benefits in an environmentally conscientious manner is perhaps the primary issue facing forestry researchers. The owners of small tracts, who hold the majority of the South's forest land, have little capacity to conduct research to improve resource sustainability, but they can benefit substantially from applying the knowledge and technology developed by government and university research. Managers of privately owned forest industry lands apply the results of cooperative research efforts to improve the sustainability of wood production and other forest benefits, such as wildlife habitat and environmental quality.

strategic
planning

 We began a strategic planning effort in 1994 with the consolidation of the Southern and Southeastern Forest Experiment Stations, which resulted in a completed strategic science plan being published in 1997. This document, called the “Strategic Framework for the Southern Research Station,” guides the future of our research program.



To develop this strategic plan, we held a series of three town hall meetings, and met with groups of our collaborators and customers. Other factors that were considered during the planning process were changes in the political and leadership environment, assessments of resource, social, and economic trends and demands, regulatory mandates, expectations of user groups, and internal knowledge and guiding principles.

Our Agency is committed to the goal of sustainability, defined by the World Commission on Environment and Development as meeting “the needs of the present without compromising the ability of future generations to meet their own needs” (1987).

This definition of sustainability recognizes human actions and inputs; it includes wood fiber supply, recreation, water yield and quality, abundance and diversity of flora and fauna, and other forest resources.

Sustainability is the concept that brings focus to the Southern Research Station research program.

strategic
framework
for the
Southern
Research
Station



Simply stated, the questions underlying our research program are:

- What do we have?
- How does it work?
- How can we use it so that we will not lose it?

Translated into research priorities, these questions become the central drivers of a dynamic system for setting goals and making significant accomplishments:

- measuring and monitoring forest resources;
- understanding ecosystem structure, function, and processes;
- ensuring environmental quality and sustainable productivity.

measuring
and
monitoring
forest
resources

Measurement of forest resources has always been important to our customers and has often stimulated new avenues of research. Inventory information has been the source of feedback on policy, management, and changes in forest health across ownerships.

With our 75-year history of increasingly comprehensive inventories, the Southern Research Station offers experienced personnel, tested methods, and detailed data bases.

Our goals are to:

- shorten the inventory cycle;
- develop new techniques to reduce costs and improve accuracy;
- develop new techniques to assess public values and previously unmeasured forest resources;
- develop better methodologies for field measurements and data analysis; and
- improve our ability to display and summarize spatial characteristics of forest resources.

understanding
ecosystem
structure,
function, and
process

To succeed in sustaining multiple benefits, natural resource policies and decisions must be firmly grounded in a scientific understanding of how ecosystems function and how they respond to change. They must take into account the structure, function, and processes of ecologically and economically important ecosystems.

Achieving sustainability and meeting expectations for environmental quality require an understanding of ecosystem integrity and function. The Southern Research Station offers a wide range of scientific disciplines (from hydrology to wildlife biology to genetics), a history of long-term multiple-scale studies that cross ownership boundaries, and a strong track record of cooperative research with scientists from other organizations.

ensuring
environmental
quality
and
sustainable
productivity

The challenge for the next century will be to identify management approaches that sustain and enhance productivity of southern forests while providing commodity and noncommodity benefits. The research products needed will be a mix of study results, assessments, cost-benefit and risk analyses, prediction models, and practical guidelines.

One of the Southern Research Station's strengths is in continuing, multiple-objective studies. Our track record includes regional and national studies, such as watershed responses, global change, forest operations systems, animal and plant population biology, wetlands ecology, and forest health assessment. Our scientists will synthesize data on governing processes with data on the effects of management.

The resulting predictions of ecosystem response will help forest managers mitigate unwanted outcomes and increase productivity on a sustainable basis.

strategic
plan in
action

 Our research units, like others in the Forest Service, are decentralized to facilitate on-the-ground collaboration. Each concentrates on a few related disciplines to ensure the quality of results and provide subject-matter experts to mentor young scientists.

cross-cutting
themes
developed

To keep these benefits while engaging our scientists in multiple-level, multidisciplinary research, we have designated six cross-cutting themes (CCTs) that address the issues and needs identified during the strategic planning process.

Four of the CCTs reflect predominant resource characteristics—Southern Appalachians, Interior Highlands, southern pine ecosystems, and wetland/bottomland/riparian areas. The remaining two, inventory and monitoring, and large-scale assessment/modeling, support the sustainable management of all forest ecosystems and types.

The CCTs are dynamic and flexible. They will help us to communicate, prioritize, and integrate the work of our scientists and to develop products that are more in line with customer expectations.

Scientists will participate with customers, partners, and other scientists in deciding which research questions have the highest priority for each CCT, and each scientist will determine how his or her research can contribute to those research questions.

This CCT will provide information needed for aquatic, riparian, and terrestrial systems that sustain habitat for wildlife and provide aesthetically-pleasing landscapes, while maintaining site productivity and production of wood fiber at sustainable levels.

Scientists will develop a new integrating framework and expand research already underway associated with the mixed ownerships in the Southern Appalachian Region, including the Southern Appalachian Assessment.

Southern
Appalachian
ecosystem
research
and
sustainability



The goals of this research program are:

- identify and test principles and develop ecologically based information applicable to management of Southern Appalachian forest ecosystems;
- increase our knowledge of social and economic influences on forest resource management and the values derived from them; and,
- develop and provide tools to forest managers in a form useful for integrating ecological and socioeconomic information to aid in forest management decisionmaking.

sustainability
and
productivity
of the
Interior
Highlands
ecosystem

This CCT will build the integrating framework and scientific basis to support management of forest lands within mixed forest ownerships in the Interior Highlands (Ozark) Region of Arkansas, Oklahoma, and Missouri.

This effort will expand our long record of research in support of alternatives for private landowners. Research at two spatial scales—stand level and landscape level—will address sustainability and productivity issues within the social context of decisionmaking and linkages between ecological and social attributes.

The Interior Highlands CCT is built upon the prominence of Federal lands in the Ozark region, as well as the diverse mixture of Federal, State, private industrial, and private nonindustrial lands. Lying within northwest Arkansas, eastern Oklahoma, and southern Missouri, the Interior Highlands physiographic province is roughly 43 million acres in size, of which 23.1 million acres are forested; of that, about 3.8 million acres (16.4 percent) is national forest land—the Ouachita, Ozark-St. Francis, and Mark Twain.

sustainability
and
productivity
of
southern pine
ecosystems

This CCT will be aimed at providing ecologically sound, economically viable, and socially acceptable management alternatives for the vast southern pine and pine-hardwood complex. Forest landowners need harvesting, regenerating, and managing alternatives that are low-cost and effective without compromising productivity or environmental quality.

The fundamental questions to be addressed are:

- what information is needed to ensure this complex is sustainable?
- how will we provide alternatives that are suitable for a variety of public and private ownerships?

Of the commercial forests in the South, over 80 percent are in natural pine and pine-hardwood stands—more than two-thirds of which are held by nonindustrial private forest landowners who often have multiple objectives but limited capital to invest in

managing their stands. These and other forest landowners need harvesting, regenerating, and managing alternatives that are low-cost and effective without compromising productivity for future generations.

ecology
and
management
of forested
wetlands,
bottomland
hardwoods,
and
riparian zones

This CCT will focus on providing information necessary for restoring and managing forested wetlands, bottomlands, and riparian zones to obtain desired products and values while sustaining ecosystem functions that ensure environmental quality.

Approximately half of the wetland resource in the United States occurs in the South, and the majority of those wetlands are forested. In addition to wetlands, nonhydryic bottomlands and riparian areas occur in a hydrogeomorphic setting similar to wetlands. Together these lands provide critical benefits that are fundamental to ecosystem health at multiple scales, including productivity, habitat, freshwater resources, and biodiversity.

The forested wetland resource is also an integral component of commercial forest lands, where high rates of forest wood and fiber productivity are possible without compromising environmental values.

landscape
and
regional
integrated
assessment
and
modeling

The overriding goal of this CCT is to understand how biological, climatic, physical, and social systems operate at large scales.

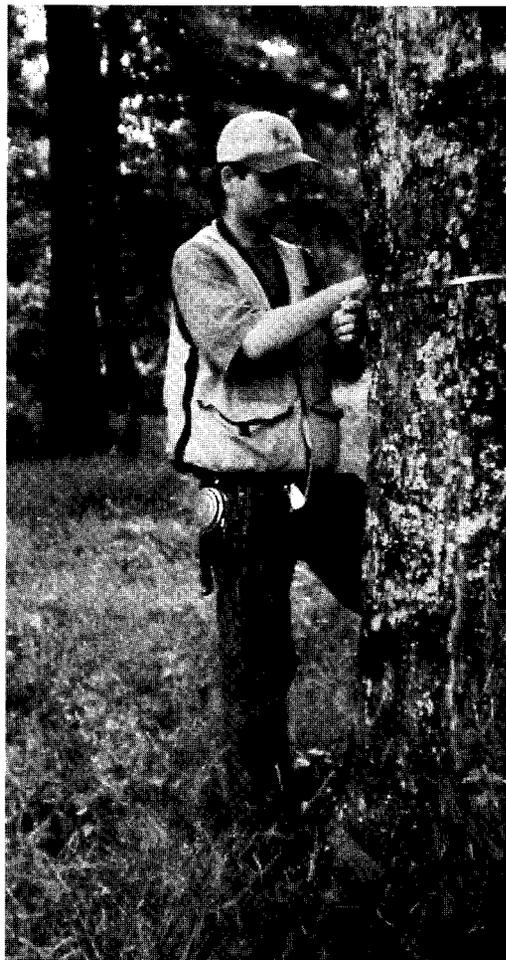
Understanding and managing large-scale ecosystems, including their forested components, is a complex problem that requires integration of analyses across numerous disciplines, including ecological and social sciences. This is fundamental to understanding how these systems might respond to cultural and environmental changes in the future and how policy and management decisions might affect these outcomes.

inventory
and
monitoring

The goal of this CCT is to provide current resource information and analyses on a variety of issues, including forest health, and to improve techniques to inventory, monitor, and evaluate forest resources.

The South has a wide diversity of tree species, forest conditions, and landowners with varying objectives, and experiences high levels of product demands. Because of the rapidly changing condition of the resource and its importance to the national economy, inventory and monitoring is a high priority across all ownerships.

Current initiatives, such as the development of a Southern Annual Forest Inventory System (SAFIS), provide an opportunity for scientists to help develop improved inventory, monitoring, and evaluation techniques.



Other issues to be addressed in this integrated context include the assessment of nontraditional resources and the development of spatial forest information through remote sensing and other technologies.

organization
of the
Southern
Research
Station

 The headquarters of the Southern Research Station is in Asheville, North Carolina, on 11 acres of land leased from the University of North Carolina.

The headquarters building houses the Station Director and staff, and the administrative units of engineering, data processing, systems analysis, personnel, procurement, accounting, and communications and editorial services for the field Research Work Units.

The Leadership Team at Asheville provides the vision and leadership that unifies and guides the research programs of the Southern Research Station for the benefit of the forest resources and people of the South. It consists of:

- Station Director
- Assistant Directors for:
 - Resource Planning and Application
 - Research- West (Texas, Oklahoma, Arkansas, Louisiana, Mississippi, Alabama, Tennessee, Kentucky)
 - Research- East (Florida, Georgia, South Carolina, North Carolina, Virginia)
- Administration
- Program Manager for Southern Forest Inventory, Monitoring and Analysis
- Program Manager for Forest Health Monitoring
- Communications Group Leader
- Workforce Diversity Program Manager
- Customer Service Specialist
- Staff Assistant

The Management Team is a larger group that includes the Leadership Team, Program Managers, Administration Group Leaders, and the Research Work Unit Project Leaders.

This group provides the overall leadership and management for the research program and administrative functions.

research
work unit
descriptions

 **Our Research Work Units (RWUs)** are located in offices and laboratories in nine States across the Southern United States. Our work covers the **13** Southern States, with findings that are applicable throughout the Nation and internationally as well. While each RWU has a headquarters location, listed below, subunits are located at additional sites.

Longleaf Pine

**Biological/
Engineering
Technologies**

G.W. Andrews Forestry
Sciences Laboratory
Devall Drive
Auburn, AL
36849

The G.W. Andrews Forestry Science Laboratory is located on the campus of Auburn University.

The modern office and laboratory facility contains well-equipped environmental chemistry and soil laboratories and a large engineering research laboratory. Adjacent buildings house greenhouse, shop, warehouse, and chemical storage facilities.

Vegetation Management Research and Longleaf Pine Research for Southern Forest Ecosystems (SRS-4105). The mission of this unit is to:

- determine the environmental fate and impact of forest herbicides and to develop integrated vegetation prescriptions for multiple resource benefits in southern forestry; and
- develop systems and models for the development of a variety of regeneration and management alternatives for longleaf pine ecosystems.

Long-term longleaf studies and demonstrations are maintained on the 3,000-acre Escambia Experimental Forest in south Alabama.

Biological/Engineering Systems and Technologies for Ecological Management of Forest Resources (SRS-4703). The mission of this unit is to develop an understanding of the interaction between biological and engineering systems in forest ecosystems and to provide engineering knowledge and improved, economically viable forest operations for sustained resource management.

Website for SRS4703: <http://srs4703.usfs.auburn.edu/unit.html>

Upland Forest Ecosystems

Forest Resources
Building
University of Arkansas
at Monticello
PO. Box 3516
Room 211
Monticello, AR
71656-3516

Upland Forest Ecosystems is located at the University of Arkansas, in cooperation with the School of Forest Resources and the Arkansas Agricultural Experiment Station.

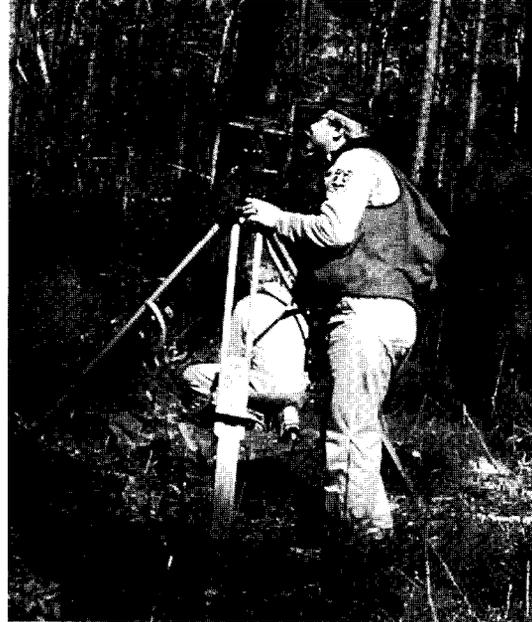
The 1.675-acre Crossett Experimental Forest, located 7 miles south of Crossett, is maintained as a research and demonstration forest.

Managing Upland Forest Ecosystems in the Midsouth (SRS-4106).

This unit provides scientific information to understand, manage, and sustain the ecological processes, structures, and benefits of loblolly pine, shortleaf pine, mixed pine-hardwood, and hardwood forests in the uplands of the Midsouth.

Research includes the development of:

- a better understanding of the environmental factors and ecological processes influencing establishment and growth of forest reproduction which is needed to fully develop silvicultural alternatives for upland forests in the Midsouth
- silvicultural alternatives for regenerating and managing upland forests which requires a better understanding of forest stand dynamics, including the role of disturbance
- a better understanding of the effects of silvicultural treatments on forest stands and interactions between stands which is needed to make landscape-level decisions.



**Southern Pine
Ecosystems**

**Insects and
Diseases**

**Trends in
Recreation and
Wilderness**

Forestry Sciences
Laboratory
320 Green Street
Athens, GA
30602-2044

The Forestry Sciences Laboratory is on **4** acres of land near the University of Georgia's School of Forestry.

The facility, containing 17,962 square feet of laboratory space, and 14,000 square feet of office space, consists of two buildings, an insectary, greenhouses, a nursery, a fully equipped woodworking and fabricating shop, and a wood products testing laboratory. The nearby 4,500-acre Scull Shoals Experimental Forest is the site of several silvicultural research studies.

Disturbance and the Management of Southern Pine Ecosystems (SRS-4104). The unit conducts research to sustain and enhance the productivity of southeastern forests, whether intensively cultured or extensively managed. Specific research is being conducted in the areas of forest ecology, fire ecology, smoke management, and harvesting and wood properties of forests of the Atlantic Coastal Plain.

Insects and Diseases of Southern Forests (SRS-4505). The unit conducts research to acquire the knowledge necessary to develop effective, practical, and environmentally acceptable management options to control insects attacking seed orchards, tree nurseries, and plantations. Interactions of land use and forest management practices on arthropod populations are studied with regard to their functional role as decomposers, as pollinators of rare plants, and as prey for endangered species, such as the red-cockaded woodpecker.

The unit also works to develop control measures for nonnative, invasive species, such as the fungi that cause dogwood anthracnose and butternut canker.

Assessing Trends, Values, and Rural Community Benefits from Outdoor Recreation and Wilderness in Forest Ecosystems (SRS-4901). The unit applies research theory and methodology to assessments of outdoor recreation and wilderness, with emphasis on supply-and-demand trends, economic values, and benefits to rural communities.

Legal, Tax, and Economic Influences

T-10034 U.S. Postal Building
701 Loyola Avenue
New Orleans, LA 70113

Evaluation of Legal, Tax, and Economic Influences on Forest Resource Management (SRS-4802). This is the Forest Service’s principal unit concerned with effects of Federal, State and local taxes, laws, and regulations on forestry.

The unit also analyzes export markets for southern softwood products and the economics of innovative silvicultural practices for southern forests.

Ecology and Management of Southern Pines

Southern Pine Beetle

Southern Forest Resource Utilization

Alexandria Forestry Center
2500 Shreveport Highway
Pineville, LA 71360

The Alexandria Forestry Center in Pineville was constructed in 1963 to house the Forest Sciences Laboratory of the Southern Forest Experiment Station (now Southern Research Station), the Supervisor’s Office of the Kisatchie National Forest, and Forest Pest Management of State and Private Forestry.

The Center is located on about 27 acres and includes an insectary, two greenhouses, a forest products building, and a main office/laboratory building. The nearby Palustris Experimental Forest consists of two separate tracts that total 7,500 acres.

Ecology and Management of Even-aged Southern Pine Forests (SRS4111). This unit provides fundamental knowledge on the ecology and physiology of southern pine species and even-aged management options to enhance and sustain the productivity of southern pine ecosystems. The program is the basis for improving our knowledge of the physiological responses to silvicultural treatments during plantation establishment and development.

Southern Pine Beetle: Ecology, Behavior, and Management (SRS-4501). This unit is responsible for Forest Service research on improved methods for predicting and managing the southern pine beetle through acquisition and use of basic knowledge of its ecology and behavior.

Utilization of Southern Forest Resources (SRS-4701). This unit defines and applies fundamental chemistry, material science, and engineering principles to the utilization and processing of southern forest resources in an environmentally sound way.

**Southern Institute
of Forest Genetics**

Harrison
Experimental Forest
23332 Highway 67
Saucier, MS
39574-9344

The Southern Institute of Forest Genetics was established July 1, 1954 on the Harrison Experimental Forest, located 25 miles north of Gulfport, MS.

The Experimental Forest covers 3,850 acres that typify about 31 million acres of land with similar soils and topography in the South. The Institute is housed in some buildings that date back to the mid-1930's, constructed by the CWA, WPA, and CCC; four new laboratories for molecular genetic analyses on southern pines were recently added to the site.

Southern Institute of Forest Genetics (SIFG) (SRS-4153). Research at the SIFG focuses on developing procedures to improve the health, productivity and genetic diversity of southern forests through better understanding of the genetics, ecology and evolutionary relationships in forest ecosystems.

SRS-4153 Website: www.data.sync.com/muse/sifg/

**Wood Products
Insect Research**

**Forest Inventory
and Analysis**

P.O. Box 6124
Mississippi State, MS
39762-6124

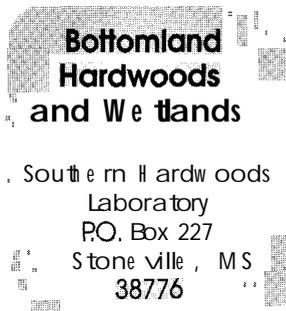
The Forestry Sciences Laboratory, established in 1969 to house seed tree research, genetics, and rural fire research, is on a 7-acre tract adjacent to Mississippi State University.

Computer facilities include data base management, image analysis, and geographic information systems.

Wood Products Insect Research (SRS-4502). The mission of this unit is to define the role of termites in forest ecosystems, to improve protection of wood against damage, and to understand the impact of termites on forest health. All new termiticides must undergo extensive laboratory and field testing by this unit prior to EPA registration.

Forest Inventory and Analysis (SRS-4801). This unit, part of SRS-4801 headquartered in Asheville, NC, develops, analyzes, and maintains forest resources information for Southern States and conducts research to provide improved inventory and evaluation techniques.

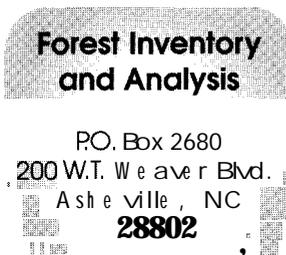
SRS-4801 Website: www.srsfia.usfs.msstate.edu



The Southern Hardwoods Laboratory is located on a 3.45-acre site that is part of the Mississippi State Forestry and Agricultural Experiment Station.

The 18,000-square-foot building houses offices, a photo lab, and lab facilities for plant pathology, entomology, plant physiology, and soils. The site also has 2,000 square feet of greenhouse space, and separate soils building, and an insectary. The 2,900-acre Delta Experimental Forest, 3 miles north of Stoneville, is the site of numerous research plots.

Center for Southern Bottomland Hardwood and Wetland Forest Ecosystems (SRS4155). This unit conducts research and technology transfer in southern pine genetics/diseases, wood products insects, forest inventory, and management and ecology of bottomland hardwoods, including tree seed technology and regeneration, stand management and forest health, threatened, endangered, and sensitive terrestrial and aquatic fauna, hydrology, and wetlands restoration.



The Southern Research Station occupies 11 acres of land leased from the University of North Carolina and houses the Station Director and staff, administrative units, and SRS-4801.

A Forest Health unit of the National Forest System's Southern Region is also located at this site.

Forest Inventory and Analysis (SRS-4801). This unit develops, analyzes, and maintains forest resources information for Southern States and conducts research to provide improved inventory and evaluation techniques. In 1996, this unit became part of the Southern Research Station's new Southern Forest Inventory, Monitoring and Analysis Program which consolidates Forest Inventory and Analysis research conducted at Asheville, NC and Starkville, MS, Forest Health Monitoring for Southern States and the Biometrics unit, both in Asheville, NC.

SRS-4801 Website: www.srsfia.usfs.msstate.edu

**Southern
Appalachian
Hardwoods**

Bent Creek
Research Forest
1577 Brevard Road
Asheville, NC
28806

The Bent Creek Research and Demonstration Forests located adjacent to Asheville, NC on land that was once part of the Vanderbilt Estate.

Today, scientists at this 6,300-acre tract study regeneration of red oak, site classification, and intermediate stand management. The demonstration forest allows resource managers, students, and private landowners to learn the latest forest management practices.

Ecology and Management of Southern Appalachian Hardwood Forests (SRS4101). This unit's mission is to develop and disseminate the scientific knowledge and silvicultural techniques needed to provide a full range of benefits in Southern Appalachian hardwood forests.

**Watershed
Responses to
Disturbance**

Coweeta Hydrologic
Laboratory
3160 Coweeta Road
Otto, NC
28763

The Coweeta Hydrologic Laboratory is located in the 5,400-acre Coweeta Basin, near Franklin, NC; watershed responses have been studied here for over 60 years.

This world-renowned research operation was selected by the National Science Foundation as one of eleven Long-Term Ecological Research sites, and was included in the International Biological Program, the International Hydrologic Decade, and UNESCO's "Man and the Biosphere" Program.



Evaluation of Watershed Ecosystem Responses to Natural, Management, and Other Human Disturbances of Southeastern Forests (SRS-4351). This unit's mission is to evaluate, explain, and predict how water, soil, and forest resources respond to management practices, natural disturbances, and the atmospheric environment; and to identify practices which mitigate impacts on these watershed resources.

**Biological
Foundations
of Sustainability**

**Forest Health
Monitoring**

**Economics of
Forest Resources**

Forestry Sciences
Laboratory
3041 Cornwallis Road
PO. Box 12254
Research Triangle
Park, NC
27709

The Forestry Sciences Laboratory was built in 1962 on a 26-acre tract donated by the Research Triangle Foundation. A greenhouse, nursery, and service buildings were added later.

Its location enables close contact with the forestry schools and libraries at Duke University and North Carolina state University.

Biological Foundations of Southern Forest Productivity and Sustainability (SRS-4154). This unit's mission is to quantify aboveground and belowground processes governing forest productivity and sustainability. This research is conducted by scientists at two locations, Research Triangle Park, NC, and Athens, GA.

SRS-4154 **Website:** www.emapfhm.gov/soils/soilhome.htm

Forest Health Monitoring (SRS-4803). This unit monitors the Nation's forests in order to detect unexpected deviation from established baseline conditions or trends, identify cause, and define basic relationships sufficient to predict consequences.

Economics of Forest Protection and Management (SRS-4851).

This unit's mission is:

- to analyze the economic status, trends, and opportunities for forest management in the South, including the effect of public programs and regulations on private forest landowners;
- to perform economic and impact assessments of forest insect, disease, and other forest health questions;
- to develop and implement regional forest resource analysis models of inventory, multiple-use, and land area interactions;
- to evaluate economic and social impacts of changing public values, laws, and programs.

SRS-4851 Website: www.emapfhm.gov/econ/econhome.htm

Southern Global Change Program

Southern Global
Change Program
1509 Varsity Drive
Raleigh, NC
27709

The Southern Global Change Program is housed at the Air Resources Consortium on the North Carolina State University campus.

Southern Global Change Program (SRS-4852). Through cooperative research efforts and in-house research, this unit is charged with providing increased understanding of forest ecosystem response to global change. Global change impacts include air pollution, current and potential future climate stress, and changing human resource demands. The program develops and evaluates science-based strategies to ensure sustained productivity and ecosystem health.

SRS-4852 Website: <http://sgcp.rrc.ncsu.edu/index.html>

Center for Forested Wetlands

Center for Forested
Wetlands
2703 Savannah
Highway
Charleston, SC
29414

The Center for Forested Wetlands Research is located in Charleston, SC. Facilities include a soil and water laboratory, offices, greenhouses, and a library. The Center also administers the 6,100-acre Santee Experimental Forest, northeast of Charleston.

Center for Forested Wetlands Research (SRS-4103). The specific mission of the Center is to develop, quantify, and synthesize ecological information needed to sustainably manage and restore the structure, functions, and productivity of forested wetland landscapes.

Endangered (TES) Species

Department of Forest
Resources
Clemson University
Clemson, SC
29634

This unit has office and laboratory space at Clemson University's School of Forest and Recreation Resources.

Endangered, Threatened, and Sensitive Wildlife and Plant Species in Southern Forests (SRS-4201). This unit's mission is to determine habitat and population relationships of wildlife and plant species associated with fragmented and isolated forest communities.

SRS-4201 Website:
srsfia.usfs.msstate.edu/srs/srs4201/srs4201a.htm

**Wildlife Habitat
and
Timber Resources**

Wildlife Habitat
and Silviculture
Laboratory
Box 7600, SFA Station
506 Hayter Street
Nacogdoches, TX
75961

The Nacogdoches Wildlife Habitat and Silviculture Laboratory is located near the 2500-acre Stephen F. Austin Experimental Forest.

Integrated Management of Wildlife Habitat and Timber

Resources (SRS-4251). This unit investigates questions concerning wildlife and habitat interactions. It is the only Forest Service wildlife research unit in the South whose mission focuses on game and nongame species in addition to threatened and endangered species.

**Coldwater Streams
and Trout Habitat**

Department of Fisheries
& Wildlife Sciences
Virginia Polytechnic
Institute and State
University
Blacksburg, VA
24061

Coldwater Streams and Trout Habitat in the Southern Appalachians (SRS-4202).

This unit's mission is to acquire new knowledge about the factors that influence the distribution, abundance, and productivity of trout and other coldwater fish in the Southern Appalachians and to provide the technical basis for protecting, enhancing, and restoring coldwater streams and their fauna.

The Center for Aquatic Technology Transfer is part of this unit.

**Tree Quality,
Processing and
Recycling**

Brooks Forest Products
Center
Virginia Polytechnic
Institute and State
University
1650 Ramble Road
Blacksburg, VA
24061

Integrated Life Cycle of Wood: Tree Quality, Processing, and Recycling (SRS-4702).

This unit's mission is to enhance wood resource conservation and sustainability through advanced timber analysis and wood processing, and effective wood product recovery, reuse, and recycling.

SRS4702 **Website:** www.se4702.forprod.vt.edu

research
and
publication
highlights

1997 Success Stories for the Southern Research Station



The Productivity
and
Sustainability
of
Southern Forest
Ecosystems
in a Changing
Environment

 Terrestrial ecosystems are experiencing changes in their chemical and physical environments at unprecedented rates. The Southern Global Change Program of the Southern Research Station is funding research focused on the regional consequences of environmental change on forest ecosystems through partnerships with major forestry schools and universities throughout the South, forest industry, the Department of Energy's Oak Ridge National Laboratory, other Federal and State agencies, and the National Council of the Paper Industry for Air and Stream Improvement (NCASI). Scientists funded by the program have summarized their first five years of research in *"The Productivity and Sustainability of Southern Forest Ecosystems in a Changing Environment."*

In this book, to be published in early 1998, by Springer-Verlag, scientists report that photosynthesis and plant growth are substantially enhanced by elevated carbon dioxide. Depending on study conditions, net rates of photosynthesis in loblolly pine increased by 50 to 130 percent and were accompanied by large increases in leaf area, branch growth, root growth, and total plant biomass. Ambient levels of tropospheric ozone continue to be linked with an annual 3 to 5 percent reduction in tree growth. Additional growth reductions are predicted under the higher levels of ozone anticipated in the future. Several models indicate that the positive growth response to elevated carbon dioxide concentration may outweigh the negative depression of growth caused by ozone, increasing temperature, and increased drought frequency.

Ongoing landscape and regional scale research will refine future estimates of forest productivity under global change and provide adaptation and mitigation strategies to ensure a sustainable forest resource for the region.

A rounded rectangular box with a textured background containing the text: Recycling Wood Products That Have Received Preservative Treatments

 Disposal of wood products treated with preservatives is difficult because the treated materials' resistance to biodegradation, as well as the hazardous nature of the treatment chemicals themselves, eliminates the landfill option. Research efforts routinely have considered grinding waste wood into particles that can be used in composite panel products. This approach creates nearly as many environmental and health problems as it solves. Therefore, recent work has considered alternative approaches to utilization of treated wood products.

In their work with cooperators at Louisiana State University, researchers in the Southern Research Station's Pineville, LA, group are examining the possibility of making laminated composites from recovered utility poles. This work has shown that defect-free portions of 25-year-old treated poles retain strengths comparable to those of freshly treated poles and untreated southern pine.

Although decay resistance, dimensional stability, and lumber recovery showed a commensurate decrease over time, the wood fiber's gluability actually improved. Experiments also showed that recovered wood could be used to prepare laminated beams that were as strong as defect-free southern pine lumber. These observations suggest that high-performance, high-value, engineered wood laminates may be produced from recovered utility poles.

A rounded rectangular box with a textured background containing the text: Positive Returns From Investment in Fusiform Rust Research

 Fusiform rust is a widespread and damaging disease in the South, affecting loblolly and slash pines. For three decades, the Forest Service, along with academic institutions and forest industry, has pursued extensive research to protect susceptible plantations.

An increasing number of trees planted in the southern States now embody genetic resistance to fusiform rust. While infection rates are down, it was not clear that this expensive program had been—from a broader economic perspective—a good investment.

Research examined returns on investment in the fusiform rust program. Results from the study show that fusiform rust research

has been a good financial investment. Under the most conservative assumptions evaluated, the benefit-to-cost ratio ranged from 2:1 to 6:1. The present net value (research benefits minus research costs) ranged from \$65 million to \$288 million.

The study also looked to define potential returns from future research. Total elimination of fusiform rust could bring about \$20 million to \$40 million in additional benefits per year. Results also suggest that technology transfer to small landowners will continue to play a very important role in realizing the benefits of research. Research Paper SRS-4, "*Positive Returns from Investment in Fusiform Rust Research*," was published in May, 1997.

Southern Forest
Inventory
and
Analysis

 Given the dynamics of forest change throughout the South, land managers and other decision makers are finding it increasingly necessary to have accurate and timely data from across many jurisdictions. Traditional methods have provided inventories on a cycle spanning approximately 10 years which has meant that current or recent data were available for only a few States at a time. The Southern Research Station FIA group has concentrated on research related to development of a Southern Annual Forest Inventory System (SAFIS). Key collaborators have become participating partners in the Station's efforts. As a result, research units throughout the South are enjoying the benefits of increased organizational effectiveness. The FIA Website supports the national FIA Data Base Retrieval System (DBRS) which contains forest resources information from all national FIA units east of the Rocky Mountains.

Restoration of
Longleaf Pine
in the Southeast:
the Genetic
Resource

 Large-scale harvest throughout the South in the late-19th and early-20th centuries—followed by only sporadic natural regeneration—left many areas devoid of longleaf pine. Because the species is hard to plant and its early growth is slow, reforestation efforts of the Civilian Conservation Corps and others, favored slash and loblolly pine.

Over the last 30 years the total area has diminished even more—from 12.2 to 3.8 million acres. Restoration of the longleaf pine

ecosystem will require a lot of planting or direct seeding of this species, and choosing the proper seed source will be essential to ensure the long-term success of restoration plantings. The Saucier, MS, Forest Genetics group has surveyed genetic variation in longleaf pine by collecting seed from 23 geographic sources. Allozyme analysis indicated that sampled stands and seed orchards possessed the full range of genetic variability present in the sampled old-growth stand.

The Saucier group has demonstrated that if land managers exercise some judgement in making seed collections, genetic variations will not be a barrier to re-establishing the dominant species in the longleaf pine ecosystem.

Restoring
Bottomland
Hardwood Forests



The Lower Mississippi Alluvial Valley once supported the largest expanse of forested wetlands in the United States, but much of this land was cleared for agricultural use. Large areas cleared in the 1960s that flood too frequently are now being planted back to bottomland hardwoods.

Forest Service researchers in Stoneville, MS developed the basic methods of planting hardwoods; the need to develop new restoration methods continues. The objectives of this research are to develop techniques for restoration of all site functions so wetland values are rapidly recaptured and to evaluate new technologies for establishing bottomland hardwood trees on difficult sites.

A reforestation program that uses the eastern cottonwood, a fast-growing native species, as a nurse-crop for the slower growing red oaks is currently under study. The cottonwood/red oak interplanting scheme promises to be an excellent way to establish a diverse stand that attains a forest-like vegetative structure in 2 to 3 years. Additional economic and ecological advantages are predicted. When the cottonwood are harvested after 10 years to release the interplanted red oak saplings and used for pulpwood, the private landowner has the opportunity to garner income. Wildlife will benefit immediately in the young cottonwood forest and over time as woody debris accumulates on the forest floor. Finally, ecological processes will be restored faster, including soil quality and hydrologic characteristics.

Under the leadership of the USDA Forest Service, this research is part of a multi-organizational partnership that includes the USDI Fish and Wildlife Service, USDA Natural Resources Conservation Service, Crown Vantage, International Paper Company, National Council of the Pulp and Paper Industry, Mississippi State University.

Southern
Appalachian
Forest Ecosystem
Restoration



Fire has played a significant role in shaping the structure and function of forest ecosystems in the southern Appalachians. Fire-dependent ecosystems are deteriorating, and fire-intolerant species increasingly dominate the landscape. Attendant problems include a loss of species diversity, and an increased risk of catastrophic wildfire, insect infestation, and other forest pathologies.

Researchers at the Coweeta Hydrologic Laboratory have been studying the use of fire as a means of restoring ecosystems. They are evaluating the effects of alternative burning techniques-on vegetation composition, pine regeneration, and site nutrient pools. Research has shown that fell-and-burn treatment regenerates several pine species and increases vegetation diversity. However, nitrogen losses that result from burning the downed material and scorching the forest floor can be significant and such treatment is expensive.

As part of the Wine Spring Creek Ecosystem Management Project, the Coweeta group has been studying an alternative approach-a treatment called “stand replacement,” because its objective is to simulate an intense wildfire. With this prescription, fire is introduced into stands that otherwise have not been treated. Further, no artificial regeneration is conducted following treatment.

First-year findings have shown several positive results. For example, nitrogen losses were low and pine and oak regeneration increased. In addition, the treatment resulted in a “mosaic” of fire effects, which increased the stand’s overall structural diversity.

**Landscape Analysis
for Ecosystem
Management**

 Ecosystem management implies that land managers take a landscape perspective that includes all landowners when making decisions. This study investigated how different landowners manage their lands and how landowner category and economic factors influence land use decisions and the resulting structure of landscapes.

Satellite photos of the Olympic Peninsula and the Southern Appalachians were used to measure land cover changes over a 15-year period and the changes were then associated with various site characteristics. In these two regions of the country, national forests were shown to have more forest cover with less fragmentation than comparable lands managed by private owners.

This research also identified distinctive land use changes and landscape patterns by landowner category. These “landscape signatures” provide ways to forecast how landscape structure may change in mixed-owner settings. Accordingly, they provide a way for public land managers to anticipate where change is most likely to occur on lands adjoining national forests. Management could then be designed to complement or offset changes anticipated on these adjoining lands.

**Southern Pine Beetle
Induced Mortality
of Pines with Natural
and Artificial Red-
cockaded Woodpecker
Cavities
in Texas**

 Southern pine beetle infestation is a major cause of mortality for red-cockaded woodpecker cavity trees in loblolly and shortleaf pines in national forests of the South. Using artificial cavity inserts has become an integral part of managing for the endangered red-cockaded woodpeckers (RCW). When a natural cavity tree dies, an artificial cavity insert is placed in another tree within the RCW cluster. The objective of this research was to determine whether southern pine beetles (SPB) infest and kill pines with artificial cavity inserts at a higher rate than those with naturally excavated cavities.

Between 1991 and 1996 SPB infestation rates of pines with natural and artificial cavities on the Angelina National Forest were examined. The rate at which SPB infested and killed pines with natural cavities did not differ significantly from the rate in pines with artificial cavity inserts. Southern pine beetles infested and killed 20 natural cavity trees and 19 artificial cavity trees during

the S-year study. Partners in this research included the Angelina National Forest, the National Forests and Grasslands in Texas, and the Department of Entomology at Texas A&M University.

Integrating
Crown and
Belowground
Physiological
Information with
Environmental Data

 Southern pine forests are affected by environmental change. To maintain healthy, sustainable forests, managers must manipulate forest stands as the environment changes. To help forest managers meet this challenge, the USDA Forest Service and Louisiana State University designed a research project on the Palustris Experimental Forest in central Louisiana to provide information on the physiological mechanisms that regulate southern pine responses to environmental change.

Interactions among soil and atmospheric environments, resource dynamics, and tree physiology and growth are under study in a young loblolly pine plantation subjected to operational silvicultural treatments. Photosynthesis, transpiration, stomatal conductance, and predawn and daily xylem water potentials were evaluated at two levels in the crown after thinning and fertilization treatments.

Fertilization decreased average photosynthesis rates, transpiration, stomatal conductance and daily xylem water potentials because light was reduced, air temperature lowered, and vapor pressure was deficit within the canopies of fertilized plots. The physiological parameters were influenced by the interactions of thinning and fertilization. Fertilization significantly increased the expansion of first flush internodes in the upper crown. New root growth was stimulated by fertilization in the second half of the growing season. The timing of root growth responses was related to branch phenologies in the upper and lower crown. New root growth was linked to source-sink activities in the crown.

This research will provide fundamental knowledge about stand-level root growth and development in response to environmental change and silvicultural treatment. It will also provide an understanding of key relationships among canopy and root system processes that regulate carbon fixation and resource acquisition in managed southern pine forests. This information will advance conservation by helping forest managers respond positively to shifts in forest health and productivity.



Much of the work of the Southern Research Station includes direct cooperation with other Federal agencies, universities, private corporations, and other public and private entities. Following is a list of the entities with cooperative agreements, grants, and interagency agreements that involved transfer of funds in 1997. A total of \$6,422,238 was involved in research studies and support under these agreements. An additional \$815,372 was available under grants from other Federal agencies.

Cooperative Agreements

| | | | | |
|---|--|--|--|--|
| Alabama A&M Alabama Forestry Commission Arkansas Nature Conservancy Arkansas Natural Heritage Commission University of Arkansas Arkansas Tech University Association of Research Directors Auburn University Bowling Green State University University of California; Berkeley and Davis | Clemson University Colorado State University University of Connecticut Dartmouth College Delta State University Desert Research Institute Duke University Florida A&M University University of Florida Freshwater Institute Furman University Georgia Forestry Commission | University System of Georgia UGA Research Foundation, Inc. International Centre for Research in Agroforestry Louisiana College Louisiana Agricultural Experiment Station Louisiana State University Marine Biological Laboratory Michigan Technological University University of Minnesota Mississippi State University Montana State University | University of Nevada North Carolina A&T State University North Carolina Geological Survey North Carolina Agricultural Research Service North Carolina State University Northern Illinois University Oklahoma State University Purdue University Thomas Schmidt Southern University University of Southern Louisiana Tall Timbers Research, Inc. | University of Tennessee Tennessee Agricultural Experiment Station Texas Agricultural Experiment Station Tuskegee University Virginia Polytechnic Institute and State University Commonwealth of Virginia University of Wales University of Washington Washington State University University of Wisconsin |
|---|--|--|--|--|

Challenge Cost Share
Agreements

 The Research Challenge Cost Share program leverages federal forestry research funding dollars with matching resources from nonfederal sources, to accomplish research objectives. In 1997, seven proposals were funded.

1

Monitoring Productivity and Environmental Quality in Southern Pine Plantations; RWU SRS-4 111: \$17,000. Partners: Temple-Inland Forest Products Corporation: \$15,000; International Paper Company: \$2,000. Louisiana State University School of Forestry, Wildlife and Fisheries. Partners will also provide the equivalent of about \$75,000 in study installation costs.

2

Forest Type and Area Estimation Using Satellite Data; RWU SRS-4107: \$25,000. Partners: National Council of the Paper Industry for Air and Stream Improvement (NCASI): \$50,000. Rutgers-The State University of New Jersey; University of Arkansas.

3

Evaluation of Burkholderia cepacia Strain RAL3 as a Biocontrol Agent for Soil-borne Diseases of Loblolly Pine Seedlings; RWU SRS-4505: \$5,680. Partner: Agrium, Inc: \$5,680.

4

Allozyme and RAPD Marker Diversity in American Chestnut; RWU SRS-4 15 3: \$7,000. Partner: American Chestnut Foundation (ACF); \$7,000.

5

Effects of Intensive Silvicultural Treatments on Quality, Strength, and Stiffness of Wood from 17-year Slash Pine; RWU SRS-4 104: \$25,000. Partner: Georgia Pacific Corp: \$27,000.

6

Fate of Applied Nitrogen in Short Rotation Hardwood Plantations, Adjoining Buffers, and Wetlands; RWU SRS-4103: \$12,000. Partners: Westvaco: \$12,000. University of Charleston; North Carolina State University.

7

Productivity Processes: Understanding the Impact of Competition Control on Nutrient and Carbon Reserves for Maintaining Soil Productivity; RWU SRS-4154: \$10,000. Partner: International Paper Company; \$10,000, plus the equivalent of about \$30,000 in support of study maintenance.

other
programs



environmental
education

 The Southern Research Station participates in the Forest Service's summer intern Environmental Education Outreach Program.

In 1997, four college student interns developed and presented programs to youth in seven southern states. At sites such as YMCA's, Boys and Girls Clubs, and Day Camps, they conducted environmentally-themed programs with diverse groups of youngsters in rural, small town, and urban settings. Over the course of eight weeks, they contacted 1,806 youngsters.

The programs were developed around the themes of ecosystem management, sustainability, and stewardship, using activities appropriate to the age groups at each site.

our
workforce

 Following the consolidation of the two Southern Stations and its accompanying reduction in the number of employees on board, we have stabilized our workforce at under 450 employees.

Our program of work is built around the direction of a cadre of fully panelled scientists, with a support network of science technicians, administrative specialists, laborers, and other personnel. Every employee serves an important, vitalrole in accomplishing our science program.

The Southern Research Station is committed to building a diverse workforce and serving our diversified customer base. We have

strengthened our programs in customer service, communications, and workforce diversity to ensure that we are responsive to the needs of our external and internal customers. Our goal is to provide adequate access to our research results to everyone who can benefit from the information.

The USDA Center of Excellence in Forestry at Alabama A&M University was established. Its objectives are to:

- enhance faculty development, outreach, recruitment and retention of students;
- provide undergraduate and graduate education and training to increase the availability of under-represented groups in the field of Forestry and other Natural Resource Sciences; and
- strengthen faculty research capabilities and graduate education in Forestry at Alabama A&M and conduct appropriate forestry research mutually beneficial to the Forest Service programs and the University.

The Liaison for this program is a member of the Southern Research Station Management Team.

awards



Grants and Agreements Specialist **Jean Cook** received the prestigious Secretary of Agriculture Award for Personal and Professional Excellence.

She was selected for her consistent, outstanding performance and dedication to the Forest Service mission in negotiating, preparing, and administering research grants and agreements.



Recipients of the Chief's Honor Awards were recognized during a ceremony in Washington, D.C. on April 10, 1997.

Richard Hemingway's award for "Superior Science" was for outstanding leadership in understanding the chemistry and significance of secondary plan metabolites, particularly tannins, and utilizing an international team of collaborators in the process.

Ken Stolte's "International Award" was for his "extending the Forest Service mission globally by exporting Forest Health Monitoring technology that helps other countries manage for sustainable forests.

David Cleaves received the "Excellence in Technology Transfer Award" for his work in developing a protocol integrating decisions science principles to Forest Service environmental analysis and decision processes.

Ivory Walker received the "Multicultural Organization Award" for his activities in the Asheville/Buncombe County community and for his active representation of African Americans at the Southern Research Station.

 The recipients of the Chief's "Ecosystem Management Award" were members of the **Southern Appalachian Assessment Team**, who come from both the Southern Region of the National Forest System, and the Southern Research Station.

This project was successful partly because of the strong relationships between the Region and the Station and the equally strong partnerships with other agencies, organizations, and the public.

The Assessment Team also won the Vice President's Hammer Award.

 **Alexander Clark** was presented with the Society of American Foresters Award of Excellence for Research. Clark was recognized for his outstanding research activities which have made significant contributions to forestry in the Southeast.

Among many other accomplishments, he developed the Total Tree Multi-product Cruise Program for IBM compatible computers.

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