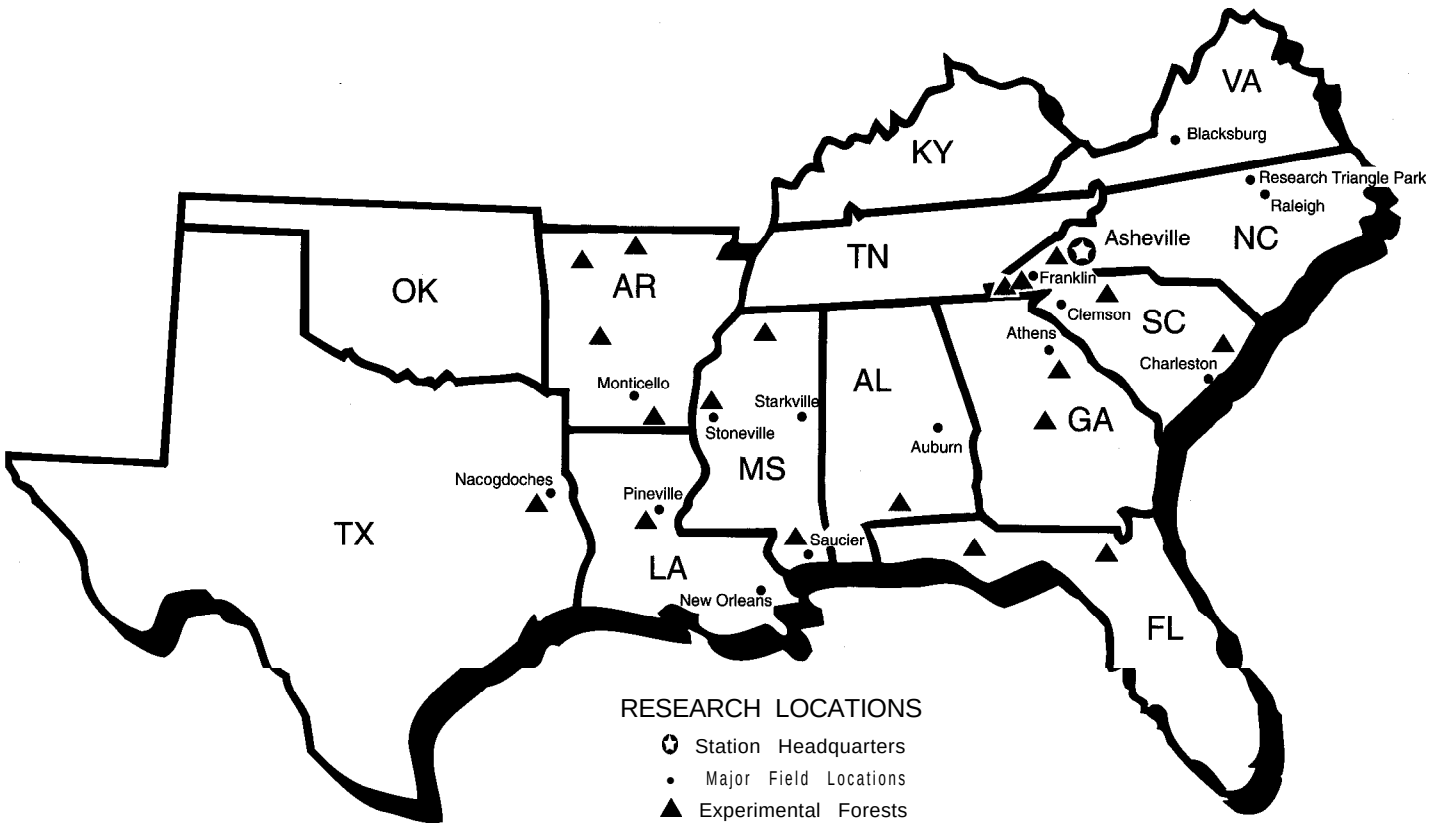
Annual Report for 1999

Southern Research Station

United States
Department of
Agriculture

Forest Service



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

Southern Research Station

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

February 2000

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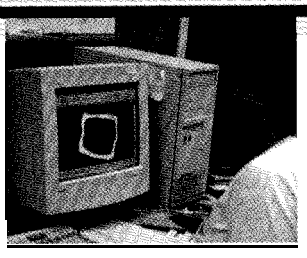

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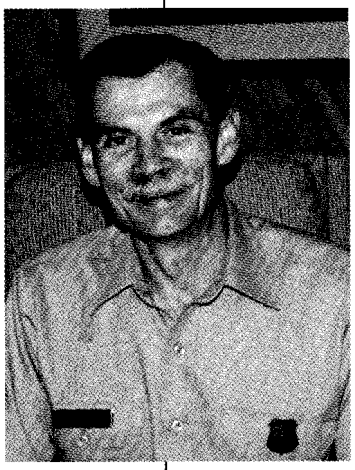
Report for the Southern Research Station for FY '99



I am pleased to provide you with the Southern Research Station's (SRS) annual report for fiscal year 1999 (FY99), which covers the period from October 1, 1998 to September 30, 1999. It includes an overview of our research, development, and technology transfer; examples of accomplishments; and a list of our publications for the year. While this report highlights accomplishments from FY99, many are based on the long-term research that underpins our continuing, valuable contribution to the body of knowledge we provide for the sustainability of forested lands and natural resources.

The SRS has a long history of excellence in forest research, and has added to and enriched that legacy this year. We received significant recognition in a high number of the Forest Service Chief's Honor Awards as well as those from our cooperators and customers. Our products were outstanding in quantity and quality-ranging from publications like the general technical report on sycamore pests, to our annual forest inventory, to commercially published books on outdoor recreation and social aspects of forestry.

In cooperation with the Southern Region of the USDA Forest Service and other agencies, we have already begun to work on the charge from the Chief of the Forest Service to conduct an assessment of all southern forest resources. We look forward to the release of the Ozark-Ouachita Highlands Assessment in early 2000.

Year 2000 brings challenges, primarily in serving our customers' needs within shrinking Federal budgets. We have gone a long way toward increasing our capacity to do work by converting to a new computer system and implementing upgrades for timekeeping, travel, financial record keeping, and purchasing. The SRS Web site attracted a half million hits from over 70,000 individual visitors, and has been recognized as a government Internet leader and innovator.

We are committed to meeting the needs of the American people in applying research findings and new technological developments to sustainable land and resource management. As always, we encourage you to contact us with any questions you may have about the work we do.

Web site: http://www.srs.fs.fed.us

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PETER J. ROUSSOPOULOS
Director

FY 99 Accomplishment Summary

Research Work Units	*25*
Publications	*528*
Web sites (research work units).	*16*
Web sites (other SRS)	*4*
Publication requests filled	
Hard copy	*33,500*
Online-electronically downloaded	*151,000*
Site tours	*283*
Presentations	*617*
To scientific societies (invited).	*192*
To lay organizations (invited)	*181*
To other science groups	*244*
International activities	*65*
Conservation Education Intern Program contacts	*8,000*
Total employees..	*470*
Scientists..	*132*
Budget (Research funds only)	*$39,691,000*
Awards to States, universities, and other Federal agencies (all funds)	*$8,478,648*
External funding received from non-Federal Sources and other Federal agencies	*$2,724,439*
Collaborating organizations	***118***

Caring for the Land and Serving People

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Your Tax Dollars at Work

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The Basics: Your Tax Dollars at Work

Snapshot of the 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.***

The Southern Research Station (SRS) is part of the Nation's largest forestry research organization—USDA Forest Service Research and Development. Since early in the 20th century, SRS scientists 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 tree plantations and natural stands, watershed management, and wildlife habitats.

Working at laboratories, experimental forests, and university campuses throughout the South, SRS scientists produce research results that are useful to producers and consumers of forest products and services. These include commodity and industry associations, conservation groups, landowners, educators, professional societies, legislative bodies, and managers of local, State, and Federal agencies. Our scientific workforce is divided into research work units that are headquartered at 16 locations throughout the South; we are responsible for forest land research, technology transfer, and inventory and monitoring for 13 Southern States. Our research findings reach far beyond benefits to the citizens of the South; they have valuable applications throughout the nation and internationally as well.

Our strategic plan, *The Strategic Framework for the Southern Research Station,* continues to shape our work and budget planning, and supports the Forest Service Natural Resource Agenda. The Natural Resource Agenda focuses on four key areas that need to be addressed on a national basis: watershed health and restoration, recreation, forest roads, and sustainable forest ecosystem management.

This annual report includes updates about the SRS strategic framework, accomplishments during FY99, an overview of our research work units (RWU) and experimental forests, and new activities in research and development.

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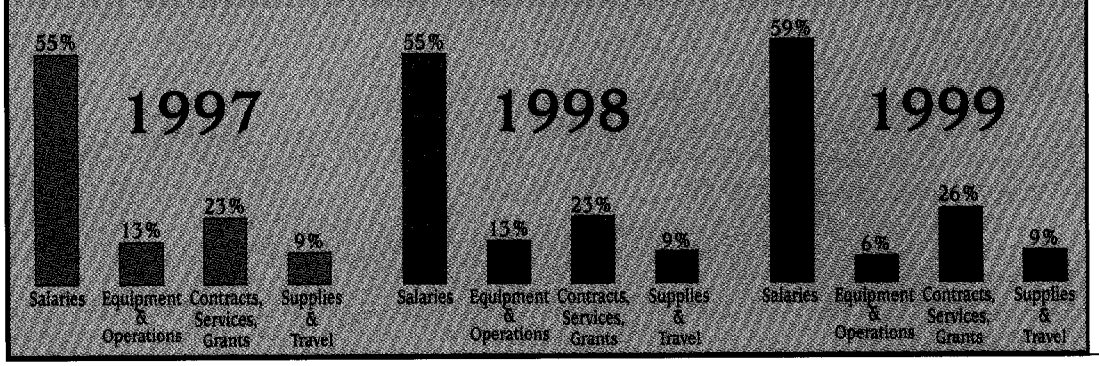
The Basics: Your Tax Dollars at Work

Allocations to Resource Categories

FUNDAMENTAL PLANT SCIENCE	$3,861,000
SILVICULTURAL APPLICATIONS	4,168,000
QUANTITATIVE ANALYSIS	1,216,000
FOREST AND RANGELAND MANAGEMENT	1,722,000
FOREST OPERATIONS ENGINEERING	958,000
INSECTS/DISEASES/EXOTIC WEEDS	5,072,000
FIRE SCIENCE	1,007,000
TERRESTRIAL WILDLIFE	1,756,000
AQUATIC HABITAT	857,000
WATERSHED	1,894,000
ATMOSPHERIC SCIENCES	1,441,000
ECONOMICS	1,578,000
WILDERNESS	50,000
SOCIAL/CULTURAL	887,000
FOREST PROD, UTIL AND PROCESSING	1,803,000
FOREST INVENTORY AND ANALYSIS	8,182,000
FOREST HEALTH MONITORING	2,890,000
MONITORING METHODS/APPLICATIONS	349,000
TOTAL	$39,691,000

Three-Year Budget Comparison



The Basics: Your Tax Dollars at Work

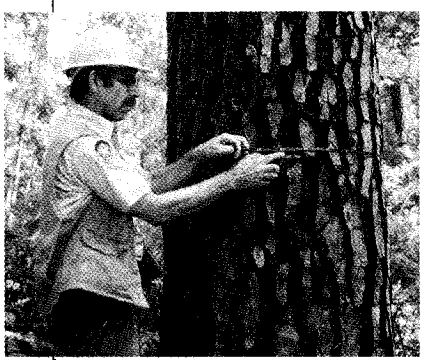
Allocations to Research Work Units

4101	Southern Appalachian Forests Asheville, North Carolina	$ 1,115,000
4103	Center for Forested Wetlands Charleston, South Carolina	1,125,000
4104	Southern Pine Ecosystems Athens, Georgia	1,613,000
4105	Vegetation Management and Longleaf Pine Auburn, Alabama	1,087,000
4106	Upland Forest Ecosystems Hot Springs, Arkansas	1,684,000
4111	Ecological Management of Southern Pines Pineville, Louisiana	1,446,000
4153	Southern Institute of Forest Genetics Saucier, Mississippi	1,771,000
4154	Biological Foundations of Sustainability Research Triangle Park, North Carolina	2,202,000
4155	Bottomland Hardwoods and Wetlands Stoneville, Mississippi	2,858,000
4201	Threatened and Endangered (TES) Species Clemson, South Carolina	786,000
4202	Coldwater Streams and Trout Habitat Blacksburg, Virginia	487,000
4251	Wildlife Habitat and Timber Resources Nacogdoches, Texas	790,000
4351	Watershed Responses to Disturbance Franklin, North Carolina	1,128,000
4501	Southern Pine Beetle Pineville, Louisiana	927,000
4502	Wood Products Insect Research Starkville, Mississippi	1,007,000
4505	Insects and Disease Athens, Georgia	1,719,000
4701	Southern Forest Resource Utilization Pineville, Louisiana	1,110,000
4702	Tree Quality, Processing, and Recycling Blacksburg, Virginia	402,000
4703	Biological/Engineering Technologies Auburn, Alabama	1,106,000
4801	Forest Inventory and Analysis Asheville, North Carolina, and Starkville, Mississippi	8,182,000
4802	Legal, Tax, and Economic Influences New Orleans, Louisiana	939,000
4803	Forest Health Monitoring Research Triangle Park, North Carolina	3,190,000
4851	Economics of Forest Resources Research Triangle Park, North Carolina	939,000
4852	Southern Global Change Program Raleigh, North Carolina	1,441,000
4901	Trends in Recreation and Wilderness Athens, Georgia	637,000
	Total	$ 39,691,000

The Basics: Your Tax Dollars at Work

Collaboration: The Key to Leveraging Appropriated Funds

Collaborative research and development with universities, private corporations, and other Federal and State agencies is a cornerstone of the SRS program. These activities involve the funding of extramural studies under cooperative agreements, grants, and interagency agreements. Working with partners is an effective way to leverage our funding to conduct research efforts **that** benefit a wide range of research results users.



Courtesy *Texas Forest Service*

A total of $8,478,648 supported research studies under these agreements in FY99 with the following:

Domestic non-Federal agreements

Alabama A&M University
Alabama Forestry Commission
Appalachian State University
Arkansas Nature Conservancy
Arkansas Natural Heritage Commission
University of Arkansas
Auburn University
Botanical Garden Foundation
University of California at Berkeley
Clemson University
Colorado State University
Duke University
Eastern Sierra Institute for Collaborative Education
Florida A&M University
University of Florida
Forest Resources Systems Institute
Furman University
Georgia Forestry Commission
UGA Research Foundation, Inc.
University of Idaho
Kentucky Division of Forestry
University of Kentucky
Louisiana Agricultural Experiment Station
Louisiana Tech University
University of Maryland
Michigan Technological University
University of Minnesota
Mississippi State University
University of Mississippi
University of Missouri
National Council of the Paper Industry for Air & Stream Improvement (NCASI)
University of Nevada
University of New Hampshire
North Carolina Department of Environment, Health, and Natural Resources
North Carolina Agricultural Research Service
North Carolina State University
University of North Carolina at Asheville
Oklahoma State University
University of Oklahoma
Pacific Lutheran University
Purdue University
Rutgers University
South Carolina Forestry Commission
Stephen F. Austin State University
Tennessee Department of Agriculture
University of Tennessee
Texas Agricultural Experiment Station
Texas A&M Research Foundation
Texas Forest Service
Tulane University
Tuskegee University
Virginia Commonwealth
Virginia Polytechnic Institute & State University
University of Washington
West Virginia University Research Corporation
Western Carolina University
University of Wisconsin

International

BioComposites Centre
University of British Columbia
Chinese Academy of Forestry
El Colegio De La Frontera Sur
Kyoto University
Kyushu University
Simon Fraser University

Interagency Agreements

USDA Agricultural Research Service
USDA Natural Resources Conservation Service
USDI Geological Survey, Biological Resources Division

The Basics: Your Tax Dollars at Work

Jumpstarting Collaborative Research Efforts

The Challenge Cost Share program for Research and Development leverages Federal forestry research funds with matching resources from non-Federal sources to accomplish research objectives. The criteria used by the SRS Leadership Team to evaluate and select the proposals to fund include:

- support of the Strategic Framework and Cross-Cutting Themes,
- initiation of collaborative research and development with new partners,
- initiation of new research with existing partners,
- research that contributes to a balanced program aimed at meeting the demand of our multiple partners
- potential to complete research within a 1 -year time frame.

In FY99, 10 proposals were funded:

- Long-term soil and productivity responses following harvesting and site preparation in a coniferous swamp (SRS 4103, $25,000; NCASI, $25,000)
- Modeling carbon sequestration in forest soils (SRS 4103, $7,500; NCASI, $7,500)
- Development of technologies for enhancing site quality and soil carbon (SRS 4103, $25,000; NCASI, $10,000; Weyerhaeuser, $10,000; Georgia Pacific, $5,000)
- Monitoring productivity and environmental quality in southern pine plantations: Phase V-measurement of tree growth and data compilation (SRS 4111, $10,700; Temple-Inland, $7,700; Willamette Industries, $3,000)
- Determining the mode of inheritance of microfibril angle in loblolly pine (SRS 4153, $12,000; Champion International, $3,000; International Paper, $3,000; Temple-Inland, $3,000; The Timber Company, $3,000)
- Estimating soil CO, evolution and changes in soil carbon content in soils supporting intensively managed loblolly pine: effect of harvesting and site preparation (SRS 4154, $30,000; Westvaco, $30,000)
- Ecology and reproductive biology of pond berry (*Lindera melissifolia*) [Walt] Blume) (SRS 4155, $3,000; Arkansas Natural Heritage Commission, $3,000)
- Productivity and canopy processes in southern bottomland hardwood forests (SRS 4155, $5,000; Anderson-Tully, $5,000)
- Roosting behavior of tree bats in forest landscapes of the Interior Highlands of Arkansas (SRS 4251, $13,000; Arkansas Game and Fish, $13,000)

8 Reproductive success and survival of ruffed grouse in response to alternative forest management techniques at Wine Spring Creek Ecosystem Management Project (SRS 4351 and SRS 4101, $7,500; Ruffed Grouse Society, $7,500)

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Jumpstarting Collaborative Research Efforts

Many research work units have agreements to receive external funding from other sources. The FY99 total for these dollars was $682,373 from non-Federal sources. The SRS received $2,042,066 from other Federal sources to support research and development projects designed to meet the missions of the agencies involved.

This external funding came from the following:

Non-Federal Cooperators:

AgrEvo
Alabama River Woodlands, Inc.
American Cyanamid Company
Anderson-Tully Company
Arkansas Game & Fish Commission
Bayer Corporation
Boise Cascade Corporation
Canal Forest Resources, Inc.
Champion International
Composite Panel Association
Derrill L. Hume
DowAgro Sciences, Inc.
DowElanco
Fiber Research International, Inc.
FMC Corporation
Georgia Forestry Commission
Georgia-Pacific Corporation
HPC Enterprises, Inc
International Paper
J.J. Mauget Company
Kriebich Consulting
Lab Services
Mead Coated Board Division
National Council of the Paper Industry for Air & Stream Improvement (NCASI)
National Hardwood Lumber Association
Novartis Crop Protection, Inc.
Potlatch Corporation
Rayonier, Inc.
Resource Management Service, Inc
Rhone-Poulenc Ag. Company
Stephen F. Austin State University
Taensa, Inc.
Temple-Inland Forest Products
Texas Parks & Wildlife Department.
Texas Water Development Board
The Nature Conservancy
The Nature Conservancy of Texas
The Ruffed Grouse Society
The Timber Company
Tim Traxler
Union Camp Corporation
University of Georgia
Virginia Polytechnic Institute and State University
Westvaco
Weyerhaeuser
Willamette Industries, Inc.
Zenica Professional Products

Federal Cooperators:

Environmental Protection Agency
U.S. Department of Agriculture, Foreign Agricultural Service/International Cooperation and Development (FAS/ICD)
U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS)
U.S. Department of Agriculture, Economic Research Service
U.S. Department of the Air Force, Wright-Patterson Air Force Base
US. Department of the Army
U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA)
U.S. Department of Energy
U.S. Department of the Interior, Bureau of Land Management
U.S. Department of the Interior, Fish and Wildlife Service
U.S. Department of the Interior, Geological Survey, National Wetlands Research Center
U.S. Department of the Interior, Geological Survey, National Wetlands Research Center
U.S. Department of the Interior, National Park Service

The Basics: Your Tax Dollars at Work

Changing the Way We Work: Improving Administrative Efficiency

Administrative service functions for several Forest Service units have been unified under the Eastern Administrative Zone (EAZ). The EAZ Service Center serves the SRS, the National Forests in North Carolina, the Francis Marion and Sumter National Forests in South Carolina, the Savannah River Natural Resource Management and Research Institute, the Lyndon B. Johnson and Schenck Civilian Conservation Centers, and Forest Health Protection in Asheville, NC. A full range of human resource services-staffing, classification, workforce management, employee relations, labor relations, employee development, pay and benefits-are provided to an internal client base of nearly 1,600 people. Acquisition services are also provided to the EAZ clients.

The Fiscal Resources Staff provides accounting, auditing, processing, and financial analysis to internal and external customers. Fiscal year 1999 was a challenge to this staff as they prepared to change to a new accounting system. This accounting system, Foundation Financial Information System (FFIS), is intended to achieve accountability in several ways for the Forest Service. Financial statements will be readable, reliable, and provide useful financial information and financial deficiencies will be corrected by adhering to financial accounting standards. We will be able to communicate better with internal and external constituencies and resolve long-standing audit issues. For the Forest Service to retain leadership in the natural resource arena, the agency must become expert at managing its financial resources. The FFIS will enable us to reliably reflect our diverse business operations and help us use financial information to plan, manage, and set priorities for programs to better carry out our mission. By implementing a new approach to financial management and an integrated financial management system, the Forest Service will become the first natural resources agency to merge good business practices with resource decisions.

The Information Resources Staff reviewed, upgraded, and replaced telecommunications and computer technology where necessary to bring the SRS to 100 percent compliance for Y2K readiness. This included the forest inventory and monitoring software that was identified as a noncompliant critical application by the Washington Office.

Our Civil Rights and Workforce Diversity Program continued to give emphasis to the civil rights/human rights philosophy developed last year — "the right of everyone in the workplace to be treated fairly, impartially, and respectfully." The philosophy was the subject of a video created by our Civil Rights Committee, which was viewed and discussed by all employees. While the SRS supported employee resource

The Basics: Your Tax Dollars at Work

Changing the Way We Work: Improving Administrative Efficiency

groups, the focus has been on building unity, not separateness. The SRS and National Forests in North Carolina added a Heritage Awareness Month to the traditional monthly awareness celebrations to focus on the value all cultures bring to the workforce.

The SRS seeks development of new approaches to reach underserved populations with our programs and services. We are strengthening our relationships with southern minority landowners by participating in conferences and expanding our publication distribution services. Publications from three SRS research work units addressed issues and strategies involving diverse publics and minority low-income communities. Ten grants and agreements, totaling $583,214, were awarded in FY99 to minority universities. We are working on recruitment efforts for new employees from underrepresented populations with the development of a career information Web site, along with other efforts.

We have demonstrated a strong commitment to the Continuous Improvement Process (CIP) for positive change in the work environment. We had 66 percent participation in the FY99 survey—up 10 percent from the last survey and well above the 44 percent national participation rate. Good progress has been made to act on the commitments from CIP this year in response to recommendations. We have a well-below-average personal injury frequency rate of .83 and have been diligent about requiring employees to give deliberate attention to safety. Headquarters employees attend monthly safety meetings on topics chosen by the hosting staff. We have conducted an active awareness program for prevention of workplace violence.

Recruitment Initiatives: The SRS serves as the lead unit for two special recruitment initiatives at Historically Black Colleges and Universities: Alabama A&M University (AAMU) and Florida A&M University (FAMU). Each initiative has a Forest Service employee working as a liaison with the university and students, carrying out recruitment and placement activities. In FY99, eight FAMU students were placed in Forest Service summer temporary-employment program appointments, and one participated in the Forest Products Laboratory summer intern-research program. There were nine students at AAMU, partially or fully supported by the Forest Service, who received undergraduate degrees in forestry, environmental, or plant science in FY99. Three graduates were placed in permanent full-time positions with the Forest Service. There were 32 students placed in summer jobs with the Agency through the AAMU Initiative. Initiative student

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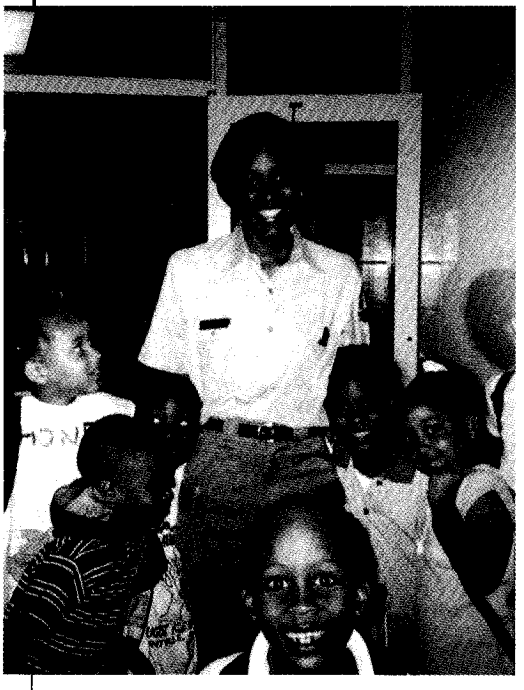
Changing the Way We Work: Improving Administrative Efficiency

Latrice Swain, Outstanding Freshman in the AAMU School of Agriculture and Environmental Sciences, was selected for Who's Who in American Colleges and Universities.



National Multicultural Recruitment Initiative at Alabama A&M University
Web Site:

http://www.srs.fs.fed.us/aamu.

Careers in Forest Service Research and Development Web Site:

http://www.srs.fs.fed.us/careers/index.htm.

Branching Out to the Youth of America

In 1992, the USDA Forest Service, Northeastern Area State and Private Forestry and Northeastern Forest Experiment Station initiated the Conservation Education Outreach Program's (CEOP) *Branching Out to the Youth of America* Program. The SRS has participated in the program for 7 of its 8 years and in FY98 assumed its coordination. Intern teams are based in Asheville, NC; Atlanta, GA; Huntsville, AL; and Milwaukee, WI. The program currently contacts over 8,000 children annually in summer day camps, American Indian youth programs, civic groups, boys and girls clubs, and summer schools. In FY99, the SRS provided support for a partnership between the *Branching Out to the Youth of America* interns and the Upward Bound program at Mars Hill College in western North Carolina. This collaboration provided conservation education experiences to high-school-age youth in a 6-week biology and mathematics curriculum. The CEOP Team at AAMU reached over 1,800 children in 4 States through fun, educational games in English and Spanish.

The concept of the CEOP is to engage urban youngsters in conservation education activities in urban settings in the inner cities where they live. The target audiences are selected for cultural, sociological, and economic diversity specifically including

The Basics: Your Tax Dollars at Work

Changing the Way We Work: Improving Administrative Efficiency

underserved, nontraditional publics. The goals of the program are: (1) to interact with urban youth from diverse age groups, socioeconomic backgrounds, ethnicities, and geographic locations helping them to gain an appreciation for natural resource conservation and sustainability; (2) to create an interest in Forest Service careers among underrepresented populations in urban environments; and (3) to provide contact between scientists and the summer interns to encourage them to pursue advanced degrees, thereby expanding the pool of diverse candidates for research positions.

The Conservation Education Program Web Site:

http://www.srs.fs.fed.us/consed/index.htm.

Improving Customer Service

The SRS Web site attracted a half million hits from over 70,000 individual visitors, and has been recognized as a government Internet leader and innovator. The Web site contains data bases for publications (can be downloaded in PDF format) and scientist and employee contacts, as well as links to SRS research work units and other SRS sites. The quarterly Recent Publications Catalog was sent via e-mail to over 1,000 customers. Our hard-copy catalog distribution continues; while it is at a much-reduced level, it meets the needs of those who use our information but do not have Internet access. Our overall publication distribution has increased dramatically as our outreach efforts continue, and our customers are able to acquire publications directly from the Web-over 150,000 were downloaded during FY99. In addition to responding to direct requests, we distribute some publications to mailing lists and at meetings and conferences. Many SRS publications can be found at libraries throughout the country.

The Forest Service has a nationwide customer service comment card program that is used both electronically and through hardcopy mail. The SRS is among the units receiving the most responses from the comment card system, with the comments being overwhelmingly positive. The few negative comments are quickly addressed and we try to make improvements in our service accordingly. We are developing an additional form to elicit comments evaluating our publications and anticipate beginning distribution of these with requested publications by the end of FYOO.

Careers in Forest Service Research and Development Web Site:

http://www.srs.fs.fed.us/careers/index.htm.

Southern Research Station Comment Card Web Page:

http://www.srs.fs.fed.us/customer/commentcard_srs.htm.

The Basics: Your Tax Dollars at Work

Individual and Team Recognition

Chief's Honor Award:

The Chief of the Forest Service recognizes outstanding contributions that support the Department of Agriculture's Employee Recognition Program and reinvention of government initiatives, major improvements in service to the public, workforce diversity, and ecosystem management initiatives.

The staff of the Coweeta Hydrologic Laboratory, located near Franklin, NC, received the Chief's Stewardship Award for "the significant knowledge and application of science generated by the Lab providing major advances in the stewardship of water, soil, and air resources for regional, national, and international programs."

The Center for Aquatic Technology Transfer, located in Blacksburg, VA, with cooperators in Oxford, MS, received the Chief's Award for Excellence in Technology Transfer for "outstanding achievement and innovation in technology transfer promoting scientifically-based management of aquatic habitat and resources on forest and range lands."

Dr. Emile Gardiner, Research Forester at the Center for Bottomland Hardwoods Research in Stoneville, MS, received the Chief's Early Career Scientist Award for "sustained productivity and exceptional promise for significant future achievement from research on oak ecophysiology and the regeneration biology of bottomland hardwood forest ecosystems. "

Dr. Jim Barnett, Project Leader of the Southern Pine Management Research Work Unit (RWU) in Pineville, LA, received the Chief's Superior Science Award for "individual research in seed and seedling physiology that has significantly improved reforestation success and for team leadership in sustaining the long-term productivity of southern pine plantations."

Other Chief's Awards:

Dr. Ron Thill, Project Leader of the Wildlife Habitat and Timber Resource Integration RWU in Nacogdoches, TX, and Steve Kirkindall, volunteer, received the Chief's Outstanding Achievement Award for Conservation Education,

recognizing their work to develop and promote the Stephen F. Austin Interpretive Trail in east Texas.

Dr. Frank Bonner, retiree from the Center for Bottomland Hardwoods Research in Stoneville, MS, received the Chief's Retiree Volunteer Service Award for "leadership and contributions to the revision of Agriculture Handbook 450, Seeds of Woody *Plants of the United States.*

The Basics: Your Tax Dollars at Work

Individual and Team Recognition

Dr. Paul Hamel, Research Wildlife Biologist at the Center for Bottomland Hardwoods Research in Stoneville, MS, was part of a team receiving the Chief's Volunteer Award for a Forest Service Employee in Research for "advancing the Forest Service mission by effectively recruiting and utilizing volunteers in the studies of birds and mammals of bottomland hardwood ecosystems."

Center for Bottomland Hardwoods Research, RWU SRS-4155, Stoneville, MS, received the Chief's Volunteer Award for a Forest Service Research Unit for "advancing the Forest Service mission by effectively recruiting and utilizing retired, student, and international volunteers to accomplish important research on bottomland hardwood ecosystems."

External Awards

Dr. Phil Araman, Project Leader of the Tree Quality, Processing, and Recycling RWU, Blacksburg VA, was one of four recipients of the National Hardwood Lumber Association's 1999 Hardwood Research Award for recognition of pioneering research in the development of machine vision technology for the forest products industry.

Dr. Jim Miller, Research Forest Ecologist with the Vegetation Management Research and Longleaf Pine Research RWU, Auburn, AL, received the 1999 Weed Scientist of the Year Award from the Southern Weed Science Society for outstanding achievements in research and technology transfer related to forest vegetation management science and for senior authorship of Southeast *Forest Plants and Their Wildlife Uses.*

Dr. Thomas Miller, Retired Plant Pathologist, Olustee, FL, received the Southern Forest Pathologists Achievement Award at the Southwide Forest Disease Workshop for his work as codirector of the Integrated Forest Pest Management Cooperative and for collaboration on fusiform rust research.

Dr. Paul Hamel, Research Wildlife Biologist at the Center for Bottomland Hardwoods Research in Stoneville, MS, was one of the group receiving the Partners in Flight Award for Investigations. The award went to "those most directly involved with making the Mississippi Alluvial Plain Migratory Bird Initiative the first real model for integrating the needs of various bird species groups and molding these into a solid plan of action."

Dr. William D. Boyer, Research Forester Emeritus (retired from the Vegetation Management and Longleaf Pine Research RWU), Auburn, AL, was inducted into the Alabama Foresters Hall of Fame by the Society of American Foresters. Dr. Boyer was recognized for his research and technology transfer accomplishments related to longleaf pine ecology and management and his long-term service to the Society of American Foresters.

The Basics: Your Tax Dollars at Work

Experimental Forests

The SRS maintains 19 experimental forests located on or near National Forest System lands. Scientists in research work units use these as sites for their studies and demonstration projects in conjunction with the managing national forest unit. Experimental forests are designated to represent a specific ecosystem or forest type, and to present opportunities for the study of different approaches to sustaining forested ecosystems. Several of the experimental forests in the South were selected for their potential to demonstrate rehabilitation of deteriorated farm forests and soil resources that occurred during early European settlement and plantation farming of the region.

Among the experiments conducted on these forests are studies on stand management and regeneration; restoration of wildlife and plant populations; watershed management; and the effects of pollution, climate change, and timber harvest. Many experimental forests also provide educational and nonmotorized recreation activities, including interpretive methods to enhance public understanding of forest management principles. Research on experimental forests plays a vital role in the conservation of America's natural resources.

State	Experimental Forest	National Forest	Acres	Date Established
Alabama	Escambia	—[1]	2,990	06/14/61
Arkansas	Alum Creek	Ouachita	4,281	04/02/59
	Crossett	Ouachita	1,675	08/27/40
	Henry R. Koen	Ozark	720	09/17/51
	Sylamore	Ozark	4,180	03/28/34
Florida	Chipola	—[1]	2,760	06/21/61
	Olustee	Osceola	3,135	03/28/34
Georgia	Hitchiti	Oconee	4,602	12/04/61
	Scull Shoals	Oconee	4,487	09/17/38
Louisiana	Palustris	Kisatchie	7,515	07/19/35
Mississippi	Delta	—[1]	2,580	06/14/61
	Harrison	DeSoto	4,111	07/19/34
	Tallahatchie	Holly Springs	4,569	04/12/50
North Carolina	Bent Creek	Pisgah	5,242	06/25/27
	Blue Valley	Nantahala	1,400	06/23/64
	Coweeta	Nantahala	5,482	03/28/34
South Carolina	John C. Calhoun	Sumter	5,082	10/08/47
	Santee	Francis-Marion	6,000	07/06/37
Texas	Stephen F. Austin	Angelina	2,499	06/28/61

[1] Private land

Caring for the Land and Serving People

The Basics: Your Tax Dollars at Work

Experimental Forests

The following are descriptions of some of the experimental forests in the South including establishment histories, past research emphases, and current research projects.

Bent Creek Experimental Forest

Bent Creek Experimental Forest—the first to be established in the South, is one of the oldest research areas maintained by the Forest Service. Its purpose was to provide opportunities for the systematic development of experiments in silvicultural practices. Since 1925, before its establishment as an experimental forest, scientists have been developing and demonstrating sound forestry practices at Bent Creek. Their research-both early and current-on fire, insects, diseases, timber, wildlife, and water is being applied over much of the Southern Appalachians. With an increasing intensity of land use throughout the region and around the country, research conducted at Bent Creek is important to the sustainability of the South's forested lands.

Current research is focused on: (1) understanding the distribution and productivity of forest vegetation as a function of the controlling environmental variables; (2) understanding the structural and compositional dynamics of forest vegetation in relation to both natural and human-imposed disturbance regimes; (3) relating wildlife habitat to forest structure and composition; and (4) synthesis and integration of research information to provide decision support to forest managers.

Coweeta Hydrologic Laboratory

The Coweeta Experimental Forest was set-aside in 1934 with a research emphasis on watershed management; and measurements of rainfall, streamflow, climate, and forest growth began. These have been continuously monitored since. In 1948, the site was renamed Coweeta Hydrologic Laboratory. In the early 1980's, Coweeta was selected by the National Science Foundation as one of 11 sites in the Nation for the Long-Term Ecological Research program. The Coweeta Basin is ideal for hydrologic research. Local rainfall is usually plentiful-80 to 100 inches per year. Solid bedrock underlying the soils permits hydrologists to account for most of the rainfall that enters the basin. The valley contains numerous small watersheds; many are similar in size, climate, and vegetation.

Each of the experimental watersheds has a weir in its stream to measure the flow of water. The weir is an accurate stream-gauging station. The height of the water behind the weir blade is continuously monitored by automatic recorders. The heights, along with the characteristics of the opening of the weir, permit calculation of streamflow day and night, storm and sunshine, throughout the year. Silt that accumulates in the ponding basin behind the weir may also be measured. These measurements show how natural or human disturbances to the watershed change stream characteristics. Research

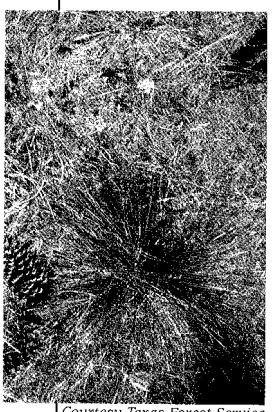
The Basics: Your Tax Dollars at Work

Experimental Forests

work at Coweeta has provided internationally important information about the effects of timber harvesting, road construction, and natural disturbance in watersheds.

Escambia Experimental Forest

The Escambia Experimental Forest was established through a 99-year lease agreement with the TR Miller Mill Company of Brewton, AL. This 3,000-acre tract in southwest Alabama was selected as typical of second-growth longleaf pine forests that, at the time, covered about 6.2 million acres in south Alabama and northwest Florida. Research on the Escambia was initially aimed at solving the principal management problems associated with longleaf pine, including natural regeneration, management alternatives, growth and yield, rotation lengths, thinning regimes, forest grazing, and economic costs and returns.



Courtesy Texas Forest Service

Today, the Escambia Experimental Forest constitutes a unique example of longleaf pine ecosystems in all stages of development. The forest supports continuing long-term research studies and management demonstrations. Research has involved all aspects of longleaf pine natural regeneration, including development of the shelterwood system for this species. Other long term studies and demonstrations include stand management and management alternatives; growth and yield of even-aged natural stands in relation to age, site quality, and stand density; and fire ecology, including long-term effects of season and frequency of prescribed fire, or fire exclusion.

Harrison Experimental Forest

The Harrison Experimental Forest is on the DeSoto National Forest, 25 miles north of Gulfport, MS. The Agency chose the site because its soils and appearance mirrored the South's 31 million acres of coastal forest land. By the 1930's, loggers had almost completely clearcut these vast stretches of southern pine. In some areas, residual trees produced seed for natural regeneration. Much more often, however, few seed trees remained to start the regeneration process. The seedlings that did sprout soon succumbed to cattle, feral hogs, palmetto competition, fire, or pest infestations.

Some of the earliest studies on the Harrison involved fire behavior and wood preservation. Scientists on the Harrison introduced water spray as a preprocessing preservative. This technique is still in use at sawmills today. Early trials of fence posts treated with various preservatives have been revisited every year since 1939. The problems with planting and growing trees and reestablishing forests soon became the primary focus for research at the Harrison. One important effort-the southern pine seed-source study-got

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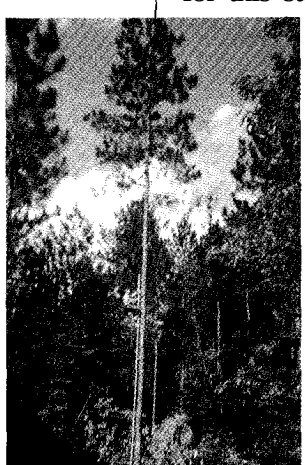
Experimental Forests

underway to match regeneration sites with seed sources and to determine how far seeds could be moved without jeopardizing regeneration.

Long after the seed-source study results were reported, the plantings for this study continued to be useful for new research, such as efforts to determine the genetic basis of pest resistance, variation in wood quality, and effects of climate on pine growth. Most recently, Harrison's scientists have begun evaluating the original genetic variation of the plantings with a vision toward long-term gene preservation.



Since 1956, the Harrison has been home to the Southern Institute of Forest Genetics (SIFG). The institute's research on the inheritance of growth, form, and pest resistance of forest trees has guided tree improvement programs across the South. Some of its most recent research on DNA markers is being used to help incorporate resistance into the American chestnut needed to reestablish a species that has been obliterated from the forests of the East by the chestnut blight.

While planting trees and reestablishing forests were needed early in the century, sustainability is now the collective vision for southern forests. The South needs new knowledge and guidance on how to manage biological and ecological systems within a social and economic context. The SIFG scientists are working to discover the principles of heredity that operate in southern forests and to show how those principles may be applied in sustaining forest quality and productivity.

Palustris Experimental Forest

The Palustris Experimental Forest is an area of the Kisatchie National Forest designated by Congress to conduct forestry research. The forest is named Palustris in recognition of the species longleaf pine that was prevalent in the region prior to the great harvesting of virgin pine forests in the early 1900's. The Palustris consists of two separate tracts, which total about 7,500 acres in size. The area was used by pioneer Southern Forest Experiment Station (now Southern Research Station) researchers to develop early reforestation techniques for the four major southern pines. Studies have provided the information to convert a region of decimated forests to one where forestry is of leading economic importance.

The JK Johnson Tract, located 18 miles southwest of Alexandria, LA, is the site of numerous long-term studies, such as a longleaf pine planting spacing, prescribed burning, pruning, and a thinning regime study that is now 60 years old. It also serves as the area for plantings of shorter-term studies evaluating seedling physiology. At this tract, studies are underway to evaluate the effects of global

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climate change on forest productivity and to devise management strategies to reduce such effects. These studies require very intensive measurements of tree and stand morphology and physiology, and involve cooperative efforts with organizations and agencies outside the Forest Service.

The Longleaf Tract, about 35 miles south of Alexandria, LA, has been the site of some of the most intensive multiresource research in the South. Since the mid-1940's, the interactions of cattle grazing, wildlife management, and timber production have been evaluated. Current research emphasis includes evaluations of effects of forest management practices on long term soil productivity.

Numerous long-term (30 to 60 years) growth data sets have been collected for longleaf, loblolly, and slash pine. These data are the basis of growth and yield prediction systems that have been developed for these species. Other studies quantifying intensive soil and tree physiology measurements have been underway for about 10 years.

The Palustris Experimental Forest continues to serve as a field research laboratory, a demonstration site for new forestry practices, and an area to develop potential cooperative relationships. Federal, State, university, and forest industry scientists work together to address the forest concerns that now face the State, region, and Nation.

Stephen F. Austin Experimental Forest

The Stephen F. Austin Experimental Forest is located 8 miles southwest of Nacogdoches, TX, on the Angelina National Forest. It was designated with the objective of wildlife and timber management research. It contains approximately 1,800 acres of mature, bottomland hardwoods with the remainder being southern pine and mixed pine/hardwood forest. The site is used as an outdoor classroom in the study of forest ecosystems by students majoring in forestry, wildlife management, forest recreation, and environmental science. In 1990, management objectives were expanded to include educational and recreational opportunities for the general public. The Stephen F. Austin Interpretive Trail, which is wheelchair-accessible, was completed in 1997.

Current research studies relate primarily to understanding and maintaining populations of wildlife species that have, or are becoming threatened, endangered, or sensitive. A long-term study involves inoculating trees with a heartrot fungus to enable cavity dwellers, such as red-cockaded woodpeckers, to create cavities in younger trees. Studying the natural formation of snags, or snag dynamics, is important to many species that are dependent on standing, dead trees as a critical part of their habitat. Work with amphibians, snakes, and alligator snapping turtles also occurs on the Stephen F. Austin.

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The Framework

We published *The Strategic Framework for the Southern Research Station* in 1997. The Strategic Framework enhances our ability to work with other members of the forestry community on a broader scale, across State and local boundaries, to respond to the complex issues challenging natural resource management. It provides a mechanism to leverage our science and resources in an integrated fashion and to assure accountability in our research and development programs. The Strategic Framework supports our commitment to collaborative stewardship by delivering usable information and technology to public and private customers to implement sustainable land and resource management. Sustainability is the concept that brings focus to the SRS research and development program.

The Forest Service is committed to the goal of sustainability, which is defined as the ability of the biophysical resources-or ecosysterns-to meet human needs and wants without degradation. By maintaining forest health, diversity, and productivity, sustainable forest management ensures that the commodity and environmental needs of present and future generations can be met.

The Strategic Framework establishes three emphasis areas for a dynamic system for setting goals, priorities, and making significant accomplishments:

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

Achieving sustainability and incorporating human values into our research program requires a multidisciplinary approach and a customer-driven framework for applying that approach. To integrate the efforts of our 25 Research Work Units, six cross-cutting themes (CCTs) were developed that will help bring people together to address the three emphasis areas across the South:

1. Sustainability and Productivity of Southern Pine Ecosystems;
2. Ecology and Management of Forested Wetlands, Bottomland Hardwoods, and Riparian Zones;
3. Southern Appalachian Ecosystem Research and Sustainability;
4. Sustainability and Productivity of the Interior Highlands Ecosystem;
5. Landscape and Regional Integrated Assessment and Modeling;
6. Inventory and Monitoring.

This section provides an update of some of the accomplishments that occurred in FY99 relating to the CCTs. The CCTs provide a thematic focus for much of our research and development program, but they are not mutually exclusive. Accomplishments may relate to more than one theme and the CCTs do not encompass our entire program. Additionally, we produced over 500 publications and other materials in FY99 that are listed in the final section of this report; they are grouped under the most appropriate CCT.

Caring for the Land and Serving People

Successes - Our Strategic Framework in Action

Southern Pines

The Sustainability and Productivity of Southern Pine Ecosystems Cross-Cutting Theme includes components of the programs of 17 SRS research work units. This CCT embraces a major portion of our research on forest productivity-a primary resource driver of the South's economy. In addition, this CCT includes research and development related to seven criteria that have international agreement for conservation and sustainable management of temperate and boreal forests. This will lead to more holistic and integrated regional and landscape-scale studies, and become the basis for a corporate vision of the important issues and information gaps that surround these ecosystems.

A wide range of research accomplishments by SRS scientists in FY99 ties into this emerging new vision. Some highlights organized around the seven criteria include:

Conservation of biological diversity

Studies of the Louisiana pine snake indicate that it is extremely rare; it is documented on only a small portion of its historic range in eastern Texas and western Louisiana. Consequently the U.S. Department of the Interior, U.S. Fish and Wildlife Service is evaluating the potential listing of the species under the Endangered Species Act. Research is providing information on general ecology, habitat use, and impact of roads on snake populations. This information is being used by the Forest Service, military installations, and private timber companies to manage fire regimes and vehicle use in ways compatible with maintenance of Louisiana snake populations.

The effects of demographic isolation are particularly severe in small, isolated populations of the endangered red-cockaded woodpecker. An operational scale technique has been developed and field-tested to reintroduce pairs of red-cockaded woodpeckers into areas where only small populations are present and into areas where the woodpecker previously existed. The results suggest that reintroduction of pairs of first-year adults in a spatial array dense enough to allow social contact between adjacent pairs and with preexisting resident groups substantially increases the formation of new breeding pairs of woodpeckers. The ability to reintroduce this species to areas where they have been extirpated is a major breakthrough for the management and recovery of this endangered species.

We examined pileated woodpecker damage to red-cockaded woodpecker cavity trees and cavity enlargement on the national forests in eastern Texas in both longleaf pine and loblolly-shortleaf pine habitats. We also examined the effectiveness of restrictor plates in deterring pileated woodpecker

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Southern Pines

enlargement of red-cockaded woodpecker cavities. While restrictor plates are useful for protecting red-cockaded woodpecker cavities, they should be used

only in small populations when cavities are in short supply. The pileated woodpecker plays an important role, especially in the longleaf ecosystem, which is a relatively cavity-barren environment, by providing nesting sites for larger secondary cavity users, such as American kestrels, eastern screech-owls, and fox squirrels.

Maintenance of productive capacity of forest ecosystems.

The increasing intensity of forest management in the South has resulted in a great demand for quality southern pine seeds and seedlings. Production of nursery stock is now about 1.5 billion seedlings per year. The greatest problem in seedling production is for longleaf pine, a species that is in great demand because of longleaf pine restoration efforts. Guidelines are now available that allow the production of high quality seeds and seedlings and result in improved reforestation success. Container production is an effective technique for producing longleaf pine planting stock that survives and grows well in the field. Once established, other management approaches such as the use of chemicals or fire must be used to minimize the effect of competition to restore longleaf pine ecosystems. Repeated use of fire reduces the woody understory vegetation and restores the herbaceous plant community that is a unique component of this ecosystem.

Wood volumes generated from 14-year old Piedmont loblolly pine stands and 17-year-old Coastal Plain slash pine stands were dramatically increased when competing vegetation was controlled in the early years of establishment. The effect of this early competition control on the amount of juvenile wood in the 14-year-old loblolly pine stands was pronounced because the increased growth occurred during the first 10 years. In the Piedmont region, scientists found that 12-year-old loblolly pine stands grown on intensively prepared sites had 2.7 times the basal area as similar aged stands on control sites; both volume and height increased with preparation intensity.

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Southern Pines

Maintenance of forest ecosystem health and vitality

Pest Plant Alerts for the most invasive alien plants were prepared in cooperation with Forest Health Protection in the Southern Region of the Forest Service. These will be used by Forest Inventory and Analysis teams to perform the first survey of exotic plants in the region. A major book publication, *Forest Plants of the Southeast and Their Wildlife* Uses, that covers both native and nonnative plants was published in cooperation with the Southern Weed Science Society.

During a southern pine beetle outbreak, the impact of natural enemies and competitors was analyzed. The results indicated the natural enemy complex causes increased mortality 1 year after peak southern pine beetle density. This density-dependent delay is probably responsible for the regular cycles observed in southern pine beetle abundance. Two competitors with southern pine beetle, a bluestain fungus and another phloem-destroying insect, appeared to generate direct density-dependence and may affect the amplitude of the cycles in southern pine beetle.

The impacts and monitoring technology of forest access were examined in several studies. Temporary access is one method of reducing impacts from roads. Temporary access is built, used, removed, and the site restored. The total life-cycle sediment loading from temporary low-water fords was quantified over a 2-year period. Alternative sediment-trapping structures for turnout ditches on forest roads were also examined in a long-term study of erosion in forest access. Sediment basins appeared to be the most effective treatment.

Conservation and maintenance of soil and water resources

When southern pine forestsare regenerated, strips of timber are often retained along streams to minimize nonpoint water pollution during and following logging. Within intensively managed forest landscapes, these riparian zones are important to wildlife because they often provide critical habitat features, e.g., mast-producing hardwoods, snags, cavity trees, and large woody debris, that may not be present or abundant in adjacent pine plantations. However, landowners who retain riparian zones typically forego economic returns by not harvest-

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Southern Pines

ing the timber within these areas. Research initiated to determine the amount and value of residual timber in nine riparian zones in east Texas shows that landowners sacrifice significant economic returns by retaining these zones; projected values were $66, $319, and $479 per acre for narrow, medium, and wide zones. Research results also suggest that wide riparian zones provide the most benefit to many wildlife species.

The influence of silviculture treatments on physiological responses, including photosynthesis, transpiration, stomal conductance, and xylem pressure potential, and water use continues to be a focus at research sites in Louisiana and North Carolina. The data suggest that early-season shoot expansion, crown growth, foliage production, root initiation, and crown physiology respond to microclimate changes within loblolly pine stands of large trees as a result of silvicultural manipulation. Although fertilization increases leaf area and thus total water use, water relation experiments show that fertilized trees use less water per unit leaf area; thus fertilized trees actually obtain higher water-use efficiency. Global climate change may also influence environmental factors within stands and cause potential stresses on growth and productivity of southern pine forests.

Courtesy Texas Forest Service

Maintenance of forest contribution to global carbon cycles

There has been substantial progress in quantifying the role of southern pine forests in sequestering atmospheric carbon dioxide (CO_2). Fertilization resulted in loblolly pine stands being a sink for atmospheric CO_2 compared to unfertilized stands, that were sources of atmospheric CO_2. This shift in carbon economy was largely due to the higher productivity of fertilized trees. Increases of CO_2 by about 60 percent raised photosynthetic rates through the tree canopies with and without fertilization. Branch and diameter growth increased by about 20 percent. Inclusion of root growth and decomposition studies added valuable insight on belowground impact prediction models. The ability to synthesize research

Successes - Our Strategic Framework in Action

Southern Pines

results via mathematical modeling has resulted. A product of the effort was the major modeling meeting, "Toward the Application of Process Models to Sustainable Management of Southern Pine Forests."

Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies

In an evaluation of the effect of five different silvicultural strategies and wood type on mechanical and physical properties of loblolly pine particleboard and fiberboard, it was found that the inner wood can produce particleboard and fiberboard panels with comparable mechanical and physical properties to outer wood. The effect of the silvicultural strategy was minimal for most properties.

Legal, institutional, and economic framework for forest conservation and sustainable management

Conservation Reserve Program (CRP) participants in Alabama were surveyed to determine how their lands would be managed after CRP funds expire without opportunity for renewal. If the CRP lands were planted in trees, 90 percent would remain in trees; if the lands were planted in grasses, 60 percent would be converted to row crops. Therefore, for sustained mitigation of soil loss and reduction of excess production capacity, tree planting as a conservation practice should be advocated and encouraged.

The statutory, administrative, and judicial adjustments in the Federal income tax and in the State income, property, and harvest taxes were monitored in terms of their effect on owners and managers of nonindustrial, private forest land. Forest-related tax law provisions and proposed legislation were interpreted for Agency and external clients. Prototype tax compliance software was developed for private forest land owners through cooperative research with university specialists.

Lead contacts for the Sustainability and Productivity of Southern Pine Ecosystems Cross-Cutting Theme: RWU SRS-4105 at Auburn, AL, and RWU SRS-4111 at Pineville, LA.

Successes - Our Strategic Framework in Action

Wetlands, Bottomland Hardwoods, and Streams

Approximately 50 percent of the wetland resource in the United States occurs in the South, and the majority of these wetlands are forested. In addition to jurisdictional wetlands, nonhydric bottomlands and riparian areas occur in a hydrogeomorphic setting similar to wetlands. Sustainable management of these forests, a majority of which are in private hands, provides research challenges addressed by SRS scientists. The Ecology and Management of Forested Wetlands, Bottomland Hardwoods, and Riparian Zones Cross-Cutting Theme involves activities of 13 research work units in the SRS. Two of these research work units are devoted to the issues in this CCT. Our research is organized around seven criteria for sustainable management and conservation of these forest types. Through this work we investigate ways in which the critical ecosystem functions can be maintained effectively in a social and economic context acceptable to those who own, manage, and care about the resources.

Conservation of biological diversity

The importance of wetlands to biodiversity is reflected in the role of critical habitat for both plants and animals. Over 50 percent of threatened and endangered species rely on wetlands for part or all of their life cycle. Wetlands also provide habitats that are critical to diversity at the landscape scale. For example, in the Southeastern United States, wetland ecosystems contain 75 percent of all bird species that use forests. Because approximately 50 percent of the wetlands in the Southeast have been destroyed, wetland restoration is important to the maintenance of biodiversity.

Assessing the effectiveness of forested wetland restoration is difficult because of the long time frame necessary for the development of soils, vegetation, hydrology, and fauna1 communities. To assess the success of forested wetland restoration projects, metrics are being developed that are sensitive to early changes in community development and are predictive of future conditions. These studies are being conducted in the Atlantic Coastal Plain and Mississippi Alluvial Valley; in floodplain, bottomland hardwood, and swamp ecosystems; and in

Successes - Our Strategic Framework in Action

Wetlands, Bottomland Hardwoods, and Streams

sunken wetlands such as Carolina Bays. Carolina Bays are not only poorly understood with respect to hydrology, but have been severely altered by human activity, and are of ecological significance as habitat for several biological communities and rare species. Numerous studies have been initiated to assess differences in the hydrologic regime and other ecosystem functions between altered, restored, and reference ecosystems as a metric for evaluating the success of wetland restoration.

A cornerstone to the restoration work and other biodiversity-related research in this area has been the establishment of reference wetlands in the Atlantic

Coastal Plain and Mississippi Valley. These wetlands provide a baseline for assessing ecosystem structure and function that is critical to the maintenance of biodiversity. Results of one initiative were presented in a symposium as part of the annual meeting of the Society for Wetland Scientists in Norfolk, VA. The symposium was titled "Development of Reference Bottomland Hardwood Ecosystems: The Southern Forested Wetlands Initiative."

Understanding the interaction of land management practices and the use of wetlands by avian and invertebrate species has been constrained by insufficient knowledge. Studies employing experimentally created gaps, timber harvests, and reduction of insect populations determine the relative importance of these factors in bird and invertebrate populations. These studies are being conducted in a variety of wetland types across the South. Silvicultural manipulation can influence wildlife and endangered species habitat and biodiversity; however, there are few long-term studies of the influence of intensive management on these resources. In a continuation of experiments conducted for decades on a paired watershed, vegetation dynamics in a watershed managed for the endangered red-cockaded woodpecker is being compared with vegetation dynamics in a watershed that has been excluded from intensive management. Models are being developed to predict habitat quality for birds on public and private land in the South. Field data from research projects are being used to validate the model and, if necessary, refine it. Refinements may include incorpo-

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ration of quantitative models that employ landscape or vegetation-structural-predictor variables. These models are used to integrate field studies, which are in turn used to parameterize and test the models.2. Maintenance of productive capacity of forest ecosystems

Maintenance of productive capacity of forest ecosystems

Operational planting under the Wetlands Reserve Program has produced few successful plantings of bottomland hardwoods in the Lower Mississippi Alluvial Valley. A recent survey of afforested agricultural land in Mississippi found 90 percent failure, indicating the difficulty of the task of forest restoration in bottomland hardwood systems. While planting seedlings was more successful than direct seeding acorns, only 23 percent of the land planted with bare-root seedlings had at least 100 trees per acre after 3 years. Research reported this year continues our efforts to specify techniques for successfully planting harsh sites. Matching tree species to site conditions (soil characteristics and flood regime) continues to be the most critical factor and mismatching accounts for many problems in operational plantings. Proper handling of planting stock and planting techniques are nearly as important.

Precommercial thinning of water tupelo stands in the Mobile-Tensaw River Delta was investigated. Contrary to results in other parts of the country, survival of water tupelo coppice was very high and the thinning and cleaning treatments did not affect survival. Cleaning Carolina ash and willow from the stands had no positive effect on individual tree- or stand-level variables measured. We concluded that cleaning had no beneficial effect over the 5 years of the study. Thinning, however, significantly increased diameter growth of the water tupelo. Thinning is potentially an effective option in stands with a high density of water tupelo sprouts (approximately 2,000 sprouts per acre over 3 feet tall at age 4 after clearcutting).

Forest soils are the basis of sustainability in resource management. We are focusing on the impacts of forest operations on soils, their physical and bio-

Successes - Our Strategic Framework in Action

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geochemical responses, and resulting effects on vegetation. Studies of above- and belowground growth and carbon allocation are being conducted in both reference and harvested bottomland hardwood forests, short-rotation woody crop plantations, and in flood tolerance experiments. In addition, the influence of different water level management and cover crop treatments on biomass productivity, retention of nutrients in biomass, carbon sequestration, and their influence on water quality are being quantified using experimental catchments.

Regenerating bottomland hardwood forests following harvest usually depends upon advanced regeneration and/or sprouting of the cut stems. However, the low regeneration success of desirable species illustrates our need to better understand regeneration dynamics in floodplain forests. Studies of the environmental factors that influence survival and growth of advance regeneration is helping to determine whether survival and growth of advance regeneration can be enhanced by preharvest treatments.

Maintenance of forest ecosystem health and vitality

We are evaluating electronic aromascan technology to detect pathogenic microorganisms in absence of visible indicators. These organisms cause economic loss in bottomland hardwood and other forests in the South. We have been able to discriminate pure cultures of wood decay fungi isolated from decayed trees. This technology has potential to identify wood decay fungi, vascular wilt fungi, bacterial wetwood, bacterial leaf scorch, and many microbes capable of causing lumber degrade in wood samples. Another approach is to develop a simple, accurate system to detect wetwood in living oaks and sawn oak lumber using ultrasound. An accurate prediction of site risk factors would allow silvicultural manipulation to reduce incidence of affected trees. We are focusing on characterizing bacterial populations, measuring physical characteristics, and using ultrasound to detect wetwood of oaks on bottomland sites in the Mississippi Delta.

Many wetland ecosystems in the Southeast are dependent on natural fire regimes. We are participating in research with the National Fire Laboratory to de-

Successes - Our Strategic Framework in Action

Wetlands, Bottomland Hardwoods, and Streams

velop prescriptions to apply prescribed fire to organic soil wetlands. That research is considering both fire behavior and the environmental effects on forest ecosystem health.

Southern Research Station scientists participated in an important symposium, "Ecology and Management of Bottomland Hardwood Systems: The State of our Understanding." The meeting brought together a wide array of our clients, including the full range of interests from production forestry in bottomland hardwoods to the protection of wetland forest ecosystems. Papers given at this symposium will be published in 2001.

Conservation and maintenance of soil and water resources

Long-term study of watersheds in the Atlantic Coastal Plain has allowed SRS scientists to evaluate the effects of prescribed fire, hurricane damage, and intensive versus nonintensive forest management on streamflow, water quality, and nutrient cycling. Often these studies involve collaboration with other Federal agencies, forest products industry, and university collaborators. Information from these studies is being used in regional assessments, such as the National Water Quality Assessment Program of the U.S. Geological Survey, and in preparation of wetland management guidebooks using hydrogeomorphic modeling by the Environmental Protection Agency.

A study of Carolina Bays has been initiated to determine the origin of water, establish pathways for net water transformations, determine the role of soil physical properties on water retention within the bays and associated uplands, assess the processes affecting water quality and mineral cycling in the bays, and evaluate the role of restoration on water quality improvements.

Hydrologic modeling is critical for assessing and managing the Nation's water resources. Unlike in the Western United States, there are few models for the Coastal Plain and Piedmont regions. Work is underway on the application of several models. The wetland hydrologic model, FLATWOODS, is being tested by the Southern Global Change Program in South Carolina to increase our understanding of the effects of land management on natural forest processes and the effects on available clean water. The information from this study will be applied to other types of forested wetlands (cypress ponds, Carolina Bays, and bottomlands) in the South. This model has the capability to simulate lateral water movement from upland forests to wetlands and can be used by land managers and planners. Tests are proceeding with a two-dimensional model, WATRCM, to assess water re-

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Wetlands, Bottomland Hardwoods, and Streams

sources at the landscape level. Future improvements to the models will include the ability to track nutrient concentrations dissolved in the water as they move across the landscape. These hydrologic models are also being used to provide the basis for models on soil carbon and nitrogen cycling in forested wetlands.

Maintenance of forest contribution to global carbon cycles

Following the conventional paradigm, afforestation of former agricultural fields should increase soil organic matter and thus not only improve the long-term, sustainable productivity of the soils, but also contribute to sequestration of atmospheric carbon. Numerous studies of reforestation are underway to test how different restoration techniques, site preparation methods, and silvicultural management practices influence carbon sequestration into soil organic matter.

Peatlands are natural carbon sinks because organic matter decomposition is less than net primary production. Because one-third of the global soil carbon pool is found in boreal peatlands, considerable concern exists over the potential impacts of global change and land management practices on the carbon balance in peatlands. In collaboration with Scandinavian scientists, studies of the changes in soil carbon pools associated with silvicultural practices are underway.

Soil carbon in wetlands is recognized as an important component of global carbon budgets and contributor to future climate scenarios. Until recently, however, little work has been done on modeling soil carbon cycling in these diverse ecosystems. In particular, studies have not addressed how the organic matter decay factor is modified as the soil environment changes, whether from land management activities, human disturbances, or climate change. Recently, a wetland soil carbon mode1 has been developed.

Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies

Society is increasingly demanding that timber production be conducted in a manner that enables forests to provide other benefits and services, including recreational

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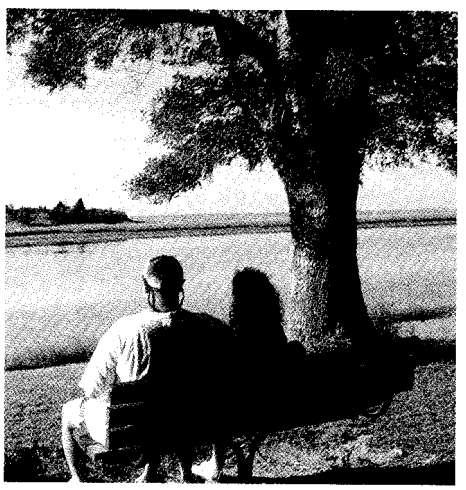
and scenic enjoyment, watershed protection, and wildlife habitat. A model has been developed to integrate economical and ecological perspectives for sustainable forestry. Models of economic



analyses are used to formulate research questions and study plans to develop socioeconomic assessment frameworks of sustainable forestry. In addition, a model is being developed for the simulation of forest stand succession and to predict forest stand attributes for forest ecosystems in landscapes with wetlands.

Legal, institutional, and economic framework for forest conservation and sustainable management

A module for economic analysis with environmental constraints has been developed for use with the model LEEMATH to assess the implications of alternative management strategies to the net profits from timber production and wildlife habitat quality.

Lead contacts for the Ecology and Management of Forested Wetlands, Bottomland Hardwoods, and Riparian Zones Cross-Cutting Theme: RWU SRS-4103 at Charleston, SC, and RWU SRS-4155 at Stoneville, MS.

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Southern Appalachians

The objectives of the Southern Appalachian Ecosystem Research and Sustainability Cross-Cutting Theme are to: (1) identify and test principles and develop ecologically based information applicable to management of Southern Appalachian forest ecosystems, focusing on natural and planned disturbances; (2) increase our knowledge of social and economic influences on forest resource management and the values derived from them; and (3) develop and provide tools to forest managers in a form useful for integrating ecological and socioeconomic information to aid in forest management decision-making.

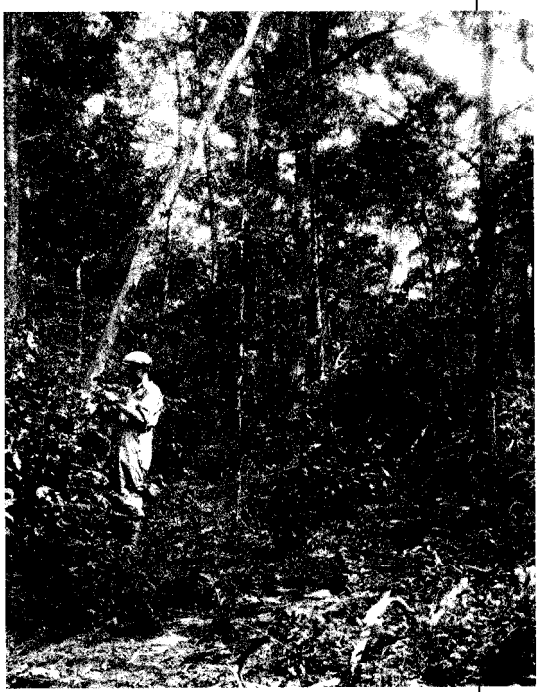
The major questions are straightforward and are not unique to the Southern Appalachians: (1) what are the values people associate with forests, both public and private, and what are the benefits expected from forests, given these values, and (2) what are the capabilities of forested ecosystems to provide these benefits on a sustainable basis?

The overall approach has been both to identify relevant ongoing research efforts and to initiate new efforts that will provide the information needed by forest managers. Much of this work will require interdisciplinary efforts and partnerships. Integration across disciplines and spatial scales will be aided through the development of land management tools such as decision-support systems. Research activities are organized in three broad categories: ecosystem dynamics, structure and function; social and economic influences in forest management; and synthesis and integration of information. Highlights in these categories for FY99 include:

Ecosystem dynamics, structure and function

Analysis of data from an ongoing study of mixed hardwood tree species indicated that site environmental factors related to soil moisture availability was superior to site index for explaining variation in periodic diameter growth of individual trees.

Southern Institute of Forest Genetics scientists developed DNA-based markers to facilitate the restoration of the American chestnut tree to



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eastern forests. The DNA-based markers developed for the host are being used to determine the number of genes that control resistance to chestnut blight fungus; detect additional sources of resistance; determine levels of genetic variation and how it is portioned across the natural range; and identify pure species from putative hybrids. The DNA-based markers developed for the pathogen are being used to study genes that cause a hypovirulent phenotype that may be used to develop a successful control program for the chestnut blight fungus.

Results from a study of the use of stand restoration burning in xeric pine/hardwood ecosystems were published in a series of papers in a special issue of *Forest Ecology and* Management. Studies showed that stand restoration burning is an effective tool for restoring desired species composition and diversity without negative impacts on nutrient cycling, small mammals, or forest floor insects, Studies are continuing that examine the linkages between biodiversity and ecosystem function in the Southern Appalachians. Several papers were published quantifying the significance of individual species' physiological characteristics, e.g., leaf respiration and photosynthesis, in regulating net primary productivity across the landscape. In addition, new studies have been established that examine the role of understory herbs and grasses in regulating forest floor processes. Research is continuing on developing understanding and predictive models of land-use change in the Southern Appalachian region. Concurrent studies of the effects of these changes on terrestrial and aquatic systems provide a linkage between historic, contemporary, and future effects of disturbance on ecosystem structure and function.

Our research on the interrelationships among the endangered Carolina northern flying squirrel, hypogeous mycorrhizal fungi (truffles), and spruce-fir habitat continued. In January 1999, we initiated a collaborative study with scientists from Clemson University, SC and North Carolina Wildlife Resources Commission to determine the seasonal food habits of northern flying squirrels and some of their potential competitors (southern flying squirrels, red squirrels, and chipmunks) in the Balsam Mountains, NC and the Great Smoky Mountains National Park, NC. Results of this study will allow us to determine the relative importance of truffles in the diet of northern flying squirrels as well as determine dietary similarity and the potential for competition among the various squirrel species.

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To gain further information about the habitat relationships of mycorrhizal fungi, we initiated a cooperative study with scientists at Appalachian State University, NC. The objectives of this research are to

test the relationships between mycorrhizal fungal sporocarps and habitat type (spruce-fir versus northern hardwood) as well as to examine the occurrence and abundance of fungi associated with tree roots in the two habitat types. This study is an excellent follow-up to previous work on the occurrence and abundance of truffles in spruce-fir and northern hardwood habitats and will test some of the hypotheses that were generated in earlier descriptive work. This research will also provide more specific information on potential dietary items for northern flying squirrels and the interrelationships between the fungi and dominant tree species in northern flying squirrel habitat.

Natural and artificial regeneration of upland hardwoods has been problematic in national forests and other landownerships in the South. Intensive research continues on long-term studies on hardwood regeneration, specifically northern red oak and white oaks. The research clearly indicates that tree seedlings with high numbers of first-order lateral roots are the most competitive and thus most likely to survive and become established when planted in harvested forest land. Both genetic and nursery selections are needed to secure quality seedlings. Full sunlight has been identified as the most critical requirement for artificial regeneration of these species on good sites in the Southern Appalachians, followed closely by competing vegetation control. Photosynthesis and other physiological studies demonstrate that under low light conditions, as occurs when planting these species beneath an overstory, carbon allocation to roots of these tree species is curtailed in favor of some limited stem growth, resulting in a declining ability of the seedling to compete with other vegetation once the overstory is harvested. These findings provide important technology for artificial regeneration of these oak species and have implications relative to species diversity and mast production for various wildlife species.

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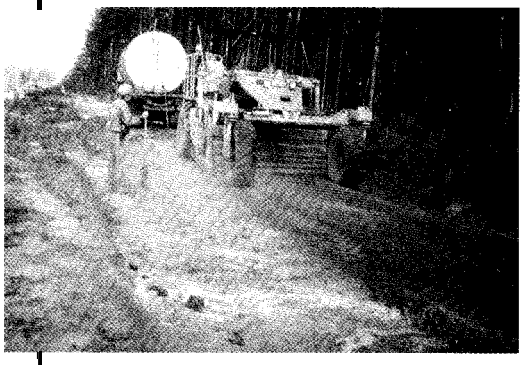
From a large subregional study of acorn production, we found that yearly acorn production varies among species and individual trees vary dramatically in their average production. Determining acorn crop sizes, patterns of production, and potential ways to predict crop size is useful to foresters in oak reproduction, and wildlife managers in assessing acorn availability for food.

Long-term studies of erosion control methods for forest roads are quantifying sediment trapping efficiency of alternative turnout ditch designs, erosion control for various vegetative stabilization treatments of road sideslopes, and life-cycle sediment yields of temporary stream crossings. The results of these studies will be synthesized into guidelines and recommended practices. A new



study has been initiated to examine the impacts of road obliteration practices.

Forest operations in upland sites are being investigated. The effect of removal intensity on productivity and cost for ground-based systems has been reported. A long-term study of manual methods for selection of stump sprouts was initiated. The costs of various methods were determined and the growth of the selected stems is being monitored to assess outcomes. A landscape visualization tool has been developed to depict alternative treatments. The program is being refined for open distribution.

Social and economic influences in forest management

The evaluation of hardwood pallet cants when converted to pallet parts was completed. We determined that cants with > 30 percent unsound wood should be reduced to chips. We also developed a spreadsheet business plan model and economic evaluator to enhance recovery and high-value uses of pallets at landfills. This has developed into a major effort at landfills to recover wood for reuse and recycling.

Understanding how people influence forests is crucial for developing effective ecosystem management plans. A research study evaluated patterns of land uses and development in four large areas of the Southern Appalachians. These studies explain how patterns of land use are determined by topography and by economic conditions. These research findings are incor-

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porated in a land use of forecasting model that predicts where and how land uses and building density may change in the future.

Another key to effective ecosystem management is understanding the values that people place on all of the benefits derived from forests. Three studies developed estimates of the amenity value of forests in the Southern Appalachian Mountains. The first study determined that recreation values in wilderness areas varied by the size of tree, maximum elevation, the amount of running water present and the degree of isolation offered. The second study evaluated the importance of various services provided by National Forests and discovered that people value ecological services (such as the supply of clean water or native ecosystems) more than recreational opportunities, the consumption of fish and game, or the supply of timber. The third study examined the distribution of benefits for protecting a unique forest ecosystem and found that conservation efforts provide equitable benefits to broad segments of the population.

Synthesis and integration of information

The first fully operational version of the NED ecosystem management decision-support system,

NED-l, was completed this year. The Microsoft COM/DCOM interoperability standard was tested and implemented as a generic, software communications standard for the NED family of software products. We were able to connect NED-l with the Forest Service growth and yield standard, forest vegetation simulator (FVS) using COM/DCOM.

Another major accomplishment was the consolidation of the extensive knowledge base of species-specific forest regeneration responses. This knowledge base has been captured in a computer program that simulates the postdisturbance response of forest regeneration in the Southern Appalachian region. The computer program is being distributed to practicing foresters (State forestry agency personnel, consulting foresters, and National Forest System silviculturists) through their participation in recurring silviculture short courses and other ongoing technology transfer activities.

Lead contacts for the Southern Appalachian Ecosystem Research and Sustainability Cross-Cutting Theme: RWU SRS-4101 at Bent Creek, NC, and RWU SRS-4351 at Franklin, NC.

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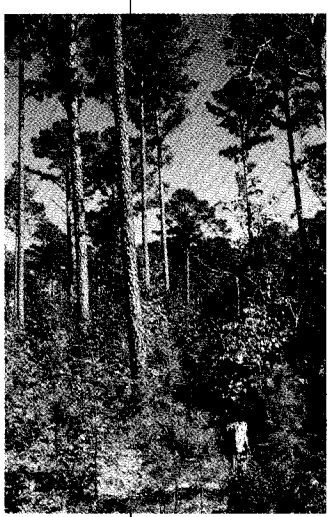
Interior Highlands



Research has an important role to play in the implementation of the Forest Service Natural Resource Agenda. The research conducted under the Sustainability and Productivity of the Interior Highlands Ecosystem Cross-Cutting Theme directly supports two elements of the Natural Resource Agenda-watershed health and restoration, and sustainable forest ecosystem management. The Interior Highlands are among the most important but least intensively studied regions in the mid-South. Four major ecological provinces comprise the Interior Highlands—the Ozark Highlands of southern Missouri and northern Arkansas, the Boston Mountains of north Arkansas, the Arkansas River Valley, and the Ouachita Mountains of western Arkansas and eastern Oklahoma. This CCT is designed to provide the scientific basis and integrating framework to support management of the Interior Highlands forests for public, forest industry, and nonindustrial private forest landowners.

The CCT builds on both the long standing ongoing research in the oak-hickory forest type, and on newer research studies in the shortleaf pine and pine-hardwood forest types, which constitute some of the lesser known of the major forest types in the South. These studies are bound together using interdisciplinary research programs that encompass vegetation, wildlife, aquatic ecology, hydrology, and human dimensions. Within these programs, SRS scientists have developed cooperative studies with scientists from the North Central Forest Experiment Station as well as with university, State and industry cooperators in Arkansas, Oklahoma, Missouri, Texas, Louisiana, Mississippi, and elsewhere.

A major effort contributing to this CCT has been the Ozark-Ouachita Highlands Assessment, an interdisciplinary assessment of conditions in the region coordinated by the National Forest System and the SRS.

This assessment will include the most comprehensive assembly to-date of data that relate to terrestrial and aquatic ecology, hydrology, atmospheric, and social sciences in the Interior Highlands. Of special interest to the research community is the potential of the Ozark-Ouachita Highlands Assessment to

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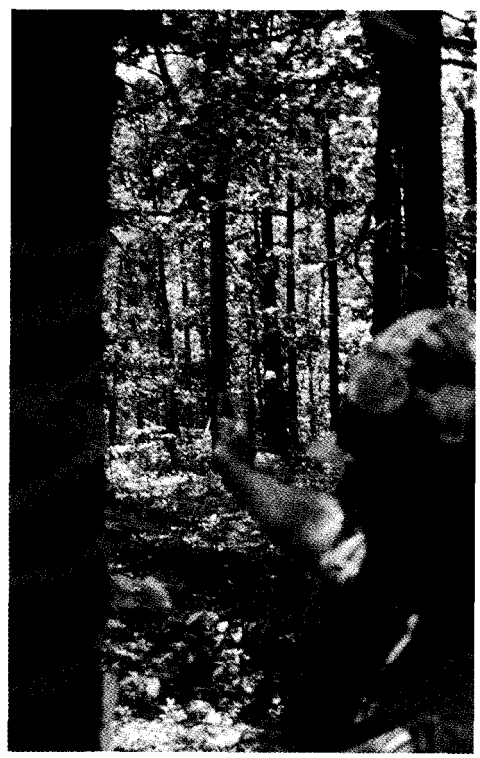
identify prominent gaps in existing knowledge of natural resources in the region, that can be addressed by expansion of existing interdisciplinary research programs.

Progress under this CCT was made in the ongoing measurement and monitoring associated with the Ouachita Mountains Ecosystem Management Research Project-a three-phase comprehensive ecosystem management research and demonstration project in Arkansas and Oklahoma. In FY99, the fifth year of post-treatment data was collected in the 52-stand data base; these data quantify the effects of reproduction cutting alternatives on vegetation, wildlife, arthropods and microbial diversity, logging and economics, visual quality, soils, and water quality. Treatment plans were finalized and implementation of the treatments commenced in the four-watershed landscape study, in which time substitutes for space in large-scale experimental replication of pretreatment conditions. The landscape treatments are being operationally conducted by cooperators in the National Forest System and forest industry. The experimental design, treatment, and monitoring of such broad-scale plot-intensive studies is possible because of cooperation with colleagues in the National Forest System, State agencies, and universities within and near the Interior Highlands. The end of FY99 saw plans in full gear for convening the "Symposium on Ecosystem Management Research in the Ozark and Ouachita Highlands," which is to be held in the first quarter of FYOO. The agenda calls for scientists to present more than 70 papers and posters emphasizing 5-year results



after treatment in the stand-level study, and 5-year baseline conditions in the landscape study, as well as data from other ecosystem management research projects in the Interior Highlands.

Additional studies are in the planning stages to better characterize the vegetation, wildlife, soil, herpetofaunal, and entomological effects of large-scale ecological

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process restoration using prescribed fire on public and private forests; to expand the spectrum of sustainable management alternatives in oak-hickory stands in the Interior Highlands; and to learn more about bat communities in the region.

Key research outcomes accomplished are documented in publications listed in the final section of this report. The publication of research describing landscape patterns of distribution of coarse woody debris in oak-hickory forests

in the Interior Highlands should prove useful in forest health monitoring and in comparisons with other regions. Publication of an even-aged, natural shortleaf pine growth and yield model, and release of the user's guide for the model, gives forest landowners and managers a guide for sustainable management of even-aged stands of shortleaf pine. The model can be used to project stand dynamics under different thinning regimes and also under alternative reproduction cutting methods. The model can be tailored to the specific conditions in a given forest stand. Research was published on the effects of alternative timber harvest activities on southern flying squirrels. The presence of mature forests adjacent to harvested stands, along with retention of unharvested riparian areas, overstory hardwoods, and snags within harvested areas reduced the severity of harvesting impacts on flying squirrels. However, the seed tree regeneration method, particularly where overstory hardwoods were not retained, produces a level of disturbance too severe for flying squirrel persistence. Research results on the quality of residual stands following uneven-aged reproduction cutting in oak-hickory stands in the Boston Mountains of Arkansas provided information on damage that can be expected when alternative reproduction cutting methods are imposed in the region.

Lead contact for the Sustainability and Productivity of the Interior Highlands Ecosystem Cross-Cutting Theme:
RWU SRS-4106 at Monticello, AR.

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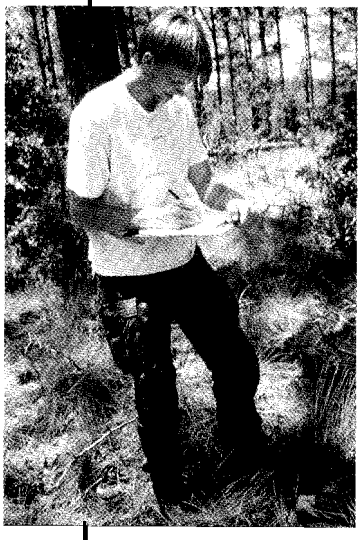
Large Scale Assessment and Modeling

The goal of the Landscape and Regional Integrated (Large-Scale) Assessment and Modeling Cross-Cutting Theme is to understand how biological, climatic, physical, and social sciences operate at large spatial scales under historic, current, and future conditions. Understanding and managing large-scale ecosystems is a complex problem that requires integration of analyses across ecological and social sciences. This integration 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. The broad focus of this CCT dictates that the research will cut across and integrate work being done in many disciplines. Developing landscape and regional modeling approaches provides a mechanism for translating field, laboratory, and fine-scale modeling research into a form that has applications to important problems related to large-scale forest ecosystems.



Research under this CCT is contributing to conceptual frameworks for interdisciplinary research to address regional environmental questions in the South. This work is being conducted in two areas. One addresses the issues faced by forest managers by organizing information on forested ecosystems and management responses in decision-support systems. The other, regional assessments, studies social and ecological systems at regional, continental, and global spatial scales and across time scales. The product of this research is improved scientific understanding and a set of assessment models that can be applied to examine regional resource issues.

Decision Support Systems

In the area of decision support, three research efforts have made considerable progress over the past year. An ecosystem management decision-support system has been developed for the Southern Appalachians. The system, named NED, brings together available knowledge on silviculture, wildlife, and water quality to fully inform and aid forest management. In addition to linking forest management to ecological and environmental implications, NED allows managers to design and compare the impacts of alternative management treatments on complex ecosystem management goals.

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Large Scale Assessment and Modeling

Another decision-support system effort is focusing on forest management at a broader scale. A prototype of the decision-support tool, Landscape Evaluation of Effects of Management Activities on Timber and Habitat (LEEMATH), has been completed that simulates timber growth and harvest, and habitat loss and regrowth for birds, reptiles, and amphibians in managed forest landscapes in the Southeastern United States. As an assessment tool of habitat quality at large scales, LEEMATH predicts potential habitat locations and areas of target species for a landscape or region with geographic information system (GIS) data. LEEMATH is being tested with wildlife data from field studies on the properties of the International Paper Company.

A third decision-support system was developed to maintain good water quality at the watershed scale. The GIS Assessment of Transport of Eroded Sediment (GATES) model is based on field research on the Wine Spring Watershed Ecosystem Study in western North Carolina. This GIS-based modeling system predicts where soil erosion will occur within a watershed, given alternative forest management practices. The model is designed to use existing data and to be operated by Forest Service and other land managers, The manager is able to develop alternate management practices, e.g., road construction and harvesting locations and timing, that minimize the amount of soil sediment that moves into a stream. The model is being validated with data collected throughout the Southeastern United States, as well as from collaboration with China that was recently funded by the Forest Service International Program.

Regional Assessment

Several research projects are contributing to our ability to assess historic, current, and future changes in southern forests. This includes work that examines the linkages between social and ecological systems, and linkages between climatic, physical, and biological components of forest ecosystems. Systems for evaluating the impacts of global climate change are being developed at regional and national scales.

In the area of social science, a set of studies has examined factors influencing land-use change in the South at various temporal and spatial scales. The research shows how economic and topographic factors organize patterns of land uses and have led to the development of land-use forecasts. Predictions of land-use changes are being incorporated in national and regional assessments. In the Southern Appalachians, fine-scale land-use forecasts have been used to focus ecological studies along a development gradient and to estimate the long-run ecological implications of land-use changes.

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Large Scale Assessment and Modeling

The SRS also completed a national assessment of recreation supply and demand and continues research on spatially explicit analysis of recreation trends. This research focuses not only on what kind of forest-based recreation is being demanded and where these demands are focused, but also on the broader implications of recreation use for forest ecosystems. These studies provide forest managers with basic data and insights into the recreation and tourism demands on southern forests and highlights where demands may be most intense. In addition, research has investigated the impacts of population growth and dispersion on forest conditions and uses on both private and public lands.

The South now produces twice as much timber as it did in the 1960's and more than 55 percent of all the timber produced in the United States. This has raised concern regarding the sustainability of forests and forestry in the region. To address these concerns, SRS leads a private-public consortium called the Southern Forest Resource Assessment Consortium to improve the assessment of timber supply and inventory in the South. This group, which involves 16 funding entities and 12 universities, has funded more than 25 studies over the past 5 years and continues to develop resource assessment tools for the public and private sectors.

The SRS continues to make progress in developing a modeling framework for evaluating the ecological and social implications of global climate change. This year, SRS scientists developed new techniques for scaling temperatures measured at monitoring sites up to broader spatial scales. Temperature is a key driver of ecosystem processes and is likely to experience increasing variability as a result of global change. Evaluating the potential impacts of an altered atmospheric environment on forested ecosystems requires a combination of predictive tools (models), long-term measurement data, and experimentation. A model was developed to scale air temperatures, a key driver of biological processes such as plant respiration, from small scales to regional scales. This model fills an important knowledge gap for scaling physiologically based hydrology and productivity models from stands and watersheds to regions.

There has been substantial progress in quantifying the role of southern pine forests in sequestering atmospheric carbon dioxide. An analysis of field experimental data indicated that, over 3 years, fertilization resulted in loblolly pine stands being a sink for atmospheric carbon dioxide, compared to unfertilized stands that were sources of atmospheric carbon dioxide. This large shift in carbon

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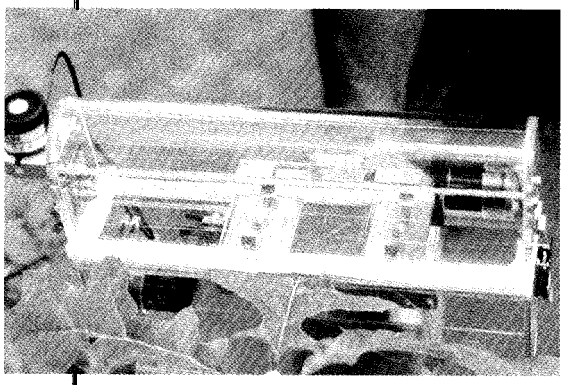
Large Scale Assessment and Modeling

economy was largely due to the higher productivity of fertilized



trees. Elevated carbon dioxide treatments increased photosynthetic rates through the tree canopies with and without fertilization when carbon dioxide was increased by approximately 60 percent. Branch and diameter growth increased by about 20 percent. Work continued to improve our ability to synthesize research results via mathematical modeling. In particular, progress has been made using a simple and effective model called Physiological Processes Predicting Growth (3-PG) in collaboration with Australian scientists. This model has the potential utility for industry as well as for making regional assessments.

The integration of global environmental change effects in regional and national assesments is critical to the development of science-based forest management and policy. In October 1997, the Southern Global Change Program and the Northern Global Change Program began a 5-year National Integrated Ecosystem Modeling Project to better understand how environmental stress influences forest productivity and hydrology across eastern forest ecosystems. Products from this effort are being used to assess regional forest productivity and carbon gain under current and future predicted climate and forest ecoregions. Forest carbon budgets are being developed for the region that will directly contribute to the National Forest Carbon Budget Assessment and research findings are contributing to the U.S. Global Change Research Program National Forest Assessment report to Congress.

Lead contacts for the Landscape and Regional Integrated Assessment and Modeling Cross-Cutting Theme: RWU SRS-4851 at Reseach Triangle Park, NC, and RWU SRS-4852 at Raleigh, NC.

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Inventory and Monitoring

The goal of the Inventory and Monitoring Cross-Cutting Theme (CCT) is to provide current resource information and analysis on forest ecosystem sustainability issues and to improve techniques to inventory, monitor, and evaluate resources. Immediate needs relating to this CCT can be summarized with four key questions:

1. How can strategic inventory and monitoring be implemented to meet timeliness and quality needs across all ownerships of the South?
2. How can social and economic influences be integrated into the strategic inventory and monitoring programs?
3. What are the relevant analytical procedures to address forest ecosystem sustainability questions and what criteria and indicators need to be developed?
4. How can the technology to achieve the necessary inventory and monitoring needs be developed?

In FY99, the Forest Inventory and Analysis Research Work Unit (FIA) hosted several meetings across the South that focused on annual inventories—these were efforts to address the first key question. Several hundred individuals from across the country representing States, universities, industry associations, landowners, and the Forest Service attended. Out of these meetings came the establishment of a Southern Annual Forest Inventory System (SAFIS) Technical Review Committee. This committee met in mid-November 1998 to review SAFIS plans and approaches, and identify future research needs. Another technical review meeting was held in May 1999. With work towards finalization of the national FIA field guide, a meeting was held with State Forester representatives to develop regional additions to the field guide. After development of early drafts, these regional enhancements were mailed out for wide review. Numerous other meetings with clients and collaborators were also held to develop technical and logistic aspects of annual inventories for the South.

Several States are now using their own resources to hire staff for field data collection for the base set of SAFIS plots. During FY99, eight States put an estimated $2,505,000 into the strategic inventory and monitoring program for the South. Funds of $1,170,000 in cost-share dollars were provided by the SRS. In terms of personnel, a total of 91 full-time-equivalents (FTEs) was utilized by the FIA unit with the State Forester organizations contributing another estimated 69 FTEs.

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Inventory and Monitoring

At the end of FY99, annual inventories were being conducted in five of the eight collaborating States (Georgia, Virginia, Kentucky, Tennessee, and South Carolina), with a final periodic inventory being done in an additional collaborating State (Alabama), and training being conducted for State-employed personnel in the remaining two States (Arkansas and Louisiana). In addition, Federal crews were conducting a periodic inventory in one State (North Carolina).

Nine SRS research work units and the Southern Forest Health Monitoring Program are now identified with the Inventory and Monitoring Cross-Cutting Theme. Initial discussions with representatives from each unit have identified several areas for potential research: recreation supply and demand; tree volume taper function development; economic and ecological models in broad scale assessments; use of FIA plots to develop a southwide data base, linking with other important variables; social/economic impacts on forest sustainability; effects of forestry and environmental laws; and ultrasonic and digital camera technology to assess tree and other resource characteristics.

One important issue that will be the subject of future study deals with the spread of exotic plant species across the South. Exotic plants are a growing threat to native plant and animal species and economically important pine and hardwood trees. The FIA program has recorded the presence and abundance of woody exotic plants as part of past inventories in the Southeastern States, and will continue recording the presence southwide in future inventories. The Southern Global Change Program, in collaboration with FIA, entomologists, and pathologists, is beginning to use past field data to map the distribution and density of exotic plant species across the Southeastern States. This information will be linked with detailed ecological data, such as soils, climate, and native plant communities, to better understand how exotic plants are able to establish and compete with native plants. The goal of this work is to develop management strategies for the control and eradication of exotic plant species.

Future work for the Inventory and Monitoring Cross-Cutting Theme will involve the development of an approach for incorporating all the science issues listed above into a coordinated plan for research.

Lead contact for the Inventory and Monitoring Cross-Cutting Theme: Program Manager for Southern Forest Inventory, Monitoring, and Analysis Program and RWU SRS-4801 at Asheville, NC.

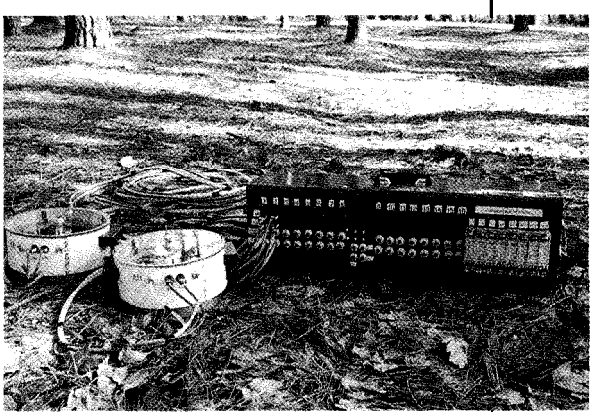
Successes - Our Strategic Framework in Action

Foundation Programs

In addition to the work that is related to the individual Cross-Cutting Themes, many studies are continuing under our overall mission that respond to several of the CCTs, to the Natural Resource Agenda, and to meeting other critical information needs. Many result from work that was begun several years, or even decades, before the current Strategic Framework was developed. The following examples show a broad cross section of the technology, information development, and research findings that do not fit just within one CCT.

Sustainable Forest Ecosystem Management

Soil, woody debris, root, and stem respiration measures are essential to understanding ecosystem carbon loss. We are now entering an age where carbon pool management is being legislated and the role soil respiration plays in carbon budgets continues to be refined. The Automated Carbon Efflux System (ACES) is a multiport, dynamic gas sampling system that utilizes an open flow-through design to measure carbon dioxide fluxes from the forest floor or woody tissue with a variety of chamber styles. It is a composite sampling system that switches sequentially through 16 chambers using solenoids; pumps air to and from the sample chamber; measures air flow rates, air and soil temperature in each chamber, and soil moisture; controls the gas analyzer; and records data from all of the output devices. The ACES is fully automatic, requiring only calibration checks twice per week. It provides the following data: time, chamber identification number, molar flow to and from the chamber, and continuous soil moisture reading. Respiration data from the ACES combined with soil moisture and temperature will provide a powerful tool for modeling CO,



efflux from soils. The ACES was designed to be used in remote field locations and runs on DC power. A provisional patent application has been submitted. The ACES will be applied to large-scale, collaborative carbon sequestration research across a variety of sites in the Southeast. The ACES is a tool integral to a newly funded Agenda 2020 project; current collaborators include Virginia Polytechnic Institute and State University, Duke

Successes - Our Strategic Framework in Action

Foundation Programs

University, Auburn University, Brookhaven Labs, Westvaco Corporation, and International Paper Company.

A spreadsheet business plan model and economic evaluator were developed to enhance recovery and high-value uses of pallets at landfills. This has developed into a major effort at landfills to recover wood for reuse and recycling. Recovery is an economical way to reuse pallet materials while reducing the need for trees as a source for new pallets.

New ways to improve the effectiveness of trenches for oak wilt control were examined. Final results for this study indicate that certain water-permeable trench inserts significantly increase the effective longevity of trenches beyond the first 3 years following trench installation. Most disease breakouts from trenches occur during the first 3 years. Biobarrier provided the best defense against trench breakouts due to root transmission of the oak wilt fungus. The epidemiology of potential vectors of the oak wilt fungus in Quercus species is the focus of a study in cooperation with the Texas Forest Service. We are developing probes to test potential insect vectors that may be carrying the oak wilt fungus. We are developing methods to quickly identify the fungi and have 10 species under study.

Recreation

Significant progress was made in understanding public preferences for forest management and ecosystem values. Nonmarket values (estimated using stated preference methods) showed that the public prefers more benign harvest practices on public forest land than on private land, and that an equal mix of areas available for harvesting and protection is preferred on public forest land.

Research assessing the national status and trends in outdoor recreation was completed and published as a book entitled Outdoor Recreation in American Life. This work is the Nation's authoritative source presenting information on trends in current and future supply and demand for outdoor recreation and wilderness. It is being widely used by agency, industry, academic, and nongovernmental organizational interests. Complementary to that recreation work is another book, Integrating Social Sciences with Ecosystem

Successes - Our Strategic Framework in Action

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Management, that provides insights into the need for and use of social sciences in the management of natural resources including recreation. Other highlights include journal articles on public attitudes regarding wildlife, recreation, ecosystem management, and environmental issues.

Other research includes evaluations of recreation demand for wildland activities focusing on cultural differences for rural participants. The study has found that southern rural blacks and whites differ on nonconsumptive wildland recreation preferences, but are similar regarding consumptive activities like fishing and hunting. A study in Jamaica has demonstrated that ecotourism can be an economically viable method for conserving forests and generating jobs and revenues in a lesser-developed country.

Forest Roads and Watershed Health and Restoration

Unpaved forest roads in the Southern Appalachian Mountains were often located near streams and rivers, thereby contributing storm flow and sediment to the aquatic ecosystem. Practices developed and studied at the Coweeta Hydrologic Laboratory aid landowners and managers in reconstructing these roads to protect water quality. Simple techniques for redesign of storm water drainage structures can provide low-cost alternatives, where the forest floor can absorb and filter runoff from roads. These practices apply not just in the Appalachians, but wherever storms and roads are placing sediment in the stream. Land managers and consultants who assist nonindustrial forest land owners can use the principles for maintenance, reconstruction, or restoration of problem roads.

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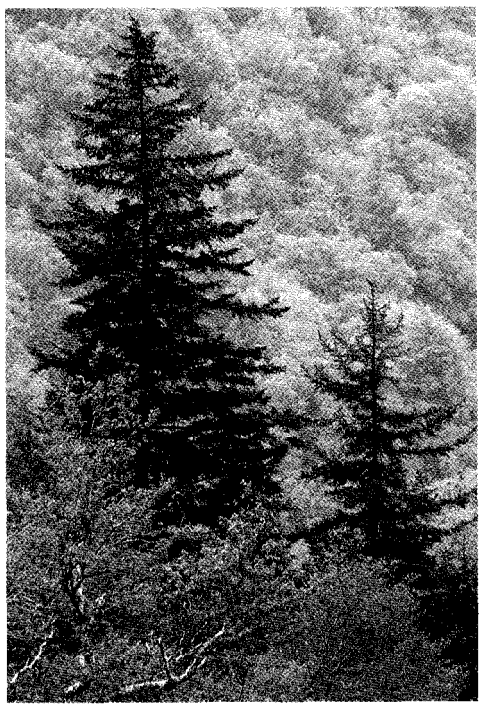
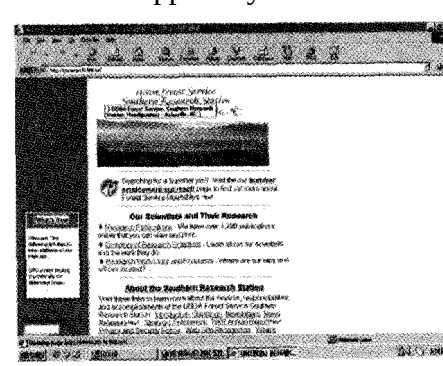
Science for Tomorrow's Forests

The SRS is providing strong leadership toward the Forest Service Natural Resource Agenda-espe-



cially in pursuit of sustainable forest management. Of particular note is the effort in restructuring Forest Inventory and Monitoring systems and in addressing special problems of the wildland-urban interface in the South. The SRS, with the Southern Region of the National Forest System, has initiated a region-wide assessment to determine the conditions and dynamics of rapidly urbanizing forest lands, and identify threats to and opportunities for enhancing the sustainability of healthy human and natural communities there. We are contributing much research information to the development of national forest plan revisions in the South: findings about the rare Louisiana pine snake and the endangered red-cockaded woodpecker that will reduce negative impacts of forest management on these species, sideboards for new riparian area management guides for the Appalachians, and a new understanding of the value of prescribed fire to understory vegetation and biological diversity of southern pine forests, especially in longleaf pine forest ecosystems. The SRS has developed a national assessment method for estimating recreation use on national forests.

We continue to lead the Nation in the transformation of the Forest Service's traditional periodic forest inventory process to a new continuous, annual inventory (SAFIS). Eight States have collaboratively implemented annual inventory techniques developed by SRS. They are contributing funding and personnel to assist the Agency's program to implement the annual inventory. The SRS Web site is reaching incredible numbers of customers globally with more than half a million hits a year by 100,000 individual visitors. The Web site contains hundreds of publications that can be downloaded as well as other research products, such as GIS-based models, hypertext, and decision-support systems.



Science for Tomorrow's Forests

Southern Forest Resource Assessment

The over 200 million acres of forested lands in the Southern United States are among the most productive and diverse in the world. They contain a rich mixture of plants, wildlife, and aquatic species and provide a wide variety of products and benefits for people. Pressures being placed on them are increasing rapidly as population in the region expands and the world's demand for forest products continues to grow.

In order for public and private policy- and decision-makers to respond appropriately in the new millennium when faced with the challenge of ensuring long-term forest resource vitality, they must be equipped with the best information available regarding the forest ecosystem's status, diversity, and sustainability. Assessment models along with data sets from throughout the SRS provide the broadest complement of knowledge for evaluating southern forest resources. Under the leadership of the Southern Region and SRS of the USDA Forest Service, several Federal agencies, and southern State forestry agencies, are initiating a 2-year assessment of the forest reources of 13 southern States. This effort is due to be completed in 2001 and is designed to organize the best available knowledge regarding southern forest for the general public and policy makers. It also will provide an excellent opportunity for informed ongoing public debates regarding research and forest ecosystems in the South.

Ozark-Ouachita Highlands Assessment

The Ozark-Ouachita Highlands Assessment was completed in 1999 and is scheduled to be released in early spring, 2000. Federal and State natural resource agencies and university cooperators worked together to produce four technical reports and a summary that examine air quality, aquatic conditions, social and economic conditions, and terrestrial vegetation and wildlife. The USDA Forest Service, including the SRS, initiated the assessment and worked with other agencies to develop a synthesis of the best information available on conditions and trends in the Ozark-Ouachita Highlands of Arkansas, Oklahoma, and Missouri. While the reports are of most relevance to planning for the management of the national forests in the area, people who are interested in the future of the area's other public lands should also find the assessment to be of interest and value. The assessment reports themselves do not contain any decisions about land management in the Highlands, or about future research, but they do provide decision-makers with an invaluable compilation of background material.

Web site: http://www.fs.fed.us:80/oonf/ooha.

Science for Tomorrow's Forests

Encyclopedia of Oak Cover - Type Ecosystems

Many social and economic institutions in the Southern Appalachians depend on benefits afforded by upland oak forests that predominate here. Traditional rural economies rely on abundant, high-quality timber; plentiful, diverse wildlife and fish; extensive recreational opportunities; and several special forest products. Public and private managers of these ecosystems are challenged by an increasingly complex set of benefits, but continue to rely on traditional ad hoc management practices. A gap remains between what scientists have learned about sustainable upland oak ecosystems here and what land managers can apply.

Currently, an overwhelming body of information about these ecosystems is not easily accessible nor readily useable, because it has not been synthesized and integrated into a coherent, meaningful knowledge structure that is useful for problem solving. A project to synthesize and integrate the past 65 years of Southern Appalachian research on upland oak ecosystems, and to translate it into an intelligent, hyperdocument-based encyclopedia system that is accessible over the Internet has been proposed. Scientists will determine pertinent research knowledge to identify its content and structure, and codify that content and structure into hypertext format. More than a Web site, the encyclopedia will incorporate programmed intelligence in knowledge-based systems and simulation models for problem solving and decision support and will integrate data base access. It will be dynamic, making future updates easier and nonlinear, allowing a greater level of knowledge integration than print media can accommodate. Additional objectives include: (1) answering scientific questions such as whether the encyclopedia is an effective way to identify knowledge gaps, and (2) determining whether the encyclopedia can enhance the decision-making abilities of land managers.

Web site: http://www.srs.fs.fed.us/bentcreek/.

Science for Tomorrow's Forests

Assessing the Urbanization of Forests in the South

Urban sprawl and its effects on forests is not a new issue in the United States. Population growth is an important factor in land-use change. The South is experiencing the biggest leap in population growth in the country. Between 1980 and 1990, population increased by 17 to 18 percent and is expected to increase another 23.7 percent between the years 2000 to 2020. These changes are most evident on the fringes of towns and cities in the wildland-urban interface- the zone where human influences, land-use conversion, and habitation are increasing impacts to natural resources and the benefits that they provide to humans. Although population growth and land-use change are major drivers for change to the forest landscape in the interface, there are also many other social, economic, and policy factors. Some examples are changing landowner objectives, changing perceptions and values, lack of comprehensive planning, and changes in market land values.

The SRS and the Southern Region of the USDA Forest Service recently began an assessment of the wildland-urban interface and the factors that contribute to the urbanization of forests in the South. It will examine resulting ecological and social impacts including: changes to ecosystem structure and function, changes in natural resource management practices, and human quality of life issues. Examples of individual wildland-urban interface issues to be addressed are habitat fragmentation, loss of biodiversity, fire management in a mixed urban/rural setting, and loss of green space. The assessment will include spatial, temporal, and historical aspects of these factors including current and future trends and GIS analysis. Its focus is region-wide, covering 13 Southern States. Web site: http://www.interfacesouth.org.

Science for Tomorrow's Forests

Fire in Florida's Ecosystems Educational Program

National Resource Conservation Education and Environmental Protection Agency grants, with other help from The Nature Conservancy and Tall Timbers Research Station, provided resources necessary for the Fire Protection Bureau, Florida Division of Forestry (FLDOF), in cooperation with the SRS to develop materials for a program titled "Fire In Florida's Ecosystems." To date an "Educators Guide," "Student's Guide," and accompanying posters have been developed to introduce the subject of wildland fire to public school children in grades 4 through 8.

Additional funding from the Federal Emergency Management Agency and FLDOF in the aftermath of the 1998 Florida wildfires enabled the FLDOF to fund, through a grant, the development of a curriculum they will use to conduct a minimum of 42 teacher workshops across Florida within the next 2 years. The goal is to train the trainers to effectively institute the Fire In Florida's Ecosystems program on a Statewide basis. Many land managers believe 1998 and 1999 wildfires were severely exacerbated by the lack of an adequate level of prescribed burning in the State, due to public resistance. Many land managers also recognize that the public's support is essential to any land management strategy. Abraham Lincoln aptly stated it ". . .with public support anything is possible, without it nothing can succeed." The underlying premise of this whole effort is that a better-informed electorate will make wiser choices.

Science for Tomorrow's Forests

Conservation and Management of Southern Bats

Nearly one-quarter of all mammals inhabiting southern forests are bats. They are among the most diverse, specialized, and fascinating groups of vertebrates and many of their activities contribute to ecosystem health and benefit humans. For example, bats consume huge amounts of insects per night, many of which are detrimental to forestry and agriculture. Furthermore, because bats fly large distances between their feeding and roosting areas, they play an important role in redistributing nutrients across the landscape.

Bat populations throughout the world have been declining for decades and it is estimated that at least half of all North American bat species are in severe decline. Four of the seven species of Federally endangered bats in the United States are found in the South and four additional species are considered to be species of special concern by the U.S. Fish and Wildlife Service and Bat Conservation International. Disturbance of hibernation and maternity caves were the major factors leading to the endangered status of species such as the Indiana bat and the gray bat; however, loss or degradation of forest habitat may be contributing to further declines, Worldwide, loss of forest habitat is the major factor contributing to the decline of bat species and is probably the most important factor leading to the decline of southern species such as Rafinesque's big-eared bat and the southeastern bat, both of which are species of concern. These and many other species use the hollows, cavities, and loose bark of large trees for roosting and maternity sites. However, we have little knowledge of forest bat habitat relationships and the factors, including forest management, that affect bat populations, The need to develop effective forest management strategies to conserve and recover the southern bat fauna is crucial because of the ever increasing demands on southern forests for timber products and the rapidly growing human population, which is resulting in further destruction and fragmentation of southern forests.

Because managers of public and private lands lack the needed information to develop effective management strategies for bats, we proposed a comprehensive research program on the biology and ecology of southern forest bats. Projected outcomes of this research program, while not yet funded, include:

1. Information on the status and distribution of forest-dependent bats including the Indiana bat, Rafinesque's big-eared bat, and the southeastern bat.
2. Forest management strategies that can be used to conserve and recover endangered and sensitive bats.
3. Determination of forest species composition, structure, and landscape configurations that satisfy the roosting and foraging requirements of southern bats.
4. An understanding of forest bat community structure and dynamics and the factors, including forest management, that affect bat communities.

Science for Tomorrow's Forests

International Activities

Much of the research and development carried out by the SRS has value far beyond the South, both nationally and internationally. The needs and demands of the American public for the benefits from forested lands are met, in part, by resources from many other countries. It is critically important that sustainable forest management science and practices be advanced throughout the world. Our scientists continue to increase their participation in the worldwide science community through many avenues. They participate in international conferences and workshops that are held here and in other countries, making presentations, displaying posters, displays, and publishing papers. They host scientists from other areas and travel to other places to provide expert advice on a wide range of subjects; for example, controlling invasive species of plants, insects, or disease. Ongoing cooperative research studies result in collaborative publications that benefit both countries involved.

The following examples illustrate the range of SRS international activities:

1. Organized and hosted International Union of Forestry Research Organizations meeting-exchanging information on decision making in forest ecosystem management with 65 attendees from 11 countries.
2. Developed collaborative research program with Chinese scientists on potential for biocontrol of kudzu as part of an integrated pest management program for kudzu control.

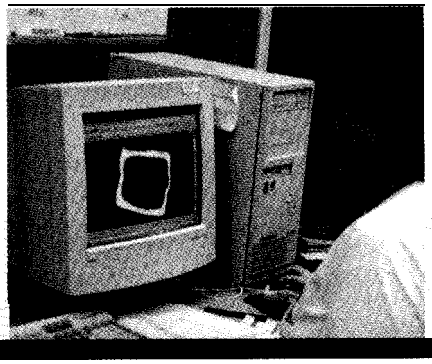
3. Served as soils consultant to the Center for International Forestry Research in Jakarta Indonesia, for project on long-term productivity of short-rotation tropical plantations.
4. Participated in a joint project with the International Centre for Agroforestry in Kenya to increase knowledge of impacts of management on soil process.
5. Served as Associate Editor for Canadian Journal of Forest Research, an international journal.
6. Presented an invited lecture and participated in collaborative research in Canada on

Science for Tomorrow's Forests

International Activities

current status of Cerulean warblers and factors affecting their habitat viability to improve understanding of threatened and endangered species conservation.

7. Invited to tour Japanese research laboratories to develop a collaborative approach to measuring forest ecosystem carbon cycles and determining impacts of land-use change on carbon sequestration.
8. Gave invited seminar at El Colegio de la Frontera Sur (ECOSUR), Chiapas, Mexico, on interactions of mites and fungi associated with the southern pine beetle and their ramifications to control these forest pests in Mexico and the Southern United States.
9. Consulted with the Chinese Academy of Forestry and developed a collaborative research program on the assessment and utilization of plantation wood resources toward comprehensive end-use products.
10. Conduct research on the economic feasibility of reduced-impact logging technology in the Brazilian Amazon.



Our Scientists at Work:
Programs, People, Facilities

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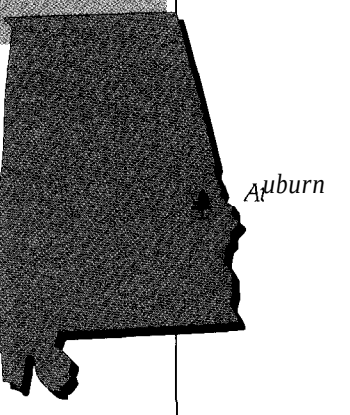
Our Scientists at Work: Programs, People, Facilities

Our research work units (RWUs) are located in offices and laboratories in nine States across the Southern United States. Our research and development 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 or individual scientists are located at additional sites in 11 Southern States. The SRS RWUs are identified by name and a four-digit number; for example, SRS-4505, Insects and Diseases of Southern Forests. The numbers provide helpful internal shorthand for budget and cross-referencing purposes.

SRS-4105 and SRS-4703



G.W. Andrews Forestry Sciences Laboratory
520 Devall Drive
Auburn, AL 36849 • (334) 826-8700

The G.W. Andrews Forestry Sciences 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 include greenhouse, shop, warehouse, and chemical storage facilities.

SRS-4105, Vegetation Management Research and **Longleaf** Pine Research for Southern Forest Ecosystems

The mission of this unit is to (1) determine the environmental fate and impact of forest herbicides and develop integrated vegetation prescriptions for multiple resource benefits in southern forestry, and (2) 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.

SRS-4703, Biological/Engineering Systems and Technologies for Ecological Management of Forest Resources

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.**

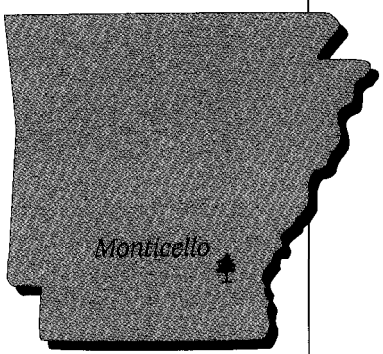
Website for SRS-4703: http://srs4703.usfs.auburn.edu/unit.html

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4106

Forest Resources Building
University of Arkansas at Monticello
P.O. Box 3516, Room 211
Monticello, AR 71656-3516
(870) 367-3464



This unit is located at the University of Arkansas, in cooperation with the School of Forest Resources and the Arkansas Agricultural Experiment Station. The 1,675acre Crossett Experimental Forest, located 7 miles south of Crossett, is maintained as a research and demonstration forest.

SRS-4106, Managing Upland Forest Ecosystems in the Midsouth

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

1. 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;
2. silvicultural alternatives for regenerating and managing upland forests which requires a better understanding of forest stand dynamics including the role of disturbance; and
3. a better understanding of the effects of silvicultural treatments on forest stands and interactions between stands which is needed to make landscape-level decisions.

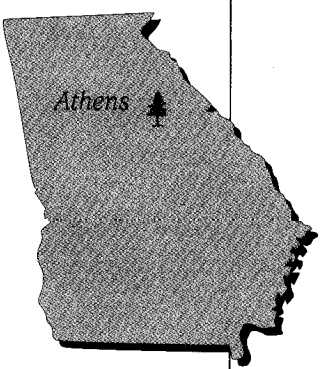
More information available at: http://www.srs.fs.fed.us

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4104, SRS-4505, and SRS-4901

Forest Sciences Laboratory
320 Green Street
Athens, GA 30602-2044
(706) 559-4222



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

SRS-4104, Disturbance and the Management of Southern Pine Ecosystems. 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 Piedmont and Atlantic Coastal Plain. The 5,000-acre Hitchiti Experimental Forest near Juliette, GA, is the focus of the Ernst Brender Demonstration Forest hosting approximately 40 workshops and tour groups per year.

SRS-4505, Insects and Diseases of Southern Forests. 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 exotic plant, kudzu, and the fungi that cause dogwood anthracnose and butternut canker.

SRS-4901, Assessing Trends, Values, and Rural Community Benefits from Outdoor Recreation and Wilderness in Forest Ecosystems. 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. SRS-4901 Web site: http://www.srs.fs.fed.us/recreation/.

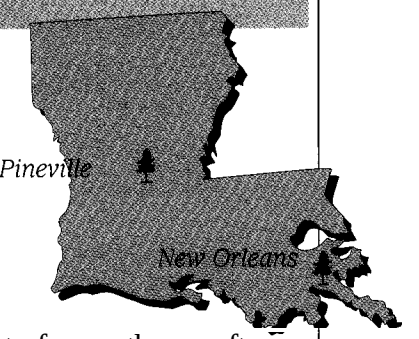
More information available at: http://www.srs.fs.fed.us

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4802

T-10034 U.S. Postal Building
701 Loyola Avenue
New Orleans, LA 70113
(504) 589-6652



SRS-4802, Evaluation of Legal, Tax, and Economic Influences on Forest Resource Management. 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.

SRS-4111, SRS-4501, and SRS-4701

Alexandria Forestry Center
2500 Shreveport Highway
Pineville, LA 71360
(318) 473-7215

The Alexandria Forestry Center in Pineville was constructed in 1963 to house the Forest Sciences Laboratory of the Southern Forest Experiment Station (now SRS), 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.

SRS-4111, Ecology and Management of Even-Aged Southern Pine Forests. 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. SRS 4111 Web site: http://www.srs.fs.fed.us/4111/.

SRS-4501, Southern Pine Beetle: Ecology, Behavior, and Management. 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. SRS-4501 Web site: http://www.srs.fs.fed.us/4501/.

SRS-4701, Utilization of Southern Forest Resources. This unit defines and describes the fundamental raw material characteristics influencing the sustainable and environmentally sound use of southern forest resources. SRS-4701 Web site: http://www.srs.fs.fed.us/4701 /.

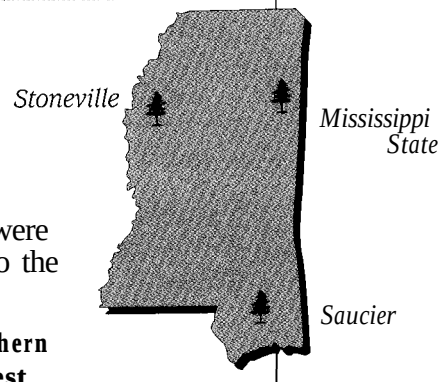
More information available at: http://www.srs.fs.fed.us

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4153

Harrison Experimental Forest
23332 Highway 67
Saucier, MS 39574-9344
(228) 832-2747



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 4,111 acres that typify about 31 millions acres of land with similar spoils and topography in the South. The institute is housed in some buildings that date back to the mid-1930's, constructed by the CWA, Works Progress Administration (WPA), and Civilian Conservation Corps (CCC); four new laboratories for molecular genetic analyses on southern pines were recently added to the site.

SRS-4153, Southern Institute of Forest Genetics. The mission of this unit is to discover the principles of heredity that operate in southern forests and demonstrate how these principles may be applied to sustain and enhance forest quality and productivity.

Website for SRS-4153: www.srs.fs.fed.us/sifg/

SRS-4502

P.O. Box 6124
Mississippi State, MS 39762-6124
(601) 325-0199

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.

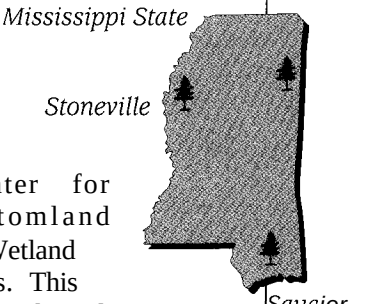
SRS-4502, Wood Products Insect Research. The mission of this unit is to define the role of termites in forest ecosystems, to improve protection of wood against damage, and to understand the impact of termites on forest health. All new termiticides must undergo extensive laboratory and field testing by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

Website for SRS-4502: www.srs.fs.fed.us/termites/

Our Scientists at Work: Programs, People, Facilities

SRS-4155

Southern Hardwoods Laboratory
P.O. Box 277
Stoneville, MS 38776
(601) 686-3154



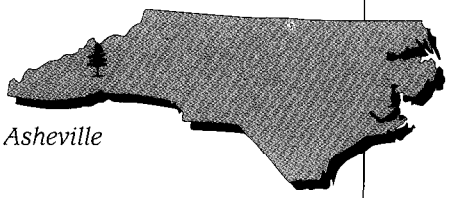
The Southern Hardwoods Laboratory is located on a 3.45acre site that is part of the Mississippi State Forestry and Agricultural Experiment Station. The 18,000-square-feet building houses offices, a photo lab, and lab facilities for plant pathology, entomology, plant physiology, and soils. The site also has 2,000 square feet of greenhouse space, 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.

SRS-4155, Center for Southern Bottomland Hardwood and Wetland Forest Ecosystems. 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.

More information available at: http://www.srs.fs.fed.us/cbhr

SRS-4801

P.O. Box 2680
200 W.T. Weaver Blvd.
Asheville, NC 28802
(828) 257-4350



The headquarters of the SRS occupies 11 acres of land leased from the . University of North Carolina and houses the Station Director and staff, administrative units, and SRS-4801. The Asheville Field Office of Forest Health Protection, a unit of the National Forest System's State and Private Forestry, is also located at this site.

SRS-4801, Forest Inventory and Analysis. 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 SRS's new Southern Forest Inventory, Monitoring and Analysis Program, which consolidated 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.

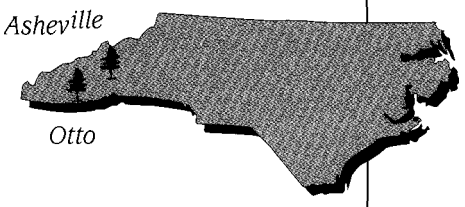
More information available at: http://www.srsfia.usfs.msstate.edu

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4101

Bent Creek Experimental Forest
1577 Brevard Road
Asheville, NC 28806
(828) 667-5261



The Bent Creek Experimental Forest is 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.

SRS-4101, Ecology and Management of Southern Appalachian Hardwood Forests. 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 forests.

Website for SRS-4101: http://www.srs.fs.fed.us/bentcreek/

SRS-4351

Coweeta Hydrologic Laboratory
3160 Coweeta Lab Road
Otto, NC 28763
(828) 524-2128

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 11 long-term ecological research sites, and was included in the International Biological Program, the International Hydrologic Decade, and United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and the Biosphere Program

SRS-4351, Evaluation of Watershed Ecosystem Responses to Natural, Management, and Other Human Disturbances of Southeastern Forests. 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.

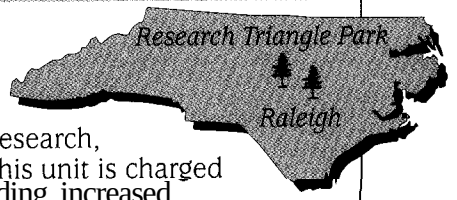
More information available at: http://www.srs.fs.fed.us

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4852

Southern Global Change Program
920 Main Campus Drive
Venture Center 2; Ste 300
Raleigh, NC 27606



The Southern Global Change Program is a member of the Air Resources Consortium on the North Carolina State University (NCSU) campus and has relocated to the Centennial Campus at NCSU.

SRS-4852, Southern Global Change Program. 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.

Website for SRS-4852: http://www.sgcp.ncsu.edu/sgcp.html

SRS-4154, SRS-4803, and SRS-4851

Forestry Sciences Laboratory
3041 Cornwallis Road, P.O. Box 12254
Research Triangle Park, NC 27709
(919) 549-4093

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 fosters collaboration with the forestry schools and libraries at Duke University and North Carolina State University.

SRS-4154, Biological Foundations of Southern Forest Productivity and Sustainability. 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-4803, Forest Health Monitoring. 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.

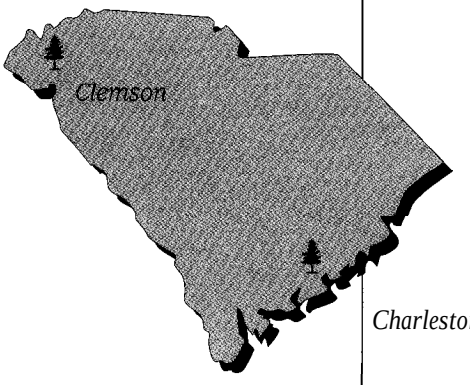
SRS-4851, Economics of Forest Protection and Management. This unit's mission is to analyze the economic status, trends, and opportunities for forest management in the South, including the effect of public programs and regulations on private forest landowners; to perform economic and impact assessments 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; and to evaluate economic and social impacts of changing public values, laws, and programs.

Website for SRS-4154: www.emapfhm.gov/soils/soilhome.htm
Website for SRS-4803: www.//willow.ncfes.umn.edu/fhm/fhm_hp.htm
Website for SRS-4851: www.emapfhm.gov/econ/econhome.htm

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4103



Center for Forested Wetlands Research
2730 Savannah Highway
Charleston, SC 29414
(843) 727-4271

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.

SRS-4103, Center for Forested Wet-lands Research. 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.

Website for SRS-4103: www.srs.fs.fed.us/charleston/

SRS-4201

Department of Forest Resources
Clemson University
Clemson, SC 29414
(864) 656-3284

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

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

Website for SRS-4201: www.srs.fs.fed.us/4201

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4251

Wildlife Habitat and Silviculture Laboratory
Box 7600, SFA Station
506 Hayter Street
Nacogdoches, TX 75961
(409) 569-7981

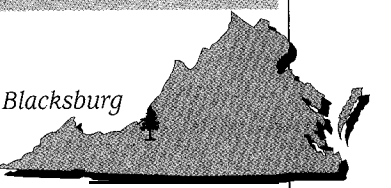
The Nacogdoches Wildlife Habitat and Silviculture Laboratory is located near the 2500-acre Stephen F. Austin Experimental Forest.

SRS-4251, Integrated Management of Wildlife Habitat and Timber Resources. 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 threat-ened and endangered species.

More information available at: http://www.srs.fs.fed.us

SRS-4202

Department of Fisheries & Wildlife Services
Virginia Polytechnic Institute & State University
Blacksburg, VA 24061
(540) 231-4016



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

Website for SRS-4202: www.trout.forprod.vt.edu

SRS-4702

Brooks Forest Products Center
Virginia Polytechnic Institute & State University
1650 Ramble Rd. • Blacksburg, VA 24061
(540) 231-4016

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

Website for SRS-4702: www.se4702.forprod.vt.edu

Caring for the Land and Serving People

Our Most Important Product: Knowledge

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The Southern Appalachians 90
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Our Most Important Product: Knowledge

Each year our scientists publish several hundred journal articles, book chapters, presentation papers, Southern Research Station publications, and other materials. The publications are sorted according to the primary cross-cutting theme (CCT) that they support, but many of them relate to more than one CCT, as well as the three emphasis areas in our Strategic Framework as well. The final section "Foundation Programs" lists materials that relate to multiple CCTs, continue important studies that are in addition to the CCTs, and also to the Forest Service Natural Resource Agenda. Many of these publications are available online at the Southern Research Station Web Site: http://www.srs.fs.fed.us/pubs/index.htm

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Our Most Important Product: Knowledge

Southern Pines

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Our Most Important Product: Knowledge

Southern Pines

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Our Most Important Product: Knowledge

Southern Pines

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Our Most Important Product: Knowledge

Southern Pines

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February 2000

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