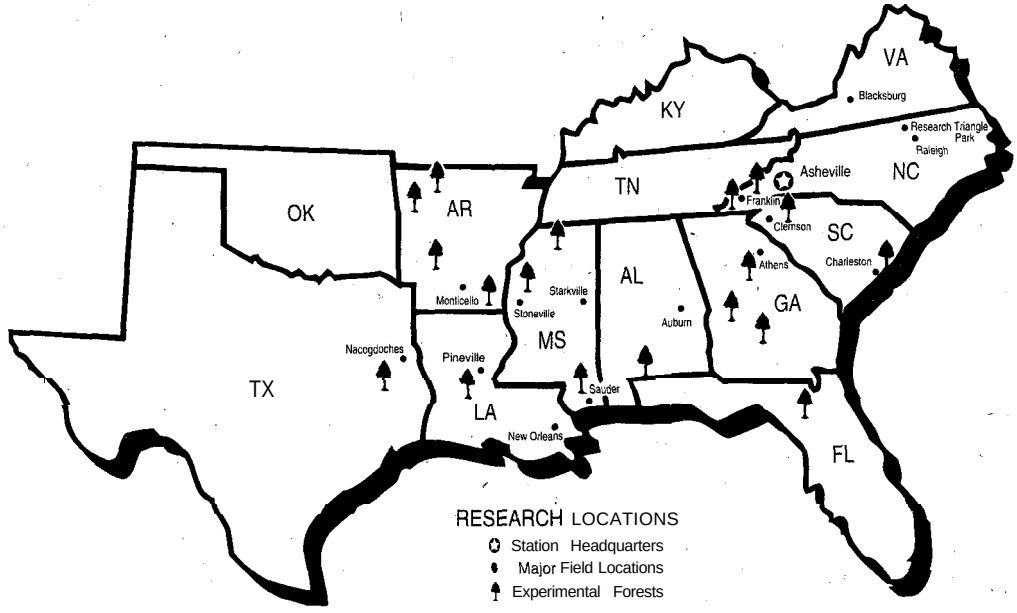
Annual Report for 1998

Southern Research Station

United States
Department of
Agriculture

Forest Service

Southern
Research
Station



Our missiqn 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

August 1999

The Director3 View

Report for the Southern Research Station for FY '98

I am pleased to provide you with the Report for the Southern Research Station for Fiscal Year (FY) '98, which highlights the time period from September, 1997 to October, 1998. It will provide'you with an overview of the work that we do, and examples of our accomplishments. Included is a list of our publications for the year; it includes abstracts, journal articles, technical reports, and books. The main "product" we offer is information-increased knowledge about the forested environments of the South. Much of our research takes place over the course of several years, so many studies are underway that are not discussed.

We have continued to progress with our Strategic Planning. The Strategic Framework' for the Southern Research, Station has set the stage for us to restructure our research program so that it is well aligned with the Forest Service Natural Resource Agenda's, goal to achieve resource sustainability. I am excited about the direction this effort will be taking us in the future, as it allows us to be flexible in response to the needs of our customers. Cross-cutting theme enhancements to address national priorities are expected to include the following topics in the near future: expanded productivity on nonindustrial private lands; the urban/wildland interface; recreation, wilderness, and social dynamics; nonnative invasive species; carbon sequestration; water quality effects of forest operations; pine productivity; monitoring; soil and water resource health; threatened and endangered species of plants and animals; and environmental and social implications of population growth.

In our internal administration, we succeeded in improving our financial management operations in accordance with national goals. Our Customer Service and Civil Rights programs are flourishing, with our workforce maintaining the vitality to provide and support exemplary research and development.

As part of the world's largest forestry research organization, we are committed to m&eting the needs of America's people in applying research findings to land and resource management.

Our Web site — **www.srs.fs.fed.us** — is a great place to start if you want to find out more about the work we do. You may also contact us in person, by mail, or phone at our headquarters office:

USDA Forest Service
Southern Research Station
PO Box 2680
200 WT Weaver Blvd.
Asheville, NC 28802
828-257-4832

PETER J. ROUSSOPOULOS
Director

FY 98-Accomplishment Summary

WORK UNITS.....25

PUBLICATIONS . . . 714

PEST-IMAGE SOFTWARE (CD-ROMs) 2

PATENTS 1

WEB SITES 13

PUBLICATION REQUESTS FILLED
HARD COPY ..... >70,000
ONLINE/ELECTRONIC . . . 25,000

SITE TOURS .....

INVITED PRESENTATIONS 297

CONSERVATION EDUCATION INTERN
PROGRAM CONTACTS 2,400

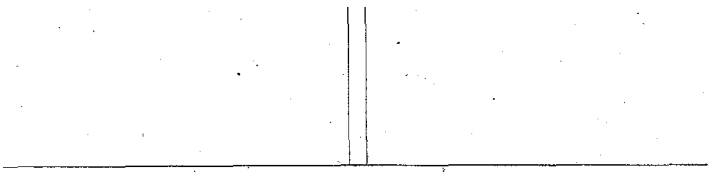
TOTAL EMPLOYEES 492
SCIENTISTS 144

BUDGET
(RESEARCH FUNDS ONLY). $36,451,000

AWARDS TO STATES, UNIVERSITIES AND
OTHER FEDERAL AGENCIES
(ALL FUNDS)..... $7,756,192

EXTERNAL FUNDING RECEIVED FROM
NONFEDERAL SOURCES AND OTHER
FEDERAL AGENCIES ..... $1.666~452

COLLABORATING ORGANIZATIONS . . . 89



Caring for the Land and Serving People

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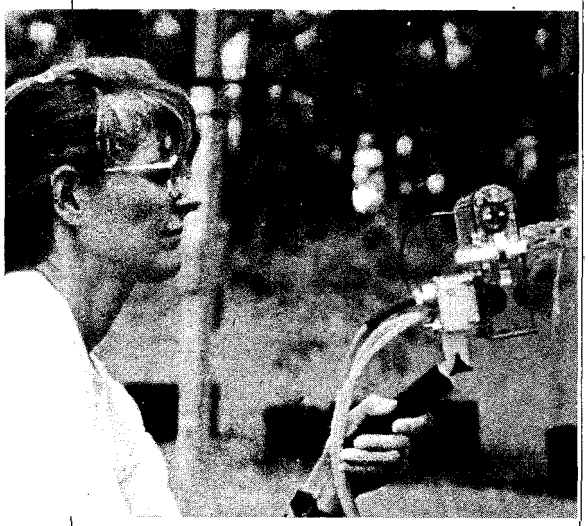
The Basics: Your Tax Dollars at Work

Snapshot of the Southern Research Station in 1998

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 is part of the Nation's largest forestry research organization-USDA Forest Service Research and Development.



Since the beglnning of the 20th 'Century, the Southern Research Station's researchers have excelled in studies on temperate and tropical forests, forest resources, and forest products. These studies provide a wealth of long-term data sets and con-clusions on the dynamics of tree plantations and natural stands, watershed management, and wildlife habitats.

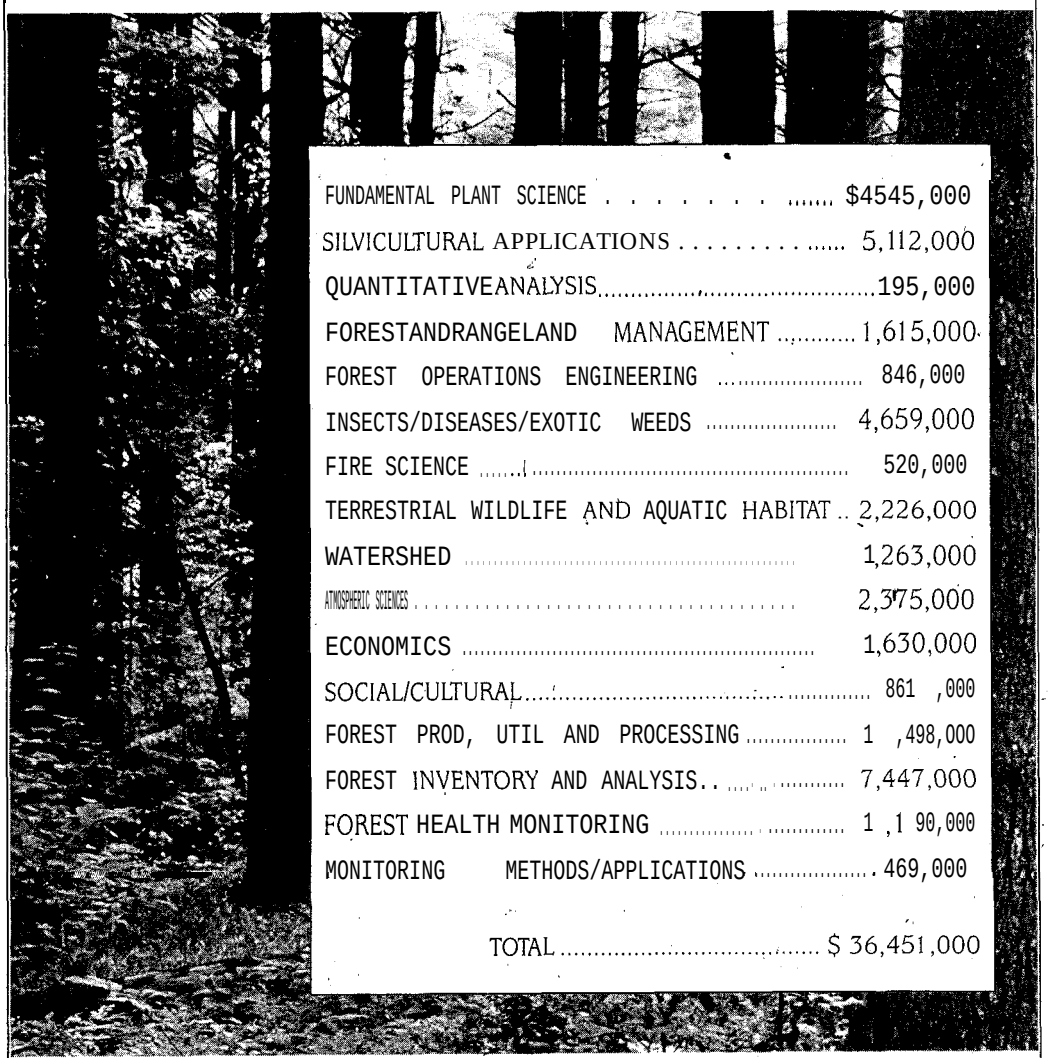
Working at laboratories, experimental forests, and university campuses throughout the South, our scientists produce research results that are useful to producers and consumers of forest products and services: commodity and industry associations, conservation groups, landowners, educators, professional societies, legislative bodies, and managers of local, State and Federal agencies. Our scientific workforce is divided up into Research Work Units that are stationed at 17 locations throughout the South; we are responsible for research 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 country and internationally as well.

Our strategic planning effort, The Strategic Framework for the Southern Research Station, continues to be integrated into'our work and budget planning, as well as being adapted to support 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 'Report about the Southern Research Station presents examples of recent accomplishments from our Research Work Units and gives an update on several of our programs.

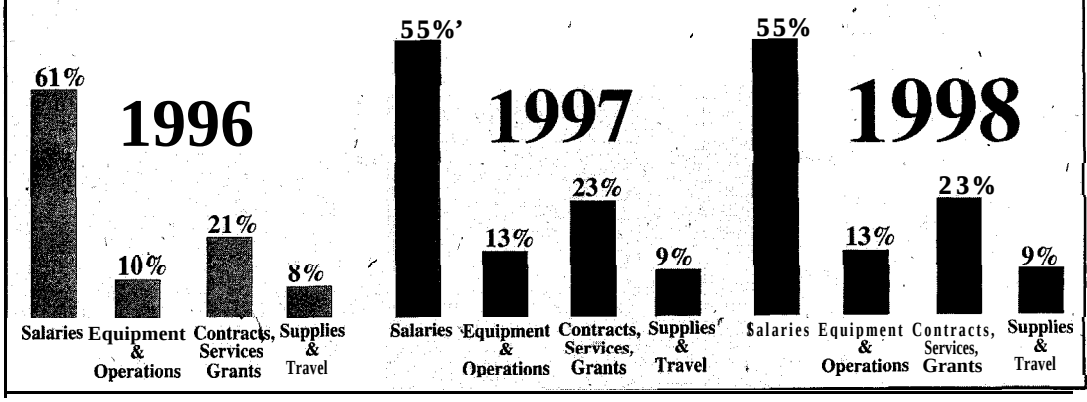
The Basics: Your Tax Dollars at Work

Allocations to Resource Categories



FUNDAMENTAL PLANT SCIENCE	$4545,000
SILVICULTURAL APPLICATIONS	5,112,000
QUANTITATIVE ANALYSIS	195,000
FOREST AND RANGELAND MANAGEMENT	1,615,000
FOREST OPERATIONS ENGINEERING	846,000
INSECTS/DISEASES/EXOTIC WEEDS	4,659,000
FIRE SCIENCE	520,000
TERRESTRIAL WILDLIFE AND AQUATIC HABITAT	2,226,000
WATERSHED	1,263,000
ATMOSPHERIC SCIENCES	2,375,000
ECONOMICS	1,630,000
SOCIAL/CULTURAL	861 ,000
FOREST PROD, UTIL AND PROCESSING	1 ,498,000
FOREST INVENTORY AND ANALYSIS	7,447,000
FOREST HEALTH MONITORING	1 ,1 90,000
MONITORING METHODS/APPLICATIONS	469,000
TOTAL	$ 36,451,000

Three-Year Budget Comparison



The Basics: Your Tax Dollars at Work ,

Allocations to Research Work Units

4101	Southern Appalachian Hardwoods Asheville, North Carolina	$ 1,255,000
4103	Center for Forested Wetlands Charleston, South Carolina	1,11 5,000
4104	Disturbance and the Management of Southern Pine Ecosystems Athens, Georgia	1,698,000
4105	Vegetation Management and Longleaf.Pine Auburn, Alabama	977,000
4106	Upland Forest Ecosystems Hot Springs, Arkansas	,219,000
4111	Ecological Management of Southern Pines Pineville, Louisiana	1 ,432,000
4153	Southern Institute of Forest Genetics Saucier, Mississippi	1,754,000
4154	Biological Foundations of Sustainability Research Triangle Park, North Carolina and Athens, GA	1,878,000
4155	Bottomland Hardwoods and Wetlands Stoneville, Mississippi	3,231,000
4201	Threatened and Endangered Species Clemson, South Carolina	779,000
4202	Coldwater Streams and Trout Habitat Blacksburg, Virginia	483,000
4251	Wildlife Habitat and Timber Resources Nacogdoches, Texas	783,000
4351	Watershed Responses to Disturbance Franklin, North Carolina	967,000
4501	Southern Pine Beetle Pineville, Louisiana	918,000
4502	Wood Products Insect Research Starkville, Mississippi	792,000
4505	Insects and Diseases of Southern Forests Athens, Georgia	1,703,000
4701	Southern Forest Resource Utilization Pineville, Louisiana	1,100,000
4702	Integrated Life Cycle of Wood Blacksburg, Virginia	398,000
4703	Biological/Engineering Technologies Auburn, Alabama	1,096,000
4801	Forest Inventory and Analysis Asheville, North Carolina and Starkville, Mississippi	7,447,000
4802	Legal, Tax, and Economic Influences New Orleans, Louisiana	930,000
4803	Forest Health Monitoring Research-Triangle Park, North Carolina	1,190,000
4851	Economics of Forest Resources Research Triangle Park, North Carolina	930,000
4852	Southern Global Change Program Raleigh, North Carolina	1 ,441 ,000
4901	Trends in Recreation and Wilderness Athens, Georgia	631,000
	TOTAL	$36,451,000

The Basics: Your Tax Dollars at Work

Collaboration: The Key to Leveraging Appropriated Funds

Collaborative research with universities, private corporations, and other Federal and State agencies is a cornerstone of the Southern Research Station program: These programs involve the funding of extramural studies under cooperative agreements, grants, and interagency agreements. Working with these partners is an effective way to leverage our funding to conduct research efforts that result in benefits to a wide range of research results users.'

A total of $7,756,192 was involved in supporting research studies under these agreements in Fiscal Year '98, with the following:

Alabama A&M
Alabama Forestry Commission
Arkansas Nature Conservancy
Arkansas Natural Heritage Commission
University of Arkansas
Arkansas Tech University
Auburn University
Botanical Garden Foundation
University of California: Berkeley and Davis
University of Charleston
Clemson University
Dartmouth College
Department of Defense — Navy
Duke University
Eastern Sierra Institute for Collaborative Education
Florida A&M University
University of Florida
Freshwater Institute
Georgia Forestry Commission
General Services Administration
UGA Research Foundation, Inc.
University of Greenwich
International Centrefor Research in Agroforestry
Louisiana Agricultural Experiment Station
Louisiana State University
Louisiana Tech University
Louisiana Department of Agriculture and Forestry
University of Massachusetts
Michigan Technological University
University of Minnesota
Mississippi State University
University of Missouri
University of Nevada
University of New Hampshire
North Carolina Department of Environment, Health, and Natural Resources
North Carolina Central University
North Carolina Agricultural Research Service
North Carolina State University
University of North Carolina -Asheville
University of North Carolina -Pembroke
Oak Ridge National. Laboratory
Oklahoma State University
University of Oklahoma
Pacific Lutheran University
Purdue University
Rutgers University
University of Sheffield
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
Tuskegee University
Université Victor Segalen Bordeauz II
Western Carolina University
USCS Biological Resources Division
USDA Agricultural Research Service
USDI Geological Survey
University of Wisconsin

The Basics: Your Tax Dollars at Work

Jumpstarting Collaborative Research Efforts

The Challenge Cost Share program for Research and Development leverages Federal forestry research funding dollars with matching resources from non-federal sources, to accomplish research objectives. The criteria used by the Southern Research Station's Leadership Team to evaluate and select the proposals to fund included:

- Support of the Strategic Framework and Cross-Cutting Themes
- Initiation of collaborative research 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 one-year time frame

In Fiscal Year '98, thirteen proposals were funded:

- Productivity processes: understanding the impact of competition control and fertilization on nutrient and carbon dynamics for maintaining soil productivity ($10,000, *SRS-4154; $10,000 International Paper Company).*
- Intensive culture of short-rotation woody crops: pilot study ($6,000, *SRS-4155; $6,000, Southern Hardwood Forest Research Group).*
- Nitrogen cycling in buffer zones adjoining short rotation hardwood plantations ($12,000, *SRS-4103; $12,000, Westvaco Corporation).*
- Monitoring productivity and environmental quality in southern pine plantations: Phase IV-additional measurements of soil, and tree growth *($22,500, SRS-4111; $15,000, Temple-Inland Forest Products Corporation; $10,000 International Paper: $2,500 Willamette Industries).*
- Performance evaluation of the Certified Pallet Repair (CPR) wood pallet to extend our timber resources *($10,000, SRS-4702; $10,000 National Wooden Pallet and Container Association).*
- Development of a soil carbon model for forested wetlands ($7,500, *SRS-4103; $7,500, NCASI).*
- Diurnal and seasonal effects of light, and soil moisture availability on physiology of Nuttall oak seedlings established beneath an eastern cottonwood nurse crop *($16,500, SRS-4155; $17,400, NCASI).*
- Effects of long-term increased water and nutrient supply on drought response, water relations and water balance of loblolly pine ($8,500, *SRS-4154; $8,500, Westvaco Corporation).*
- Economic analysis of managed forested landscapes incorporating both timber production and wildlife habitat quality: a component to LEEMATH *($15,000, SRS-4103; $15,000, NCASI).*
- A sawing trainer for primary hard; wood processing ($30,000, *SRS-4702; $30,000, National Hardwood Lumber Association).*
- Dynamics of carbohydrates in mature loblolly pine tissue supporting developing upper-crown and terminal shoots *($15,000, SRS-4154; $15,000, Westvaco Corporation).*
- Dendroecological history of old-growth bottomland hardwood forest in southern Arkansas ($6,000, *SRS-4155; $6,000, Arkansas Natural Heritage Commission).*
- Impacts of volunteer pine seedlings in plantations *($8,010, SRS-4111; $8,010, Willamette Industries).*

The Basics: Your Tax Dollars at W&k

Jumpstarting Collaborative Research Efforts

Many Research Work Units have agreements to receive external funding from other sources. The Fiscal Year '98 total for these dollars was $285,021 from nonfederal sources. From other federal sources, the Southern Research Station received $1,381,431 to support research and development projects designed to meet the missions of the agencies involved.

This external funding came in from the following:

Non-Federal:

Composite Panel Association
Fiber Research International'
'Industrial Measurement Systems
Mecker Technologies
Omega International
QST Environmental
Rhone-Roulenc
Royston Lab
Temple-Inland
Texas Parks and Wildlife
Texas Water Development Board
Union Camp
University of Georgia Research Foundation

Federal:

Department of Defense
Department of Energy
USDA CSREES
USDI Fish and Wildlife Service and Bureau of Land Management;
Environmental Protection Agency
APHIS
FAS/ICD

The Basics: Your XIX Dollars at Work

Changing the Way We Work: Breaking Boundaries, Building Cooperation

We are reconfiguring administratively to better meet the needs of our constituents, internally and externally. We are moving forward with new technology, new accounting systems, continuing our emphasis on civil rights, and recruitment initiatives.

Sharing Resources: The Southern Research Station participates in the Combined Eastern Leadership Team (CELT) which consists of the Forest Products Laboratory 'in Madison, Wisconsin, North Central Forest Experiment Station, in St. Paul, Minnesota, Northeastern Area State and Private Forestry in Radnor, Pennsylvania, the International Institute of Tropical Forestry, in. San Juan, Puerto Rico, the Southern Region, in Atlanta, Georgia, and the Eastern Region, in Milwaukee, Wisconsin.

The CELT is cooperating administratively to share positions and work in order to more effectively serve customers and to bring administrative savings to the respective units. Successes include shared health and safety programs which are providing expertise to all units in industrial hygiene, OSHA standards and requirements, improved safety inspections and investigations, better safety with hazardous materials, laboratory and chemical safety. The CELT is also sponsoring joint unit reviews, which are bringing more expertise to the review process and enhancing the transfer of technology, and procedures which streamline business administration processes and improve internal customer service:

Fiscal Resources: The Fiscal Resources staff provides budgeting, accounting, auditing, processing, and financial analysis to internal and external customers. In addition to providing these services, we reviewed all our functions and streamlined processes, and procedures which resulted in increased effectiveness and efficiency.

Information Resources: For the past 15 years, the Forest Service has used an internal computer platform that provided us with an integrated office suite of word processing, spreadsheets, and exceptional internal communications, but the system was very difficult to use for external communications. During the past year, we have converted to a client-server based, fully networked personal computer environment, which facilitates excellent external communications. This system gives us the capability to communicate with our customers and partners on the Internet and to provide useful scientific information to the public through the World Wide Web, We plan to continue to enhance this system and take advantage of -the opportunities we have to improve communication with everyone who benefits from the work that we do.

The Basics: Your Tax Dollars at Work:

Changing the Way We Work: Breaking Boundaries, Building Cooperation

Civil Rights: This 'year the Civil Rights Unit at the Station focused on implementing the recommendations of the Civil Rights Assessment Team. An Implementation Team named to recommend actions developed a "New Perspectives for Civil Rights" and a video and discussion guide 'for internal training. This new perspective stresses that "civil rights" is actually a "human rights" issue, and that,it begins with each employee. The working definition of civil rights is,. "the right of every employee in the workplace to be treated fairly, imp&-tially, and with respect." The Southern Research Station perspective encourages employees to address differences and problems one to one as they occur. It also encourages employees to rethink-civil rights and their own responsibility in it.. The video produced discusses the use of the formal processes and tools already available to us and encourages the use of the Continuous Improvement Process survey and action planning sessions as a way to address issues. All of our locations are working to make this new approach a reality.

Our efforts, too, have been focused to encouraging all employee groups -the Station's Civil 'Rights Committee and the various employee resource groups-to' work together more closely on common issues. As a result, the leaders of these groups meet and discuss the various pieces of the Station's Affirmative Employment and Recruitment Plan to decide what role each group will play in accomplishing the Station's proposed actions within the plan. We feel this is helping us to become more productive and holistic in our thinking.

Recruitment Initiatives: The Southern Research Station serves as the Lead Unit of two special recruitment initiatives at Historically Black Colleges and Universities: Alabama A&M University (AAMU) and Florida A&M University (FAMU). Five initiative students at AAMU graduated—all with hohors, one with high honors. All five were converted into the USDA Forest Service to full-time, permanent, professional positions with promotion potential. Four FAMU students graduated and two are now permanent full-time. employees, a third is schedule-d to be converted, and one is continuing on for a Master's Degree. AAMU conferred 26 Bachelor of Science degrees to graduates. with majors in E&ironmental/Plant/Soil Sciences and, Forestry. Of those, 14 students received full, or partial financial support from the Fprest Service. The Special Recruitment Initiative at AAMU, enabled 40 students to receive direct financial assistance in school year 97-98. There were 12 students in the program at FAMU. Both schools had student interns participating in the Conservation Education Outreach Program during the summer of 1998.

The Basics: Your Tax Dollars at Work

Individual and Team Recognition

USDA Secretary's Honor Awards:

The purpose of this awards program is to recognize outstanding contributions to agriculture; the consumers of agricultural products; and the ability of the Department of Agriculture (USDA) to serve rural America. The Honor Awards are the most prestigious awards presented by USDA. Employees at all grade levels and private citizens are eligible to receive these awards. Four Southern Research Station employees received Honor Awards from the US Department of Agriculture at a ceremony in Washington, DC on June 10, 1998:

Cindy Arnette received the Support Personnel award for her exceptional customer service attitude and her consistentty high standards of personal performance.

James A. Richmond received the Public Service award for outstanding public service by fostering a multi-cultural Forest Service workforce and involving minorities in natural resources.

William D. Boyer received the Personal and Professional Excellence award for excellence of long-term research on the ecology and management of longleaf pine ecosystems.

Chung Y. Hse received an Environmental Protection award for innovative research intovatue-added recycling of preservation treated wood waste.

Chief's Honor Award:

The Chief of the Forest Service recognizes outstanding contributions that support the Department's Employee Recognition Program and reinvention of Government Initiatives, major improvements in service to the public, work force diversity, and Ecosystem Management initiatives.

James B. Baker received a Superior Scientist Chief's Honor Award for outstanding career-long contributions to southern pine and hardwood siivicutture contributing to, better natural resource management in national forests, private nonindustrial forests, and industrial forests.

The Southern Research Station received the Chief's Customer Service Award in recognition of our outstanding customer service contributions and demonstration of the spirit and intent of the National Customer Service Plan-to create a "customer-driven" Forest Service.

External Awards:

Dennis Lemly received a commendation from the US Department of Interior in recognition of scientific contributions and assistance to the National Irrigation Water Quality Program.

Melvin L. Warren, Jr. and Wendell R. Haag received a Group Research Achievement award for contributing significantly to the Rise to the Future aquatic resources program.

James Granskog received the Forest Products Society's Fred W. Gottschalk Award in recognition of exceptional service to the Society, and a Recognition Award for outstanding leadership as regional board member of the Forest Products Society representing the South Central Region. Granskog received an award. for distinguished service to forestry from the Louisiana Society of American Foresters.

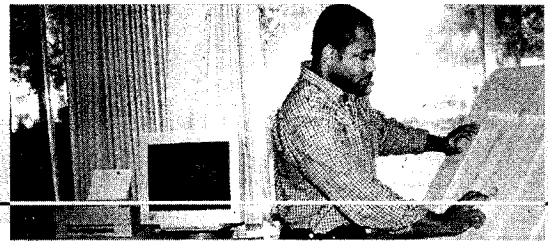
The Stephen F. Austin Interpretive Trait, a collaborative effort between the Southern Research Station and the Arthur Temple College of Forestry at Stephen F. Austin State University, received two awards at the Texas Trails Symposium:

Merit in Innovative Trail Planning and Design (Ron Thill and Steve Kirkindall) and Achievement and Efforts in Advancing Trails (Steve Kirkindall).

John Stanturf, Emile Gardiner, Paul Hamel, Callie Schweitzer, Chris Woodson, Keith Willis, and Dexter Bland were among an interagency group which received the Taking Wing award for public awareness for wetlands and waterfowl work from Ducks Unlimited and Forest Service.

Caring for the Land and Serving People

Strategies for the 21st Century



Strategies for the 21 st Century

The Framework

We published "The Strategic' Framework for the Southern Research Station" in 1997 and continue to refine and implement it. 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 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 Southern Research Station research and development program.

The Forest Service is committed to the goal of sustainability, which isdefined' as the ability of the biophysical resources-or ecosystems-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:

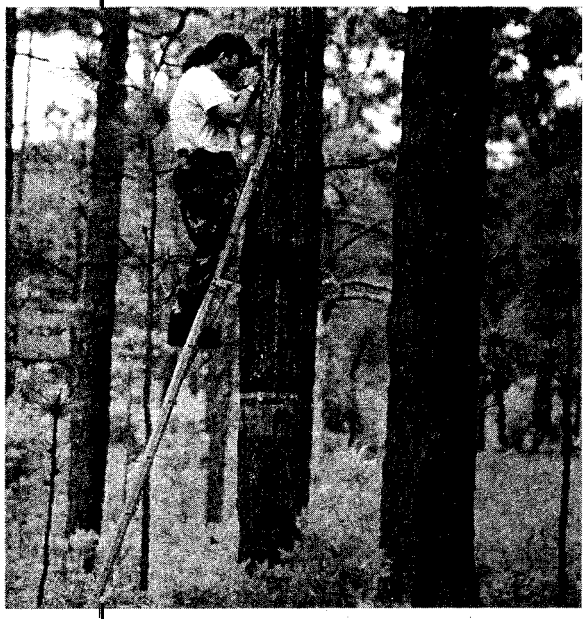
1. Southern Appalachian Ecosystem Research and Sustainability;
2. Sustainability and Productivity of the Interior Highlands Ecosystem;
3. Ecology and Management of Forested Wetlands, Bottomland Hardwoods, and Riparian Zones;
4. Sustainability and Productivity of Southern Pine Ecosystems;
5. Landscape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

During 1998, the Research Work Units involved in the CCTs made efforts to identify internal collaborative opportunities,' current and emerging issues, and potential external partners. The CCTs are a useful tool to incorporate and address national concerns, and position us to be responsive with research direction to study those concerns.

Strategies for the 21st Century

Southern Pines

A Steering Committee has been established to facilitate the continued development of the Sustainability and Productivity of the Southern Pine Ecosystems CCT. This committee consists of one member from each of the 17 Southern Research Station Research Work Units that have been identified with the CCT.



The group reviewed the draft charter of the Southern Pine CCT and began development of an informal, but dynamic, team-based approach to address the critical resource needs related to the Southern Pine Ecosystems. This document will help our widely dispersed Southern Research Station scientists develop a regional, landscape, and corporate vision of the important issues and information gaps that surround the Southern Pine Ecosystems.

The document sets forth our current thinking on the Sustainability and Productivity of the Southern Pine Ecosystems theme. It begins to identify research needed to provide for ecologically sound, economically viable, and socially acceptable management of the southern pine and pine-hardwood ecosystems. It also provides a framework to bring together other scientists, managers, and stakeholders to develop consensus on research needs for sustaining our southern pine and pine-hardwood resources

The Montreal Process Criteria, developed for use by the international forestry community for assessing forest sustainability on a national level, is now being used to categorize research issues and questions for this very broad theme. The seven Montreal Process Criteria used in the document to array research goals and directions include the following:

1. Conservation of biological diversity
2. Maintenance of productive capacity of forest ecosystems
3. Maintenance of forest ecosystem health and vitality
4. Conservation and maintenance of soil and water resources
5. Maintenance of forest contribution to global carbon cycles
6. Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies
7. Legal, institutional and economic framework of forest conservation and sustainable management.

Strategies for the 21 st Century

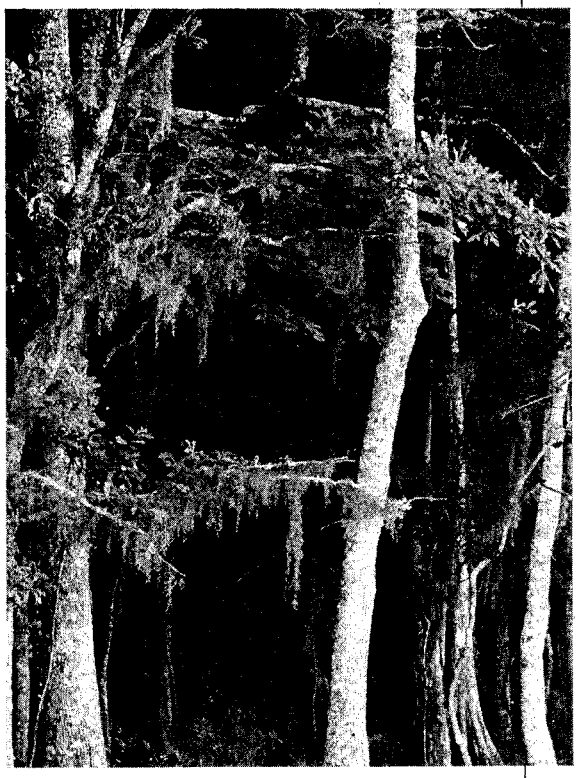
Southern Pines

The document prepared by the Southern Pine CCT Steering Committee was reviewed by interested Southern Research Station scientists; it is being revised'and is in the process of being published by the Station. The publication will be used to facilitate the development of more specific research goals and to engage interested cooperators from universities and public and private forestry organizations in development of cooperative research programs.

Supplying knowledge to meet the increasing demands for forest benefits (wood: fiber; recreation, and wildlife) in a sustainable and environmentally conscientious manner is perhaps the -primary issue facing forestry researchers. As we move forward under this CCT, we will define the ecological capacity of the Southern Pine ecosystem, using multi'disciplined team-based approaches that will build on internal capacity and expand interaction with scientists and managers from other Forest Service research stations, other federal, state, private industry, and nonindustrial private landowners. New aspects including urban/wildland, social/recreation, and wilderness issues will be incorporated into studies of sustainable pine ecosystem management. South-' ern Pine CCT research will address and provide significant accomplishments to meet the Government Performance and Results Act Outcome Objectives:?'Clean Air and Water; Productive Soils; Robust Fish and Wildlife Populations; Healthy Forests and Grasslands; Improved Knowledge of Decision Making to Support Sustainable Ecosystem Management; Improved Urban Environment; and Quality of Outdoor Recreation and Natural Settings.

Strategies for the 21 st Century

Wetlands, Bottomland Hardwoods, and Streams



Wetland forests and riparian areas are a major component of southern forests, but their extent has been drastically reduced over the past century. These ecosystems are the ultimate resting place of all water-borne pollutants and nutrients that can be trapped by surface vegetation. Enormous amounts of recreational activity occur there. They are capable of yielding a wide range of wood products. Their function can be impacted by a substantial extent by hydrologic manipulation. These ecosystems occur from the Appalachian Valleys to the coastal lowlands, crossing the breadth of the Southern Research Station.

Progress in understanding the function and management of wetland forests and riparian areas depends upon five research program components:

1. Determination and description of basic ecosystem function, as hydrology, biogeochemistry, vegetation community dynamics and productivity, ecophysiology, pathology, and wildlife of forested wetlands, bottomland hardwoods, and riparian zones.
2. Methods of management:
   a. of hydrology and nutrients to forested wetlands
   b. of silvicultural practice, and of harvesting, site preparation, and roading systems for improved production of desired outputs with reduced impact to the state and productivity of the systems themselves.
3. Methods of determining policy for, and evaluating the economic and social effectiveness of,' the management of forested wetlands, bottomland hardwoods, and riparian zones.'
4. Determination of modelling approaches to management of these systems at multiple scales.
5. Experimental manipulations of the systems, in field-scale as well as microcosm settings, to test hypotheses, raised in the other components.

Caring for the Land and Serving People

Strategies for the 21st Century

Wetlands, Bottomland Hardwoods, and Streams

During FY '98, 20 Research Work Units conducted work dealing with some aspect of forested wetlands, bottomland hardwood forests, or riparian forests. Scientists or cooperators in 16 Research Work Units published 138 papers dealing with bottomland or riparian forest species or issues relevant to management of such resources. Research work unit descriptions of the additional four units identify problems that have direct applicability to issues relevant to wetlands, bottomland hardwoods, and riparian forests.

Condensed into several questions, the tasks of this CCT are to answer the following:

1. What are the most important biotic and abiotic determinants of biological productivity of each of the major wetland types in the South and how can they be quantified?
2. How do we accurately predict biological and economic growth and yield of mixed species bottomland hardwood stands?
3. How do we predict response of ecosystems to natural disturbance and silvicultural activities?
4. What are the key biological and environmental indicators of ecosystem health for each of the major wetland types?

Streamside management zones (SMZ) are recognized to be critical for sustaining water quality, biodiversity, and habitat, yet there is little information about effectively designing and implementing these essential landscape features. We propose an initiative to do a multiscale study to characterize the hydrologic setting and dynamics for stream systems across the region; to determine the historical rates of sedimentation in major and minor river systems; and to measure sedimentation rates associated with varying landscape. and management settings. We will initiate controlled experim'ents to determine the effects of SMZ width and topographic position on water quality and habitat, and develop regional models for planning and designing SMZ systems.

Strategies' for the 21st Century

Southern Appalachians

The working document for the Southern Appalachian CCT was reviewed and the organization of the CCT was reaffirmed. The major topical categories for research are:

1. ecosystem dynamics structure and function;
2. social and economic influences; and
3. synthesis and integration.

A steering team consisting of Project Leaders of involved Research Work Units or their designees was formed and had their initial meeting. A synthesis and integration team was formed. This team completed an analysis of work needed in their research category, recommended a set of alternative approaches, and developed a proposal and submitted it for outside funding.

Research identified with this CCT remained very active. A myriad of activities on the Wine Spring Creek ecosystem management research area continued. Significant progress was made on developing a Southern' Appalachian variant of the Forest Vegetation Simulator, including a regeneration prediction submodel. Research in timber supply economics, valuation of nonmarket outputs, and social values continued, as did work on wildlife habitat. A new research component dealing 'with assessing tree quality for forest products was added in 1998.

St'rategies for the 21st Century

Southern Appalachians

Two of the natural resource issues in the South that will be used to focus our efforts for the next five years are:

1. Wilderness research in 'the Southern Appalachians; and
2. Social and resource dynamics in the Southern Appalachians.

Key research activities to address the wilderness.issue would include: assess demand; understand perceptions, values,,, attitudes, and socioeconomic interrelationships toward wilderness and management alternatives; examine special forest products collection; examine the impact and design, of recreational access on water quality, aquatic biota, and other indicators of ecosystem health; understand fundamental ecological processes and dynamics in non-manipulated ecosystems as a basis for model development or as a basis for development of conservation strategies.

Key research activities to address social and resource dynamics would include: quantify demand for outdoor recreation; quantify and forecast resource use and land use, change; examine design, costs and ecological impacts of access; model the compositional and structural dynamics of vegetation in manipulated and nonmanipulated ecosystems; develop strategies for watershed-scale restoration of riparian/aquatic ecosystems; quantify the impacts of increasing angler use and changing land use patterns on wild trout.

Strategies for the 21st Ceritury

Interior Highlands

Research plays an important national role in establishing the scientific basis for sustainability in the context of ecosystem management This‘ CCT, Sustainability and Productivity of the Interior Highlands Ecosystem, embraces one of the most important regions in the mid-South, although one that has not been extensively studied in an ecosystem context. 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.

The Interior Highlands 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. As an element of this theme, Southern Research Station scientists are developing cooperative relationships and studies with scientists from the North Central Forest Experiment Station as well as with university, state, and industry cooperators in Arkansas, Oklahoma and Missouri. The CCT builds on both **the** long-standing ongoing research in forest ecology and silviculture of oaks, and on newer interdisciplinary research programs that encompass vegetation, wildlife, aquatic ecology, hydrology, and human dimensions.

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 Southern Research Station. Findings from the assessment are not yet published, but the bulk of the collection of existing data on the social, terrestrial, aquatic, and atmospheric conditions of the region occurred during 1997-98.

Progress under the Interior Highlands CCT was made in **the** ongoing measurement and monitoring associated with the Ouachita Mountains Ecosystem Management Research Project, a comprehensive ecosystem **management** research projects in Arkansas and Oklahoma. In FY ‘98, **the** fourth year of post-treatment data was collected in the 52-stand database; these data quantify the effects of reproduction cutting alternatives on vegetation, wildlife, arthropods and microbial diversity, logging and economics, visual quality, and soils and water quality.

Strategies for the 21st Century

Interior Highlands

Similarly, the fourth and final year. of baseline data collection was completed/ in the four-watershed landscape study, in which time substitutes for space in large-scale experimental replication of pretreatment conditions. The landscape treatments, operationally conducted by cooperators in the National Forest System and industry, were also'planned in FY '98, for implementation in FY '99. The experimental 'design, execution, treatment, and monitoring of such broad-scale plot-intensive studies would not be possible, without the 'superb cooperation of colleagues in the National Forest System, industry, state agencies, and universities within and near the Interior Highlands.

Additional studies will be planned to close existing research gaps in order to better characterize the human uses and values; to evaluate the effects of large-scale ecological process restoration using' prescribed fire on public and private forests; to quantify the effects of forest management at the broad scale, and of stand-level management alternatives on wildlife, hydrology and aquatic ecosystems; and, 'to link extensive monitoring of vegetation, wildlife habitat, hydrology, aquatic ecology, 'and human dimensions to; GIS-based models usable by practitioners. The approach to achieving the objectives of these studies will be:

1. Develop a GIS-based data' and analysis system for assessing social resource-management interaction dynamics from local to regional scales, concentrating on recreation, wilderness, and special forest products; conduct major 'regional study on interrelation-, ships of public and private forest 'management on rural development; develop cooperative urban forestry prototype in selected Interior Highlands urban areas.
2. Develop cooperative studies and models to predict the 'ecological and silvicultural effects of restoring fire in Interior Highlands forest types; study how fire affects forest health, diversity, and sustainability.
3. Initiate hydrology source behavior study on water quality and aquatic systems of warmwater wild and scenic rivers, including. effects of forest operations and roads, and linking to existing wildlife, hydrology and aquati-c ecology research.
4. Expand use of GIS in existing research' and link new studies to existing GIS platforms.

Strategies for the 21st Century

Large Scale Assessment and Modeling

The research goal of this CCT is the development of an integrated, cross-disciplinary modeling framework to provide systematic analysis and assessment of the condition, productivity, and human interrelationships of large-scale forested ecosystems. Resulting models, relevant scientific, outputs, and' assessment processes are being used to evaluate the status of southern forested ecosystems at the landscape and regional scales.

The impact of current and predicted future environmental conditions, including anthropogenic stress, are being assessed to determine effects on forest health, productivity, and distribution. The human dimensions of forest *ecosystems are being considered by looking at land-use change effects, shifting demands for resources and service,, and effects of changing populations and their relationships to natural systems.

The Southern Global Change Program has developed and initiated a five-year. integrated east-wide assessment framework, in conjunction with the Northern Global Change Program. The framework encompasses a large portion of the Southern Research Station program, 'as well as that of forest industry and southern universities. 'During the! past, year, research activities have focused on the development of regional Forest Inventory and Analysis, climate, demographic, and soil databases, and the initiation of assessing regional forest structure and productivity, hydiology, and timber supply and demand. The scope of research during the upcoming year will increase to include climate prediction scenarios, wildlife, land use, and other nonmarket factors.

'The Southern and Northern Global Change Programs have developed and begun implementation of a five-year integrated modeling effort that. will link the research from both regional programs. The objective of this research is to better understand how environmental stress influences forest productivity and hydrology across eastern U.S. forests. The goal of the five-yea& assessment is to predict the impacts of environmental stress (i.e., climate change, elevated atmospheric carbon dioxide, regional ozone, and nitrogen deposition) .on a baseline model to predict and validate predictions of forest productivity and hydrology east 'of the Mississippi River. The proposed modeling framework will allow us to assess in a more 'timely manner the current and future impacts of environmental stress on forest structure and function. After the baseline model has been completed, additional modeil components will be added in a modular format.

strategies for the 21st Century

Large Scale Assessment and Modeling

Additions to the base model include:

1. a carbon budget of forest ecosystems;
2. development. of a forest maturation and density component;
3. land cover and use change;
4. subregional and interregional scale economic modeling; and
5. wildlife diversity and threatened and endangered species.

We are also proposing to conduct a large-scale integrated assess: ment of social and environmental change in the South and its implications for resource use, ecosystem condition, and environmental quality.

The three stages of this effort would be

1. a social and economic assessment of Southern forests;
2. an ecological assessment. which, incorporates regional forest productivity, hydrology, and habitat fragmentation; and
3. development of regional scale biological sampling and ecological assessment of nonnative invasive species and environmental stress-related diseases.

Additional research into biological implications of economic and environmental change would provide additional insights into the long-term consequences of current and anticipated growth and development of the south. Bringing the social and biological components into an integrated framework would provide a linkage between cause and effect and provide an innovative approach to #evaluating various policy approaches.

Strategies for the 21st Century

Inventory and Monitoring

The goal of this 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. theme 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?

This past’year, the Forest Inventory and Analysis work unit hosted several meetings across the South that focused on annual inventories. Several hundred individuals from across the country representing states, universities, industry associations, forest industries and the Forest Service attended the meetings. Out of these meetings came’ the establishment of a Southern Annual Forest Inventory System (SAFIS) Committee. This Committee met. in mid-November 1998 to review SAFIS plans and approaches, and’identify future research needs. Other planned meetings wili provide a means to monitor the new inventory system’s effectiveness.

Several’ states are now using their. own resources to hire staff for field data collection for the base set of SAFIS plots. In FY '98, the Sauthern FIA unit collaborated and distributed approximately $1.2 million dollars to six States. These funds were matched on a 50/50 basis with State funds.

The Forest Inventory and Analysis unit began collaborating with the Southern Region and other Federal natural resources agencies to develop methods for assessing forest sustainability .of southern forests. Key elements of the analysis will include productivity of forests, ecological diversity and sustainability. It is anticipated that the study will require approximately 2 years to complete, and will be based on available information.

Strategies for the 21st Century

Inventory and Monitoring

Nine Southern Research Station Research Work Units and the Southern Forest Health Monitoring Program are now identified with this CCT. Initial discussion with representatives from each unit has identified several areas for potential research; These include:

1. recreation supply and demand;
2. tree volume taper function development;
3. using economic and ecological models in broad scale assessments;
4. using FIA 'plots to develop a site-wide database;
5. social/economic impacts on forest sustainability;
6. effects of forestry and environmental laws;
7. ultrasonic and digital camera technology.

The next step is to develop a plan and approach for incorporating the science issues into the Inventory and Monitoring CCT.

The SRS Inventory and Monitoring CCT has identified three natural resource issues in the South that will be used to focus our efforts into the next century:

1. A method is needed for assessing the sustainability of southern forests at different scales;
2. New approaches are needed in developing spatial forest information and assessing nontraditional forest resources;
3. There is an urgent need to provide the,constituent groups of both FIA and FHM with a seamless database that covers all forestland and non-forest lands in the South.

Future research will:

1'. Provide information on how and what to inventory and monitor'for forest sustainability.
2,. Evaluate and assess social and economic impacts on timber availability in the 13 southern states.
3. Evaluate and assess the rules, regulations, and BMPs at the State and local levels.
4. Develop integrated systems of. generic models, algorithms, and procedures that provide effective ways of using FIA data at large spatial scales.
5. Investigate new techniques for inventorying and monitoring exotic invasive plants.
6. Expand the usefulness of forest inventory data'beyond the traditional estimation of average conditions for sample strata, into estimation of stand-by-stand' descriptions of forest structure.
7. Improve our understanding of "nonforest" tree-covered ecosysterns.
8. Provide information to improve land use planning efforts that achieve increased sustainability for riparian areas.

Celebrating the Year's Successes

Restoring Ecosystems.. .
-Providing Options for Wise' Use and Management...
Understanding Environmental and Biological Threats.. .
Aligning Products with- Customer Needs.. .

Celebrating the Year's Successes

This year, our Report presents highlights from our Research Work Units which demonstrate the wide scope of the research and technology transfer conducted by Station scientists. Much of our work is based on studies that take place over a few or many years, some are long-term spanning decades. The results we' report may be based on findings from the recent past, current progress, or interim updates. The benefits we provide to the American people, and to the world, vary from findings that are specific to certain types of southern ecosystems and individual species,, to findings 'that have international relevance and application.

Restoring Ecosystems...

Understanding the Role of Wetlands in Sustainable Management

Research Work Unit 4103
'Center for Forested Wetlands 'Research

Only one-quarter 'of the precolonial acreage of bottomland hardwood forests remains in the contiguous United States; these forests tend to be. seriously fragmented and may have lost many of their original characteristics. Presently, there is a need to have a better understanding about healthy bottomland hardwood forests so that they can be more effectively managed, conserved and restored.

Cooperative participants, characterization of "reference wetland."

The Coosawhatchie Bottomland Ecosystem Study site, in southeastern South Carolina, was developed as a "reference wetland." Scientists at the Center for Forested Wetlands Research (CFWR), Charleston, SC, have established the long-term research site for the quantification of relatively undisturbed ecosystem characteristics. The characterization includes studies of soils, hydrology, water quality, sedimentation, aquatic chemistry and organisms, vegetation dynamics, nutrient' cycling, tree physiology, woody debris dynamics, wintering and bre'e 'ding Neotropical migratory birds, invertebrates, and microbes. Some of the studies conducted on the sitk also were conducted on two other reference bottomland hardwood sites, in Arkansas and Louisiana.

define

In addition to CFWR scientists, researchers participating in the characterization were from several other federal agencies. Academic cooperators are from Auburn' University, Clemson University, Michigan Technological University, North Carolina State University, University of Georgia (Athens), and the Savannah River Ecology Laboratory. Westvaco Corporation's scientific staff members, located at Summerville, SC, are also collaborating in research on the site. Of the three reference sites, the Coosawhatchie Bottomland Ecosystern Study site is the only one on private land, owned and managed by the Westvaco Corporation.

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Restoring Ecosystems...

Research Work Unit 4104
Disturbance and Management of Southern Pine Ecosystems

Studying Individual Longleaf Pine Trees in the Sandhills: Towards Restoring the Natural Stands

Research Work Unit 4105, in cooperation with Auburn 'University School of Forestry, is developing an individual tree, spatially explicit, and biologically based growth model for natural longleaf pine stands at Eglin Air Force Base in Florida. Eglin's 200,000 acres of longleaf pine are being returned to full health'and expanded in size under a comprehensive Ecosystem Management plan coordi-, nated by The Nature Conservancy. The goal of the growth model is to provide a tool for the'land managers to 'compare silvicultural practices effects on the light and water environment in addition to stand structure of the trees.

We are addressi' ng longleaf pine ecosys tem restoration in collaboration with other agencies.

Individual trees are being selected within 3 site classes at Eglin, to fit a predetermined matrix of tree height, diameter, and crown ratio. The field data taken on-eaoh selected tree includes, stem' taper on the subject tree and location relative to the subject tree, species, size, and crown dimensions on competitors. Branches and the top of the subject tree are then lowered to the ground before the stem is cut. The stem is then cut into sections and brought back to Auburn for reconstruction. Complete crown architecture for the past three years is measured by reattaching the branches to the stem sections within a three dimensional grid. Disc samples are collected at 1 -meter intervals along the stem for measurements of heartwood and sapwood relationships, tree ring growth, and dry wood density. In the field,' every fourth branch is selected to be a sample branch from which fresh needles are removed within every meter out from the stem to determine weight, density, length, and nitrogen content. Branch discs are also taken at the base of every sample branch after crown architecture to determine sapwood, branch radial growth, and wood density.

Over 50 trees have been finished so far, ranging in diameter from seedlings just out of the grass stage to mature trees over 30 cm in diameter. Other factors such as light penetration through the crown and soil nutrients, and water holding capacity are still in the planning stages. Another 1.5 years of data collection will be required to fill out the tree size matrix at which time a preliminary model will be completed for review.

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Restoring Ecosystems...

Producing Longleaf Pine Seedlings in Containers Enhances Restoration Efforts

Research Work Unit 4111
Ecology and Management of Southern Pines

Longleaf pine savannas once dominated the Lower Coastal Plain, stretching from Virginia to eastern Texas. Wildlife proliferate in this Landscape and longleaf pine stands evoke passion among diverse groups because they are aesthetically pleasing, ecologically diverse, and profitable to harvest. Although longleaf pine is a highly desirable species and produces high quality solidwood products, it. now occupies only about 5 percent of its original range. The demand for high quality longleaf pine container stock in the South is rapidly increasing due to the interest in restoring longleaf pine on many of the sites, where it originally grew. Regeneration of longleaf pine sites is difficult because of the botanical characteristics of the species:

1. low and infrequent seed production
2. a seedling "grass" stage characterized by delayed stem. elongation
3. poor storability of bareioot nursery stock that results in low survival; and
4. seedling intolerance to shade conditions caused by competition.

We published "Practical Guidelines for Producing Longleaf Pine Seedlings in Containers" to help forest landowners be successful in regenerating longleaf pine sites.

The knowledge 'and technology to reestablish longleaf pine by planting bareroot nursery stock have improved in the last decade, but planting success of bareroot stack still remains elusive. Successful bareroot regeneration relies on five components: well-prepared, competition free sites; healthy, top-quality, Fresh planting stock; meticulous care of stock from lifting to planting; precision planting; and proper post-planting care. All these elements are essential to, successful planting of bareroot stock, but controlling all five is difficult.

Studies show that container-grown seedlings survive better and remain in the grass stage for a shorter period of time than bareroot stock on typical

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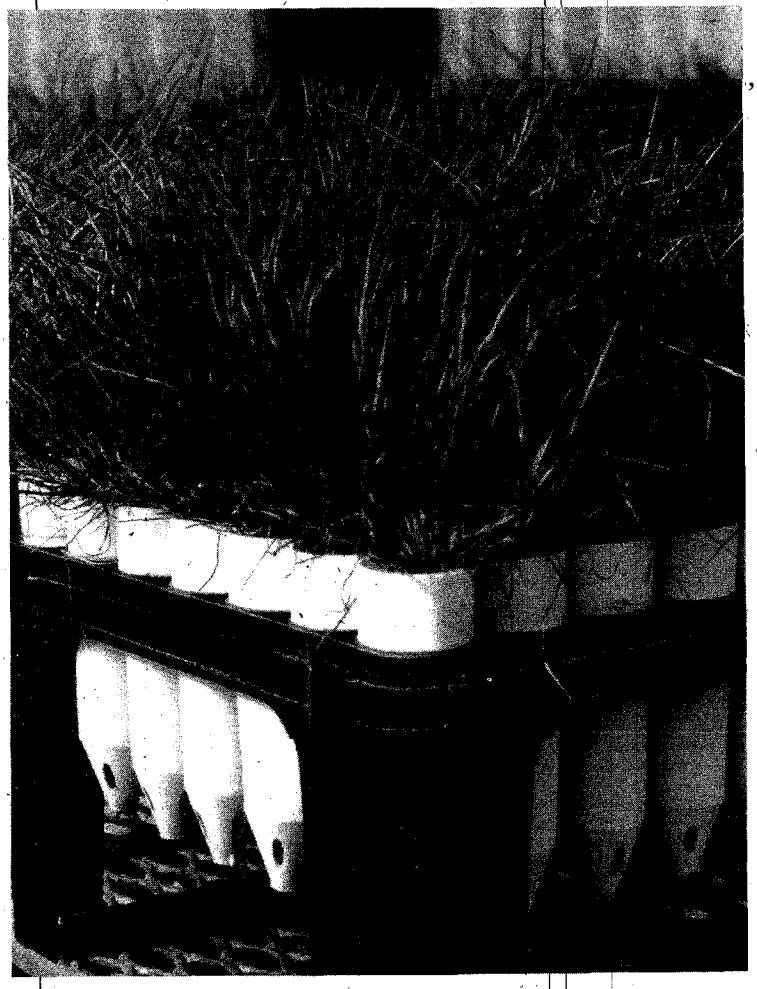
Restoring Ecosystems...

Research Work Unit 4111
Ecology and Management of Southern Pines

Producing Longleaf Pine Seedlings in Containers Enhances Restoration Efforts

longleaf pine sites. Improved survival and growth rates are generally attributed to root systems that remain intact during lifting, while roots of bareroot stock are severely damaged. Container seedlings experience 'a significantly shorter period of transplant shock or adjustment. Thus, planting of container stock improves reforestation success.

Production of longleaf seedlings in' containers has recently increased to about 40 million annually, and the demand remains for even more' quality seedlings. Because a guide to producing longleaf seedlings in containers would enhance this relatively new technology, -a silviculturist and biological technician at the Southern Research Station in Pineville, LA coauthored "Practical Guidelines for Producing Longleaf Pine Seedlings in Containers"' (GTR SRS-14). This publication provides the key information necessary to produce quality seedlings which will result in successful longleaf pine regenera-, tion and facilitate restoration of this important ecosystem,



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Restoring Ecosystems...

Bringing Back the Bottomland Hardwood Ecosystems Along the Mississippi

Research Work Unit 4115
Bottomland Hardwoods and Wetlands

The potential for restoring bottomland hardwood ecosystems in the Lower Mississippi River Valley has barely been tapped. Over the next decade, as many as 500,000 acres could be reforested. Restoration currently relies on planting native species-primarily single-species, widely spaced oak-to allow natural invasion 'of other species. However, this treatment does not work for sites that flood infrequently or sites more than 100 yards from existing seed sources.

Our improved understanding of reforestation treatments is leading to success in restoring bottomland hardwood sites.

Four different treatments were installed, examined, and compared: standard planting treatment using seedlings; standard planting treatment using acorns; new treatment using the fast-growing native species, Eastern cottonwood, as a nurse crop for interplanted oak seedlings; and treatment allowing natural regeneration and succession. This study has improved our understanding of both short-term and long-term effects of common and innovative afforestation treatments on restoring bottomland hardwood wetlands functions, including wildlife (small mammals, hawks, songbirds), soil quality and carbon sequestration,' and understory biodiversity. In addition, the quick restoration of an early successional forest ecosystem-the cottonwood/Nuttall oak interplanting-has quickly restored other ecological processes. Soil quality is restored through deeper rooting and'higher organic matter inputs to soil than would be true under continued cropping. As Eastern cottonwood ages, it sheds lower branches, thereby increasing coarse woody debris on the forest floor.

As a result of this project, forestation treatments have improved the. performance of public restoration efforts such as the Wetlands Reserve Program in Mississippi, Louisiana, and Arkansas. In 1998, the documented feasibility of the cottonwood interplanting treatment encouraged its use on approximately 6,000 acres in these states. This treatment gives a landowner "multiple options-including managing the cottonwood for timber that provides financing for other manipulations-without damaging the emerging oak stand. The treatment provides landowners with the incentive and means to actively manage their restored stands to maximize wildlife and other benefits. The project has enhanced partnerships between several Federal agencies, private, landowners, and forest industry.

Celebrating the Year's Successes

Restoring Ecosystems...

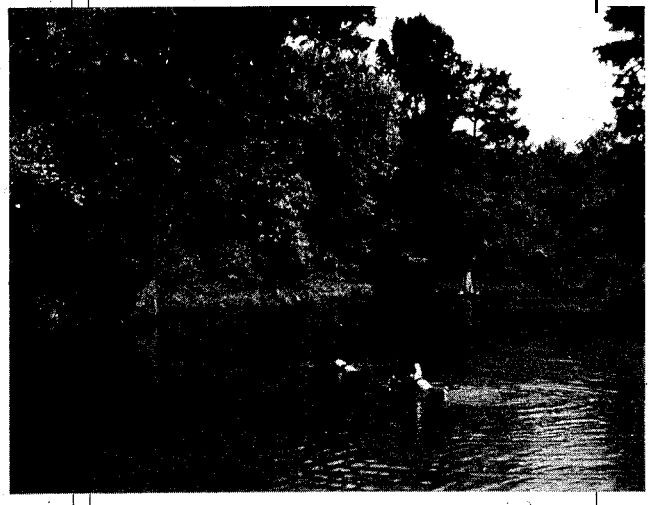
Research Work Unit 4155
Bottomland Hardwoods and Wetlands

Fish and Mussel Habitat Improvement

The, Little Tallahatchie River in north-central Mississippi was channelized approximately 50 years ago, leaving a 23-mile reach of the original river channel intact but with greatly reduced flow. Consequently, this section of river experiences stagnation at low flow and some areas have filled in completely. The "Reriver the Little Tallahatchie," project is a community-based local initiative to redirect flow from'a large tributary, from the drainage canal to the old river channel, providing year-round flow in the original channel. The project is being considered for funding under ecorestoration funds available to the Army Corps of Engineers.

We are evaluating fish and mussel ***habitat before and after restoration efforts to improve*** *streamflow.*

One of the major benefits of this project is expected to be improvement of fisheries habitat. Fisheries scientists have begun a research 'project to evaluate changes in the fish and mussel communities in the old river channel in response to restoration of flow. In the fall of 1998, they completed field sampling designed to provide a quantitative description of the fish and mussel fauna and their habitat at autumn base flow, prior to restoration. Sites on the old river channel were characterized by a diverse fish and mussel fauna typical of lentic, wetland habitats. Sites on the drainage canal were characterized by a less diverse fauna typical of degraded, lotic aquatic habitats. In the spring of 1999, field sampling will be conducted to provide a quantitative description of the fish 'and mussel fauna and their habitats at spring base flow, prior to restoration. Upon flow diversion, sampling of these sites will continue in an effort to document changes in the fish and mussel fauna and their habitats' in the context of restoration actions.



Celebrating the Year's Successes

Restoring Ecosystems...

Temporary Housing for Red-Cockaded Woodpeckers

Research Work Unit 4201
Threatened and
Endangered Species

The red-cockaded woodpecker *(Picoides borealis)* is an endangered species native to the open pine woodlands of the Southeast. These birds construct cavities in living pine trees for nightly roosting throughout the year and for nesting during the breeding season.

Recovery has focused on increasing population size and on reestablishing birds in abandoned habitat. Translocation has been a useful tool in minimizing the loss of genetic diversity in small populations and in facilitating population recovery after a catastrophic event. The numerous translocations of endangered red-cockaded woodpeckers have beneficially affected the status of many small populations. However, these releases have relied on a "hard" release approach whereby a bird is captured, taken to the release site, and immediately released. Such relocations have met with mixed results in that the bird often leaves the release site and is not incorporated into the population.

We are evaluating the use of a mobile aviary to improve relocation success of red-cockaded woodpeckers.

A mobile aviary was designed to allow a "soft" release whereby a captured bird can be maintained at the release site for 10 to 14 days before release. Maintaining the bird at the release site may help it develop an affinity for the site and be more likely to remain upon release. The aviary consists of a circular frame about 5.1 meters high and 4.7 meters in diameter with hardware and shade cloth on the outside. It is erected around a living pine tree that contains an artificial cavity insert that the bird can use for nightly roosting. The mobile aviary is currently being tested at the Savannah River Site near Aiken, South Carolina.

The study consists of three phases: 1) designing, constructing, and testing the aviary for durability; 2) determining whether a red-cockaded woodpecker can be successfully maintained in the aviary; and 3) determining whether the aviary can instill in the bird an attachment for its release site. Partners in this research include the Department of Energy and the Savannah River Natural Resources Management and Research Institute. If the use of the mobile aviary proves successful, the consequences to the recovery of the red-cockaded woodpecker could be far-reaching.

Celebrating the Year's Successes

Restoring Ecosystems...

Research Work Unit 4251
Wildlife Habitat
and Timber Resources

Studying Endangered Species in Texas

The endangered red-cockaded woodpecker *(Picoides borealis)* is a cooperatively breeding species that lives in groups composed of two to seven members. The quality of. the cavity selected by the breeding male is important to all group members because the breeding male's cavity is used as the nest tree , during the breeding season. Consequently research defining cavity tree quality is important.

Roosting and nesting red-cockaded woodpeckers make daily excavations at small wounds, called resin wells, around their cavity entrance from which resin flows down the tree. Our research has shown that the breeding male selects, cavity trees with-greater resin flow than other active cavity trees within the cluster. Longleaf pine cavity trees selected by breeding males as nest trees produced significantly greater resin yields than cavity trees used for roosting by other group members. This preference was also observed in loblolly and shortleaf pine cavity trees, but to a lesser extent. Use of cavity trees that produce copious pine resin enhances the quality of the resin barrier against rat snakes *(Elaphe spp.)*, thereby increasing the probability of nestling survival and the safety of the dominant, breeding male. Rat snakes regularly attempt to climb active red-cockaded woodpecker cavity trees, but are generally unable to reach cavities because of the resin barrier.

Studies of the, habits of red-cockaded woodpeckers and Louisiana pine snakes are expected to remit in methods which may prevent the extinction of 'these endangered species.

The Louisiana pine snake *(Pituophis ruthveni)* is a large constrictor endemic to the longleaf pine savannahs of eastern Texas and western Louisiana. There are only about 100 records known for this species. When our 'research was initiated, the Louisiana pine snake was one of the least known snakes in the U.S.

Celebrating the Year's Successes

Restoring Ecosystems,..

Studying Endangered Species in Texas

Research Work Unit 4251
Wildlife Habitat
and Timber Resources

The Louisiana pine snake inhabits primarily- longleaf pine savannahs with sandy, well-drained soils.

Radio-telemetry studies confirmed this -relationship and also demonstrated a very intimate association with Baird's pocket gophers *(Geomys breviceps).* Louisiana pine snakes spend much of their time within pocket gopher burrows or nearby on the surface. They also escape periodic fires in pocket gopher burrows and use the-m as sites for hibernation. 'Research on prey composition has also confirmed that' pocket gophers are the primary prey of Louisiana pine snakes. Laboratory 'experiments revealed specialized prey handling behavior **that** allows Louisiana pine snakes to efficiently capture pocket gophers within the confines of burrow systems.

Preliminary data indicate that pocket gophers, which feed primarily on roots and tubers of herbaceous plants, are most abundant in frequently burned pine habitats with well-drained sandy soils. Alteration of the fire. regime results in encroachment of woody vegetation that competitively eliminates herbaceous vegetation. Our working hypothesis is that alteration of fire regimes that reduce herbaceous vegetation result in the decline of pocket gophers, and may be a primary cause of the decline of Louisiana pine snakes.

Telemetry studies have also demonstrated that vehicle mortality of Louisiana pine **snakes** is significant. Moderately heavy traffic on a roadway appears to depress snake populations by 50% or more for hundreds of meters from the road corridor. The consequences of this level of mortality at- **the** landscape level are only beginning to be addressed, but are of obvious significance in understanding and managing Louisiana pine snake populations.

Celebrating the Year's Successes

Providing Options for Wise Use and Management...

Research Work Unit 4106
Managing Upland Forest Ecosystems in the Mid-South

Alternatives to Clearcutting on Public and Private Lands

The Research Work Unit's special focus is in uneven-aged silviculture. Unit scientists were invited to contribute' a synthesis of research in uneveh-aged silviculture of southern pines to a national publication about the current status of uneven-aged silviculture in the nation. There is a sixty year record of data from the "Good and Poor Farm Forestry" uneven-aged silviculture demonstration studies on the Crossett Experimental Forest, plus fifteen active studies that apply to uneven aged silviculture iri three different forest types: loblolly-shortleaf pine stands on the West Gulf Coastal Plain, pure stands of shortleaf pine and pine-hardwood stands in the Ouachita Mountains, and oak-hickory stands in the Arkansas Ozarks.. With this database, unit scientists are developing the applied ecology and silvicultural technology information needed to properly manage the upland forest ecosystems of the Mid-South using uneven-aged silviculture.

Society continues to insist on alternatives to traditional forms of timber management on public and private lands. Scientists in the Monticello/ Crossett Research Work Unit in Arkansas prqvided several key advances along these lines in FY '98.

A set of four publications appearing concurrently in one of the major forestry journals analyzed the development of poorly-stocked loblolly-shortleaf pine stands on the Crossett Experimental Forest and elsewhere in the West Gulf Coastal Plain. These studies demonstrate a much greater potential for recovery of poorly stocked cutover stands than has been previously thought. Traditional advice has been to site-prepare the cutover stand and replant, which is often too expensive for landowners. These studies suggest that such stands can be rehabilitated from far poorer stocking than previously thought, at a much lower cost than 'that incurred by site preparation and planting. The result is that they will provide high-value sawtimber returns within a relatively short period of time.

We distributed , over 200 copies of uneven-aged silviculture guidelines across the South, and published a four-part series on management of understocked stands in a major regional applied journal.

These findings have implications for every landowner who acquires or inherits 'a cutover tract, and points to the need for professional advice in evaluating the developmental potential of such tracts on a case-by-case basis.

Celebrating the Year's Successes

Providing Options for Wise Use and Management...

Integrated Ecosystem Management Studies Lead to Adaptive Management

Research Work Unit 4351
Watershed Responses to Disturbance

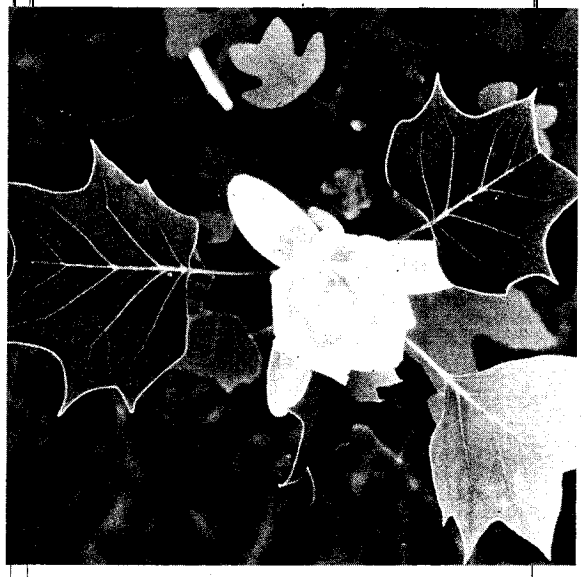
We are meeting , the growing demand for means to monitor the effects of land management activities on water quality by testing monitoring methodology in association with forest road construction and streambank restoration.

Multiple needs and uses of forest resources require an integrated, interdisciplinary ecosystem approach to research, planning, and management. The Wine Spring Creek Ecosystem Management Project in the Nantahala National Forest in North Carolina is providing both a framework and specific information to address those needs. This project in the 4,500-acre Southern Appalachian basin has multiple goals: achieving forest plan desired future conditions and demonstrating, developing, and testing alternative means to reach those conditions by using available and new research to predict and evaluate ecosystem responses.

Organized around themes of watershed restoration, forest sustainability, human and economic values, and ecosystem structure and function, the multifaceted studies in the Win'e Spring Ecosystem Management Project 'provide substantial benefits:

- Stand restoration burning in the. mixed pine-hardwood stands has reversed the decline in this forest type. This prescription stimulated pine regeneration, increased vegetation diversity, maintained small mammal and soil arthropod diversity, improved wildlife habitat, and maintained water quality and soil fertility.

- Three methods of selection harvesting in mixed oaks stands were applied to improve oak regeneration; enhance wild turkey, ruffed grouse, and Neotropical bird habitat; and increase vegetation diversity.



Caring for the Land and Serving People

Celebrating the Year's Successes

Providing Options for Wise Use and Management...

Research Work Unit 4351
Watershed Responses to Disturbance

Integrated Ecosystem Management Studies Lead to Adaptive Management

- The impoverished aquatic habitat and associated insect and fish populations are being enhanced by increasing stream structures through scientifically based additions of coarse woody debris to streams..

- Soil erosion and stream sedimentation research are showing the benefits of best management practices associated with forest roads and other management prescriptions. Results have been used to develop a landscape sediment model to assess the relative effects of alternative management practices.

- Recreation studies identified human uses of the watershed and customer preferences for future uses. A larger scale study showed how economic tools can be extended to quantify complex social and biological values associated with ecological processes. Both of these efforts provide an improved basis for management planning.

- Improved methods, developed to classify ecosystem units on the watershed, are being melded with other research and management activities to test the utility of the procedure.

These research findings, among others, are being synthesized and formulated for inclusion in a decision support system to assist and improve the forest management plan process. In the short-term, results from this research are reviewed and management techniques changed, if appropriate, in on-going feedback known as adaptive management.

Celebrating the Year's Successes

Providing Options for Wise Use and Management...

Adhesive Technology for Bonding Green Lumber

Research Work Unit 4701
Southern Forest
Resource Utilization

End-jointed lumber is sold at premium prices because it has more uniform strength and less tendency to warp than straight-sawn lumber. An adhesive system that bonds wood at a wide range of moisture contents would permit the use of low-quality plantation grown timber, short-length processing wastes, and green wood in the manufacture of. high-quality structural lumber. Such adhesives to produce end-jointed lumber that meets industry standards for structural lumber have not been available.

SoyBond resin adhesive developed which allows end-joint bonding of lumber at a wide range of moisture content.

Through the cooperative efforts of a Southern Research Station scientist and a private consultant in Washington State, the capability to end-joint wood with high moisture contents was first demonstrated using vegetable tannins to alter the cure properties of standard phenol-resorcinol-formalde! hyde (PRF) adhesives. An adhesive formulation was developed using a tannin with alkaline catalyst on one face of the joint, and a PRF resin with hardener on the opposite face. When brought together to mate the joint, the components mix and rapidly gel to form a durable adhesive bond. Because the availability and price of the tannin component stalled further development of this process, a soy protein derivative was investigated. These soy-based adhesives also bonded different wood species with wide-ranging moisture contents. Evaluated in a number of full-scale plant trials, the SoyBond resin technology has successfully met industry standards for structural lumber. Currently used commercially in one plant, the adhesive is under consideration by other lumber manufacturers.

The development of this adhesive technology provides at least four benefits for the forest industry. First, bonding short length sections from green defective lumber produces premium quality lumber from low-quality timber. Second, by end-jointing the lumber before drying, energy is not used in drying defective wood. Third, the uniform board lengths that result from this process translate into a more efficient use of the dry kiln. Fourth, by reducing the amount of resinous knot defects (common to southern pine lumber) subjected to the drying process, the amount of volatile organic compound emissions that contribute to the blue haze from dry kilns is also reduced.

Celebrating the Year's Successes

Providing Options for Wise Use and Management...

Research Work Unit 4703
Biological/Engineering Technologies

Monitoring Impacts from Forest Harvesting with Global Positioning System (GPS) Technology

Maintenance of soil productivity has been identified as a key component in sustainable forest management. Two primary indicators have been used to monitor changes in soil productivity: soil compaction and stand productivity. Neither indicator completely characterizes the influence of management on soil pro: ductivity. Stand growth, for example, is confounded with climatic, genetic, and other management factors, making conclusions about soil productivity drawn from growth measurements alone highly suspect. Degree of soil compaction is intuitively a better measure of soil productivity, and compaction has been shown to occur with various management practices, most notably with machinery traffic. Significant increases in soil compaction, however, often occur, on relatively small, widely distributed areas within a treated stand. Information on the distribution of impacts across a stand is difficult to collect in practice. Iheally, an indicator of soil productivity would be sensitive to changes in soil physical properties, be related strongly to stand growth, and be measurable at fine resolution over large areas to fully capture the effects of highly variable management activities.

Global positioning sys terns (GPS) provide a robust and practical means of tracking movements of machinery engaged in forest management activities.

Global positioning systems (GPS) provide a robust and practical means' of tracking movements of machinery engaged in forest management activities. These systems provide data on, not only where a machine went, but how often it passed over a given location. We are currently using this technology in evaluating the impacts of forest harvesting on soil physical properties at a stand level. Results of the tracking process are maps showing traffic' intensity over an entire stand. Given that traffic intensity i-s directly related to changes in' soil physical properties, the maps could be used in conjunction with data on soil, moisture at the time of traffic and soil type to identify areas within a stand receiving levels of machine traffic that could be limiting to subsequent stand growth.

Research this year has led to the'first large-scale, detailed maps of traffic patterns resulting from tree length

Celebrating the Year's Successes

Providing Options for Wise Use and Management...

Monitoring Impacts from For&t Harvesting with Global Positioning System (GPS) Technology

Research Work Unit 4703
Biological/Engineering Technologies

harvesting in the Southeast. The maps show how many times each 0.5 meter square section of a stand was traversed by harvesting machinery. Further research has been done to use the traffic maps to predict changes in soil physical properties associated with a known level of traffic passes. 'This information provides a means of estimating, with great spatial detail, the soil-related impacts from forest harvesting. Combining these results with subsequent tracking of growth in these stands will provide a clearer understanding of the relationship between traffic intensity and site productivity. Other benefits derived from'using GPS technology include near real time feedback on progress of harvesting, and the ability to remotely monitor the work. of- harvesting crews. Coupling GPS with tree measure-. ment sensors on felling equipment will provide 'precision, forestry' technology, making the flow of timber accountable from the stump to the mill and mapping stand yield without preharvest cruising. Positional data could also be used by loggers to increase productivity of their operations. We are currently doing research in all of these areas of application for GPS technology.

Celebrating the Year's Successes

Providing Options for Wise Use and Management...

Research Work Unit 4851
Economics of
Forest Resources

Forecasting Land Use and the Urban/Wildland Interface in the South

Land use and resource management choices are perhaps the most important determinants of -forest structure and condition in the South. The South's rich diversity of land 'ownership, forest types, physiography, and wood products industries defines complex interactions between people and forests. As social systems experience rapid change, the implications for the region's forests could be substantial.

Computer models provide a foundation for regional assessments of forest sustainability.

Scientists at the Southern Station's Research Triangle Park Lab and several Universities have developed spatially explicit computer models of land use change at various scales. These models simulate the effects of economic, demographic, and physical conditions on land use allocations, Projections of these driving variables — e.g., population growth and markets for agricultural goods — can then be used to forecast how and where land use would change in the future. 'Fine scale models have been linked to water quality and biodiversity for large watersheds in the Southern Appalachians. Broad scale models forecast land use shares at the county level, and have been developed for the South and the Mid-Atlantic regions. These models provide a foundation for regional assessments of forest sustainability.

The land use model for the South is also being used to assess the potential growth in the region's urban/wildland interface over the next thirty years. This change in the "human-context" of forests holds important implications for the relative values of various forest uses.' To investigate one aspect of these changing forest val-. ues, 'the land use model is also being integrated into an assessment of the south's timber markets.

Land use forecasts for the South suggest a high degree of flux between agriculture, forest, and urban land uses. However, these changes are spatially focused with urban growth concentrated in places like the Piedmont Crescent — Raleigh, North 'Carolina to Atlanta, Georgia — the coastal areas, and central Tennessee. Forest cover will, decline in these areas and residual forests will be more "urban" than "rural." In other parts of the South, the critical variables in determining the extent of forests are the relative values of forest and agricultural products. Here again, change is spatially focused with, for example, shifts from agriculture to forest being most likely in southwestern Georgia' and parts of the Mississippi Delta region.

Celebrating the Year's Successes

Understanding Environmental and Biological Threats...

An Option for Controlling American Chestnut Blight Disease

Research, Work Unit 4153
Southern Institute
of Forest Genetics

Chestnut blight is a devastating fungal disease-of American chestnut trees. The forest ecosystem of the eastern United States has been greatly altered by this catastrophic disease. Eighty years ago, chestnut trees were a major component of hardwood forests. After the accidental introduction of this fungus from Asia, it spread rapidly, and within 50 years reduced the species to a minor understory component.

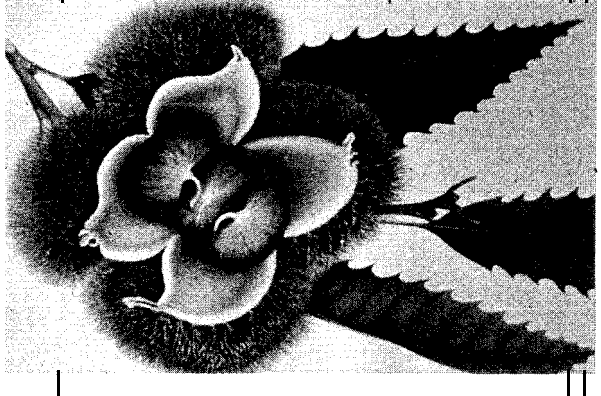
Just as this fungus is able to infect and cause disease on chestnut trees, the fungus is infected by a virus. Fungal isolates infected with virus are less virulent, producing nonlethal, superficial cankers on trees. The virus cannot be transferred sexually in the fungus,' but moves readily through fungal filaments — the transfer process controlled by vegetative compatibility (vic) genes.

Use of molecular markers minimizes cost of laboratory, testing to study virus transmission dynamics.

A transfer results in conversion of the recipient fungal strain to lesser virulence. Therefore, information about the number and prevalence of vegetative compatibility groups in natural populations of the fungus may help in developing a blight control strategy utilizing less virulent virus-infected strains.

Scientists at the Southern Research Station, Southern Institute of Forest Genetics in Saucier, Mississippi have developed molecular markers as tools for better understanding the fungal vic genes and virus transmission. To date, molecular markers linked to five of seven known vic genes have been identified. These molecular markers are being used to minimize the costs of laboratory testing.

'Using molecular markers, the time required for identifying genetically an unknown,isolate of the fungus has been reduced 'from several weeks to a single day. Our ability to quickly identify large numbers of' isolates has made virus transmission dynamics easier to study, permitting scientists to evaluate the practicality of virus transmission as an option for fungus control at a population level.



Celebrating the Year's Successes

Understanding Environmental and Biological Threats...

Research Work Unit 41.54
Biological Foundations of Sustainability

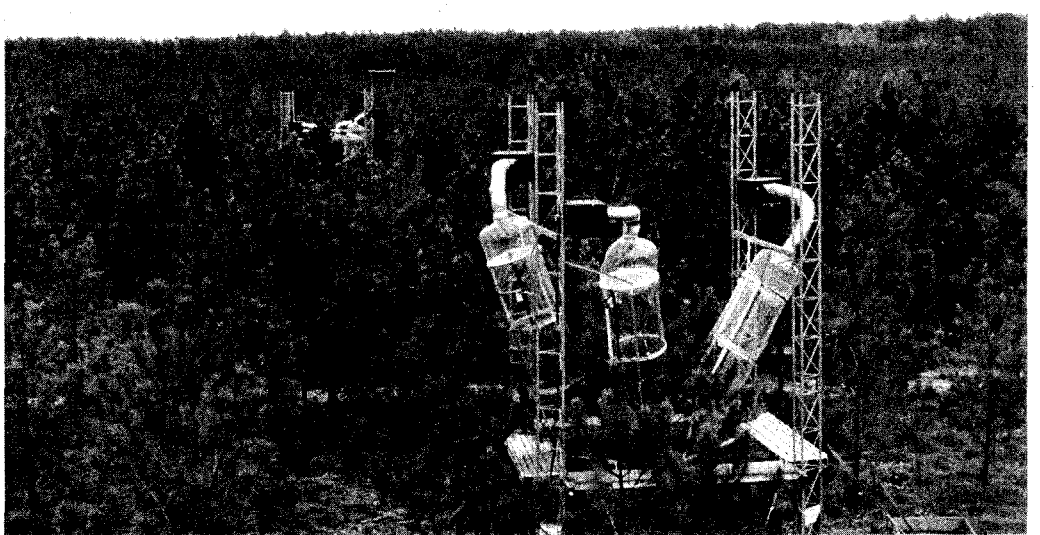
Large-Scale Outdoor Laboratory Offers Significant Research Results

The Southeast Tree Research and Education Site (SETRES), located in Scotland County, North Carolina, is a large-scale outdoor laboratory designed to study multiple aspects of sustainable southern pine forestry. SETRES was established in 1992 as an important. component of the Southern Global Change Program and <represents a major collaboration among the Forest Service, industry, and universities. SETRES has provided an excellent opportunity to assess interactions among different levels of resource availability including water, nutrition, and atmospheric carbon dioxide (CO_2).

We have shown that elevated levels of carbon dioxide increase photosynthesis and growth in loblolly pine.

In 1998, research on loblolly pine responses to elevated CO_2 neared completion. Original wdrk at SETRES increased atmospheric CO_2 surrounding individual branches and demonstrated that loblolly pine increased net photosynthesis and growth under elevatkd CO_2. No changes in branch water use were observed.

This work was followed by an intensive 2.5 year study where entire 13-year-old trees were surrounded by 40-foot-tall who'le-tree Chambers. The use of large trees for this work is novel and has permitted responses of the entire tree canopy and root systems to be evaluated. Again, elevated CO_2 has been Shown to increase growth rate and no negative consequences to tree physiology and function have been observed.



Celebrating the Year's Successes

Understanding Environmental and Biological Threats,. .

Detecting Disease Damage in Living Trees

Research Work Unit 4155
Bottomland Hardwoods
and Wetlands

Various disease-causing microbes, such as wood-decay fungi and wetwood bacteria, are foundational components of bottomland hardwood forest ecosystems. Roughly 30 percent of the total timber volume harvested in the United States is destroyed or decreased in value by heart decay each year. Lost value due to bacterial wetwood in the oak resource alone has been estimated to be $25 million a year. Whether one is interested in evaluating the relative health of a certain stand of trees, or a forested region, or wants to have the most accurate volume estimates of sound timber, it is important to-accurately estimate the incidence and severity of diseases such as heart rots and bacterial wetwood infections.

We are improving techniques to use technology to identify diseased living trees.

Progress is being made to develop ways of detecting fungal and bacterial infections in living hardwoods in the absence of obvious indicators 'and without damaging trees in the process. One set of tests indicates that ultrasound passed through the diameter of a tree can identify incipient as well as advanced heart decay in individual trees. In addition, ultrasound was able to separate a population of trees with bacterial wetwood from healthy trees, but could not detect individual wetwood-infected trees with any degree of certainty. Current efforts are focused. on improving the technique in order to identify infections in individual trees.

Another set of tests is evaluating the use of electronic aromascan technology to detect disease-causing microbes. This technology electronically measures volatile compounds given off by the microbes. So far, it has been used to separate pure cultures of wood decay fungi isolated from decayed trees. This technology has the potential to'identify wood decay fungi, vascular wilt fungi, bacterial wetwood, bacterial leaf scorch, and many other microbes capable of causing lumber degrade in wood samples. Early detection of these organisms using simple portable units would allow forest managers to adjust harvest schedules to minimize volume lost to rots, decays, and other organisms in standing trees. Aromascan and ultrasound technologies could be used' in virtually any forest ecosystem.

Celebrating the Year's Successes

Understanding Environmental and Biological Threats...

Research Work Unit 4202
Coldwater Streams
and Trout Habitat

A Bioindicator Technique for Water Quality Assessment

Watershed health and restoration is a key theme of the Forest Service's Natural Resource Agenda, and much effort has gone into the development of best management practices to protect water quality on national forests. The new insect-bacteria bioindicator has direct application to these efforts. Information gained from this technique provides a first step in the implementation of programs to initiate stream recovery. This new method evaluates detrimental effects of excess nutrients in streams.

New insect-bacteria bioindicator shows promise for evaluating stream quality.

The technique is based on the physical appearance of aquatic insects, which become covered by filamentous bacteria when excess nutrients are present. Stimulated into a bloom stage of growth by elevated concentrations of nitrate and phosphate, the bacteria readily colonize the gills and body surface of insects. By simply viewing insects collected from a stream, nutrient-impacted sites can be identified.

In laboratory studies, more than 90 percent of insects whose bodies were more than 25 percent covered, by bacteria died within 30 days, but those without bacteria survived and grew normally. The diagnostic ability of the technique was confirmed through field studies, where, a strong positive relationship was found between the degree of bacterial growth and the reduction in density of insects at nutrient-enriched locations.

Practical application of the bioindicator in a field setting requires only a hand lens with 10-15x magnification. Qualitative samples of insects can be viewed on site, allowing a screening-level assessment to be conducted within minutes. Preservation of insects in alcohol or formalin or manipulation of insects with collection equipment does not dislodge the bacteria. Consequently, severity of infestation can be confirmed in the laboratory without loss of data. Archived samples collected as part of a long-term monitoring program or for other research purposes can also be evaluated. Common stream insects such as mayflies are adequate for the assessment and no detailed taxonomic identification is required.

The bioindicator also shows promise as a significant addition to the Environmental Protection Agency's Rapid Bioassessment Protocol (RBP), a method widely used in North Anierica and Europe for stream quality rating. The simplicity and speed of the bioindicator allow it to be incorporated into the RBP with little additional effort by those conducting stream surveys.

The bioindicator should be a valuable tool for use in watershed management because it can detect nutrient impacts and evaluate the success of actions taken to control nutrients from point or nonpoint sources.

Celebrating the Year's Successes

Understanding Environmental and Biological Threats...

Advances in Control of Southern Pine Beetle

Research Work Unit 4501
Southern
Pine Beetle

We continued our exploration of interrelationships between bark infesting insects and their symbiotic fungi. We demonstrated that mites associated with the southern pine beetle (SPB) successfully, feed and develop on a fungus which competes with SPB, but do not develop well on the fungus which is mutualistic with SPB. In studies on the effects of growing season burns in longleaf pine, we found thar burns of moderate severity resulted in higher levels of root-infesting weevils and beetles in longleaf pine than did low level burns or no burning. This indicates that damage from growing season burns may result in increased presence of secondary root infesting insects and their associated fungi which can become pathogenic in stressed trees.

Patent received for beetle repellent.

Patent Number 5,695,807 was received December 9, 1997 for an invention identifying four additional analogs of 4-allylanisole, which effectively repel Scolytid beetles.' This technology is significant in that the analogs are repellents, not broad spectrum insecticides. We have also been exploring the. effects of visual silhouette modification on host selection behavior in bark beetles. The presence of a vertical black silhouette appears to be especially important, to SPB. Attractant-baited white traps significantly and dramatically reduced catch compared to standard black traps. In fact, the reduction due to this visual deterrent was stronger than that observed with semiochemical deterrents such as 4-allylanisole, a host derived compound. Importantly, the combination of visual and semiochemical deterrents produced an additive effect, suggesting that this combination may be useful in tree protection strategies with tree-killing bark beetles. We have also evaluated the effects of visual disruption treatments on another important species of bark beetle — the western pine beetle, a close relative of SPB. White traps again caught significantly fewer beetles; however, the effect was not as strong as observed in SPB. The combination of visual and semiochemical deterrents again pro-, duced the greatest effect, suggesting that this treatment be pursued to determine its efficacy as a tree protectant.

In our studies of the relationship between growth and resistance to pests and pathogens, our most significant highlight came from studying the effects of severe wounding. We conducted this wounding to reduce the reservoir of previously, synthesized oleoresin. When we combined this with repeated measurements of resin flow from bark wounds, we found that trees with large live-crown ratios recovered most rapidly. Within a few days such trees produced resin, flow greatly exceeding that measured prior to the severe wounding treatment. Such responses indicate that sampling the reservoir of preformed resin may not always lead to accurate predictions of levels of pest resistance within a tree.

Celebrating the Year's Successes

Understanding Environmental and Biological Threats...

Research Work Unit 4505
Insects and Diseases
of Southern Forests

Exotic Pests of Eastern Forests

At least 4,500 pest species of foreign origin have established free-living populations in the United States. These exotic pests have direct economic consequences, estimated 'in 1991 to have accumulated to 96 billion dollars. In addition to these direct costs for control and for lost forest, range and wildlife habitat productivity and recreation/ aesthetic value, exotic pests also cause incalculable damage by threatening biological diversity and altering key ecosystem processes, such as hydrology, nitrogen fixation, and fire regimes.

A Proceedings has been published, Exotic Pests of Eastern Forests, *which represents state-of-the-art exotic pest manage-men t in forests today.*

USDA Forest Service Research (Southern Research Station and Northeastern Forest Experiment Station) and Forest Health Protection (Southern and Eastern Regions) sponsored a conference that highlighted the impact of exotic pests in forest ecosystems and' explored management options. Developed for managers in the National Forest System and other forest land managers, the conference< included 'speakers from the USDA Forest Service,. State governments and-universities, and private enterprises engaged in impact assessment, exotic pest control, habitat preservation efforts, and ecosystem restoration work.

The proceedings of this conference were published in 1998, under the title *Exotic Pests of Eastern Forests,* in collaboration with the Tennessee Exotic Pest Plant Council and Southern, Appalachian Man and the Biosphere (SAMAB). Intended to represent state of the art exotic pest management in forests today, the publication also spotlights the need for increased interception and eradication of new pests as they are identified to reduce the ultimate' costs of invasive exotic species.

Celebrating the Year's Successes

Understanding Environmental and Biological Threats...

I Cooperative Approach to Forest Health Monitoring

Research Work Unit 4803
Forest Health
Monitoring Program

The Forest Health Monitoring (FHM) program started in 1990 when the Forest Service, the New England State Foresters, and the Environmental Protection Agency agreed to join forces to develop a national, interagency Forest Health Monitoring program. Although FHM has undergone many changes since its inception, the program has benefited over the years from support and expertise from a variety of organizations. Within the Forest Service, Research & Development, State & Private Forestry, and the National Forest System all have a role. In addition to the Forest Service, six Federal and 38 State agencies and more than a dozen universities have made important contributions toward reaching a common goal. Melding Forest Service needs, with those of different Federal, State, and university partners, into a cohesive whole has been a challenge. Though challenging, FHM's success shows that this cooperative approach will succeed for developing both the scientific underpinnings, and the administrative framework, for collecting, managing, assessing, and reporting forest health information critical to a wide range of policy and management decisions.

A cooperative approach shows success in developing the scientific and administrative framework for collecting and reporting forest health information.

Although FHM has yet to fully reach the goal of "developing and implementing a cooperative, multi-agency program to monitor, assess, and report on the long-term status and trends in forest ecosystem health in the United States," the program has made good progress. It is integrated with the Forest Service's Forest Inventory and Analysis units and is implemented in 37 States covering about 70 percent of forest land in the lower 48 States. Monitoring information increasingly responds to agency and partner information and reporting needs, is based on Santiago Declaration criteria and indicators, and includes strong quality assurance and quality control measures. FHM aims to provide scientifically sound information for formulating strategic national and regional resource plans and policy, for making ecoregion-scale resource management planning decisions, and for evaluating Forest Service success in meeting forest health protection responsibilities.

As with other resource monitoring projects, collecting data is only half the task. Communicating results to a diverse group of constituents is a key part of Forest Health Monitoring. Information is available through various national, regional, and State publications and the FHM Web site: http://www.fs.fed.us/foresthealth/

Celebrating the Year's Successes

Understanding Environmental and Biological Threats...

Research Work Unit 4852
(Southern Global
Change Program

Effects of Global Environmental Change on Southern Forests

The -assumption thatforests will grow the same way in the future as they did in the past may be invalid.

Over the last eight years, scientific research has greatly advanced our understanding of global environmental change and its repercussions for southern forest ecosystems. During this period, international scientific consensus was reached by the Intergovernmental Panel on Climate-change that "the balance of evidence suggests that there is a discernible human influence on global climate." In 1998, global average temperatures were warmer for each month of the year than in any previous time in recorded history and the global atmospheric carbon dioxide concentration rose again by 0.5 percent. Changes in the atmospheric composition and climate will have a significant influence on ecosystems in our region. The region's forest ecosystems are experiencing changes in their chemical and physical environments at heretofore unprece-. dented rates.

The Southern Global Change Program published a summary of the first five years of research conducted by the program of the critical findings from projects conducted by Southern Research Station scientists and university and private industry partners. There was consistency among these studies on one important point; the direct effects of elevated carbon dioxide on physiological factors affecting productivity were large and this leads to the expectation that there will be increases in growth for southern forests Climate change is likely to involve changes in atmospheric carbon dioxide, temperature, and precipitation-all occurring simultaneously. Current regional mode1 simulations suggest that growth will increase based on our current understanding of forest growth and physiological processes. Some of the more complex models suggest that less understood processes such as nutrient limitations, inter-tree competition, stand-closure dynamics, and water balance have the capacity to mitigate potential growth increases.

Many of the forests in the southeastern United States are currently under intensive management. The degree to which these forests continue to be managed in the future may determine how responsive they will be to global environmental changes. If limitations imposed by new climate conditions can be overcome, for example, with thinning of canopies or fertilizer additions, then managed systems may show greater response to climate change than would be otherwise anticipated. Rapid growth-pattern changes'induced by a quickly changing climate 'will invalidate the key assumption used in most management models today-that forests will grow the same way in the future as they did in the past. The analysis of regional forest process models suggests that. we can make some strong inference about growth trends under future climates based on extrapolation of our current scientific knowledge, while improving our understanding of forest-climate interactions.'

Celebrating the Year's Successes

Aligning Products with Customer Needs...

Sorting Mixed Hardwoods by Color

Research Work Unit 4702
Tree Quality,
Processing, and Recycling

While the demand for hardwood products, such as flooring, millwork, furniture, and kitchen cabinets, is increasing, the potential supply of timber is decreasing, as many forest areas are removed from timber harvesting. Because the timber industry is asked to produce more products from fewer resources, it must process mixed species, such as lower quality red oaks, which previously remained in the forest.

Commercial version of computer vision system improves material utilization.

To help industry maintain the production of high quality wood products, scientists in the Tree Evaluation, Processing and Recycling Research Work Unit and at Virginia Tech University cooperatively developed a computer vision system that separates cuttings from lumber by wood color. The cuttings are automatically separated, and cuttings of like color are processed into higher value products. These scientists then helped industrial cooperatorsdevelop a commercial version of the computer vision system, This commercial machine has been successfully operating in a plant for more than 1.5 years.

These research efforts were awarded the 1997 Hardwood Research Award from the National Hardwood Lumber Association. The work was selected as the research with the most significant implications for the hardwood industry. Evolving from research, this commercial machine is helping industry adjust to the changing hardwood resource by improving material utilization.

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Aligning Products with Customer Needs...

Research Work Unit 4801
Forest inventory
and Analysis

Implementing an Annual Forest Inventory System

For more than 70 years, the Forest, Inventory and Analysis (FIA) program has been the only inventory work that produces a comprehensive account of natural resources on both public and, private lands. It has also been the only inventory work that historically focused on broad regions of the country where it conducted inventories on a State-'by-state, cyclic basis with cycles of 8 to 15 years. Using this design, inventory crews' measured all field plots in one State before moving into another State. However, data collected under this design are only accurate for a State for 1 to 3 years after, that State's inventory is completed. In addition, the data are not connected in time across State boundaries, either between or within regions. Because more timely, consisterit data across the entire South were need.ed, the concept of an annual inventory system was introduced in 1995.

Annual inventory data for each southern State will provide critical data to address forest sus tainabili ty issues.

The annual forest inventory system provides the basis for integrating the Forest Health Monitoring (FHM) and the FIA 'program,' thereby increasing the effectiveness of each. The objectives of this system are to create and to maintain a database of current inventory estimations. To meet -these objectives, 20 percent of the ground plots in all of the 13 southern States must be'measured annually. Components of the annual system include plot strategies; field logistics; greater use of remote sensing, models and statistical procedures; quality assurance; database management; and an annual sample of measured plots.

The annual forest inventory system has, now been scheduled for implementation in all 13 Southern States. Because the scope of annual inventories is large, partnerships have been formed with several organizations, most notably the Southern State Foresters. At the end of FY '98, six States were actively collaborating with the Southern Research Station in, the implementation of annual inventories. These six States expended a total of $2,328,000 in FY '98, an amount above and beyond the efforts and resources provided by the USDA Forest Service. Plans are in place to implement annual inventories in the remaining seven southern States within the next 2 years.

Annual data for each State will provide critical data to assess criteria, and indicators for forest sustainability and to address forest sustainability issues. Data acquired using the new annual procedures have produced a number of specific benefits:, 1) more uniform information among states; 2) confidence intervals that are more stable from year-to-year; 3) the ability to immediately incorporate innovations into each State's inventory; and, 4) annual observations of inventory events.

Celebrating the Year's Successes

Aligning Products with Customer Needs...

Wood Products Markets in China

Research Work Unit 4802
Legal, Tax, and
Economic Influences

In the 1980s China emerged as the world's second largest importer of forest products and the second largest export market for U.S. forest products. However, United states wood products exports to China declined nearly 93 percent from 1988 to 1996, from $448 million to $33 million. Little was known about the factors that caused this decline. More generally, less is known about the forestry and wood products market in China than most other United States trading partners.

As an importer of wood products, China shows an emerging interest in United States hardwood species.

A scientist' from the Southern Research Station was a member of a 3-person team, participating under the Scientific Cooperation Program of the USDA Foreign Agricultural Service, that visited China for research and fact-finding to assess recent trends in China's wood product imports and the competitiveness of U.S. wood product exports. Trade statistics were collected from Chinese sources, and interviews were conducted with importers that accounted for more than 90 percent of the wood products imported into the country. After the trip was completed, data were compiled and analyzed. A major finding was that wood product import demand had shifted from softwood logs and lumber to hardwood products, especially tropical hardwood; however, there was an emerging interest in United States hardwood species. The competitive advantages of American wood products in Chinese markets were found to be product quality, service, and reputation of exporting firms; disadvantages were price, transportation time, and lack of credit provided by exporters. Results were disseminated at the Society of American Foresters National Convention and through the proceedings, and as the feature article in the June 1998 issue of the Forest Products Journal:

This research can help enhance the competitiveness of the domestic forest products industry, which increases jobs and incomes, and benefits wood products manufacturers, workers, and forest landowners. In China, consumers will benefit, and substitution of imports for domestic timber from environmentally-sensitive areas will promote sustainable forest management. Also, the successful collaboration in data-gathering, analysis, and publication with Beijing Forestry University should foster future cooperative research efforts.

'Celebrating!, the Year's Successes ,

Aligning Products with Customer Needs...

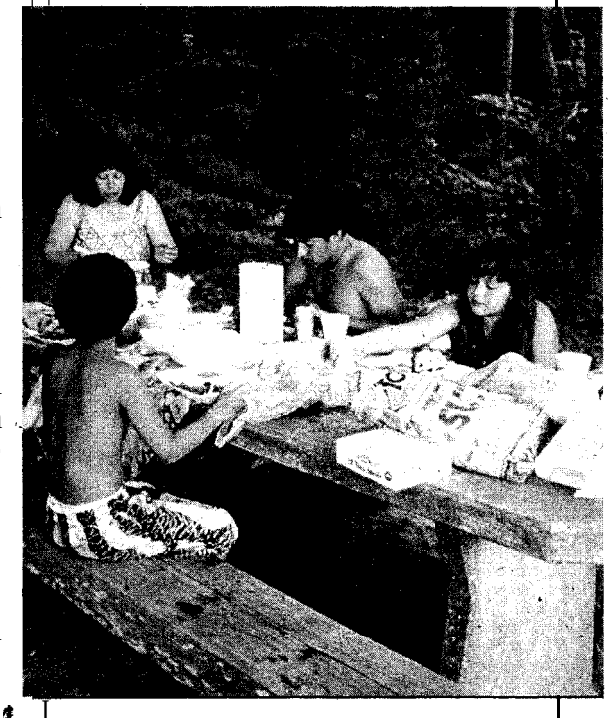
Research Work Unit 4901
Trends in Recreation
and Wilderness

Ethnicity Recreation Research

Demographic trends indicate. that growth of minority groups has been increasing faster than the overall United States population. Forecasted population growth is expected to follow these trends with 82 percent of the nation's growth over the next 30 years coming from minorities. Increased population diversity creates a managerial need to better understand minority preferences and behavior related to natural settings and outdoor recreation as the Forest Service and other land management agencies define and fulfill their missions.

. We are studying the relationships among increasing minority populations and recreation uses.

Researchers at the Southern Research Station's Outdoor Recreation and Wilderness Unit are examining social and economic issues pertaining to ethnicity and recreation nationally and in the Southeast. Social scientists from the Southern Research Station and Florida A&M University provide a review and synthesis of theory and empirical investigations of Anglo and African American participation in outdoor recreation in *Theoretical Perspectives of Ethnicity and Outdoor Recreation! A Review and Synthesis of African American and European American Participation.* Recent empirical research with southern rural African American and Anglo populations has uncovered insights about visitation, use, meanings, and perceptions of forested areas. For example, in *-Race, Rural Residence, and Wildland Visitation: Examining the Influence of Sociocultural Meaning,* Southern Research Station and University of Georgia, scientists find that the, meanings rural blacks and whites attach to wildlands are fundamental to explaining differences in visitation rates between the two groups.



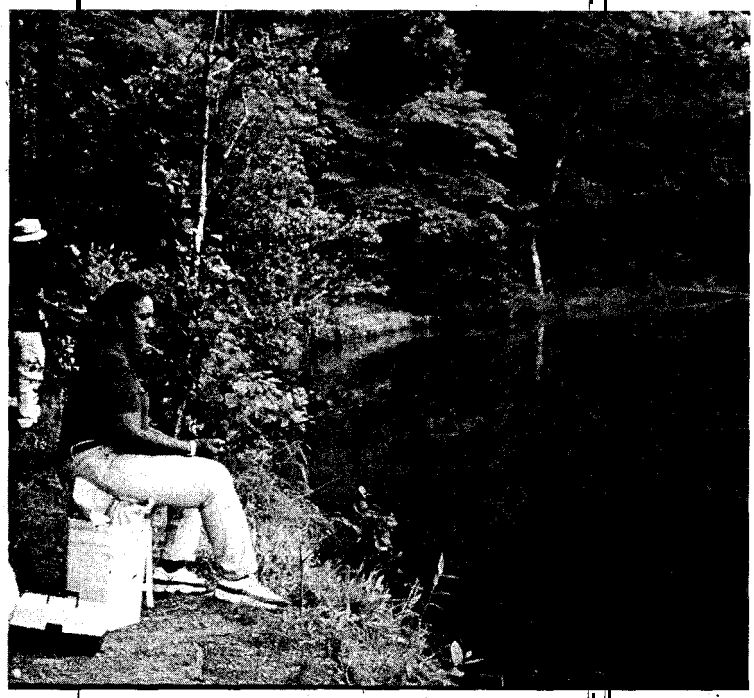
. Celebrating the Year's Successes.

Aligning Products with Customer Needs...

Ethnicity Recreation Research

Research Work Unit 4901
Trends in Recreation
and Wilderness

In the reiated paper, *Wildland Recreation in the Rural South: An 'Examination of Marginality and Ethnicity Theory,* social scientists from the Southern Research Station and Florida A&M University use logistic regression models to test competing theoretical explanations for black and white -visitation rate differences to wildlands. Their findings suggest that race, sex, and age are strong predictors of wildland visitation among rural residents.. Moreover, contrary to theory and previous research, race and income interact among blacks to effect. greater visitation among poor blacks than more affluent blacks. Underlying reasons for black and white visitation differences are explored further in A Consideration of Collective Memory in African Attachment to Wildland Recreation Places. Sex, age, and race are important determinants of wildland place attachment f-or rural southerners.



Working with an economist from the National Oceanic and Atmospheric Administration, natural resource-based recreation travel demand by whites and Hispanics to the Florida Keys is examined in *Accounting for Ethnicity in- Recreation Demand: A Flexible Count Data Approach.* Using nonlinear regression, models, researchers find significant differences in price response between whites and Hispanics. Higher'demand elasticity for Hispanics means price increases related to recreation trips to the area is likely. to disproportionately displace Hispanic visitors. This result implies that pricing policies, like user fees, could have important distribution and equity consequences.

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Research Work Unit 4104
Disturbance and Management of Southern Pine Ecosystems

Smoke from Wildfires Causes Problems at Night

Recent catastrophic wildfires in Florida emphasize the 'need to reduce fuel loadings. in southern forests. Improved models of smoke movement and dispersion would permit more widespread prescribed burning, which is currently limited by smoke problems. Daytime smoke can be a nuisance when it moves into sensitive areas and a traffic hazard when it drifts across roadways. However, the most severe impacts can occur at night when small amounts of smoke from smoldering heavy fuels are trapped near the ground and carried long distances in slow-moving air with little dispersion. Smoke can also be entrapped within moist shallow valleys at night,, thereby initiating' or intensifying local fog. Development and validation of nighttime smoke models has been limited because it has been impossible to observe smoke near the ground at night in detail; this barrier to model development is being surmounted. Smoke trapped near the ground at night has been recorded in moonlight by an,. intensified multispectral video camera from aircraft at approximately 5,000 feet above ground level.

Remote sensing allows study of smoke movement at night.

Results verify the hypothesis that smoke can be observed from the air under moonlight if the smoke is sufficiently dense. A light-intensified video camera can be used for remote sensing of smoke moving near the ground at night. This technology is critical for smoke management because airborne observation is the only way to observe and understand the movement 'of an entire smoke plume and to validate computer models for ground-level smoke movement and dispersal at night.

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Increasing Foresters' Skill Levels

Research Work Unit *4101*
Southern Appalachian Hardwoods,

We have improved, the instruction' in our Silvicul ture *Short-course and expanded the range of participants.*

Since 1992, all Bent Creek scientists and several outside speakers have channeled their efforts, to train foresters in the fundamentals of hardwood silviculture. They present an annual workshop which focuses on the principles and, practices of silviculture and closely related disciplines for managing hardwood dominated upland forests in the Appalachian Mountains and Interior Uplands.

The target audience for this annual training is southeastern State service foresters, forestry consultants, and industrial foresters Speakers blend classroom lectures with hands-on field exercises to ensure comprehension of complex concepts. Participants are trained in:

- forest disturbance history
- site classification.
- forest health
- economics
- wildlife management
- stand and forest dynamics
- hardwood autecology and synecology
- hardwood regeneration
- managing mixed stands of pines and hardwoods
- managing low-value hardwood stands
- intermediate stand treatments

Since 1992, about 200 foresters have benefited from this intensive training. This training is offered annually in June or July.

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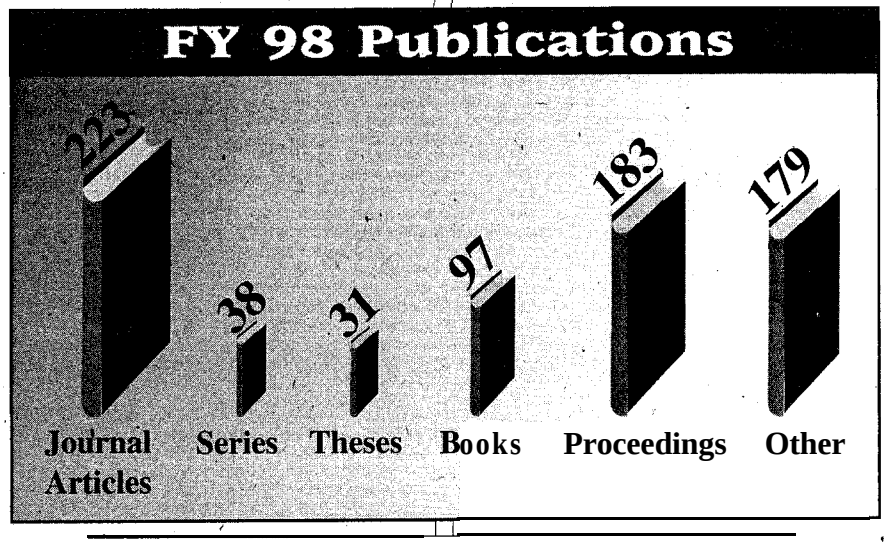
We have responded to new customer needs with improved product delivery.

We have been making a concentrated effort to increase the distribution of our research results, by traditional means, and modern electronics communications. We distribute our hard copy "Catalog of Recent Publications" four times a year, listing the articles and publications that our scientists author- or co-author. These publications are distributed free by request to people throughout the country and internationally. The FY '98 List of Publications is the last section of this Report.

The Stand Management and Forest Health Team at Research Work Unit 4155—Bottomland Hardwoods and Wetlands-has produced four insect and disease image CDs that may be purchased from that Unit.

We have developed, a major World Wide Web presence with our Web site at www.srs.fs.fed.us, which contains a wealth of information about the Southern Research Station and hundreds of Portable Document Format (PDF) files of individual publications. The Web site also serves to distribute the "Catalog of Recent 'Publications" electronically to a mailing list (listserv) of over 1,000 addresses-see Web site page www.srs.fs.fed.us/pubs/pubs_list.htm to subscribe. The site includes directory information, the Strategic Framework for the Southern Research Station, links to Web sites of our Research Work Units, links to other forestry sites, and other information. By the end of 1998, 12 of our Research Work Units had sites available on the Web. Visitation to the Southern Research Station Web site has been expanding at a dramatic rate and information is being added to it frequently.

Scientists and other 'employees participate, in a variety of information-sharing activities: tours and site visits; training sessions; informal and formal presentations, such as giving scientific papers and doing poster sessions'; and staffing exhibits at' meetings and conferences.



Celebrating the Year's Successes

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In tern teams visit summer camps with messages 'about natural resource conservation and careers.

The goal of the Conservation Education Outreach Program is to provide basic conservation education to urban youngsters-children who may never have been exposed to the concepts of conservation, recycling, or forest management. The Southern Research Station hosted two teams of 4 college interns. during the summer to provide a fun, learning experience for children at sites throughout the South.

The visits include environmental games that teach conservation concepts, usually with 20 to '35 children at a time. One 4-person team was located in Asheville, North Carolina, and one was in Huntsville, Alabama. The team in Asheville started a beneficial relationship with the YMI Cultural Center in downtown Asheville to provide conservation educational programming in exchange for office space.

The Southern Research Station teams worked with approximately 2,400 youngsters in FY '98, and conducted the intern training and provided overhead support for two other teams, located in Atlanta, Georgia and Milwaukee, Wisconsin.

We continue to emphasize improving service to those who use our products and information.

Customer Service at the Southern Research Station is providing the products and services needed by our external and internal customers-getting the research results out to the people who can benefit from them. The Station's standards for customer service include:

1. listening and responding to the needs of our customers—incorporating our customers' needs and responding to our customers when feasible;
2. meeting commitments made to our customers in a timely and efficient manner;
3. providing quality advice and work products that meet our customers needs 'and expectations; and
4. seeking, evaluating and being responsive to feedback from our customers to improve personal and organizational effectiveness.

If you have any comments on the products or services provided by the Southern Research Station, please contact our Customer Service Coordinator at 828-257-4342, or use the comment form on our Web site.

Caring for the Land and Serving People

Our Scientists at Work:
Programs, People, Facilities

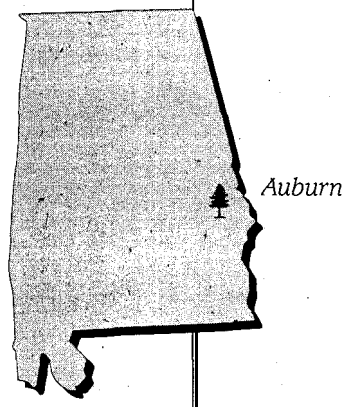
Auburn, Alabama
Monticello, Arkansas
Athens, Georgia
New Orleans, Louisiana
Pineville, Louisiana
Saucier, Mississippi
Mississippi State, Mississippi
Stoneville, Mississippi
Asheville, North Carolina
Otto, North Carolina
Raleigh, North Carolina
Research Triangle Park, North Carolina
Charleston, South Carolina
Clemson, South Carolina
Nacogdoches, Texas
Blacksburg, Virginia

Our Scientists at Work: Programs, People, Facilities

Our Research Work Units (RWU) are located in offices and laboratories in nine States across the Southern United Stares. Our work covers 13 Southern States, with findings that are applicable throughout the Nation and internationally as well. While each RWU has a central location, listed below, some have subunits located at additional sites. Our directory of Research Scientists, which includes more detail about the expertise of each'scientist, is located on our Web site at: http://www.srs.fs.fed.us/staff/scientist/index.htm

SRS-4105 and' SRS-4703

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



The G.W. Andrews Forestry Science Laboratory is located on the campus of Auburn University. The modern office and laboratory facility contains well-equipped environmental chemistry and soil laboratories and a large engineering research laboratory. Adjacent buildings house greenhouse, shop, warehouse, and chemical storage facilities.

SRS-4105, Vegetation Management Research and Longleaf Pine Research for Southern Forest Ecosystems. The mission of this unit is tb: 1) determine the environmental fate and impact of forest herbicides and to 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 provide basic scientific information which will improve the forest operations tools used in resource management. Projects are designed to elicit knowledge about: 1) the biological/ecological effects of forest operations; 2) knowledge about engineering system performance and cost; 3) knowledge about human performance in forest work; and, 4) knowledge about decision-making and planning technologies. The research goal is to deveiop -forest operations that do what resource managers prescribe in an efficient and economical manner without generating undesirable side effects.

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

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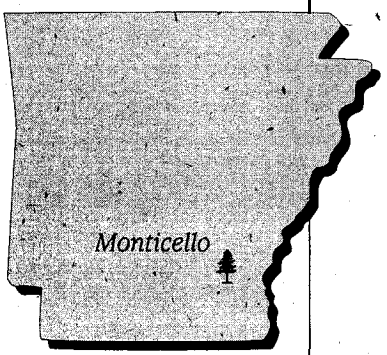
Our -Scientists at Work:] Programs, People, Facilities

SRS-4106

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



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:

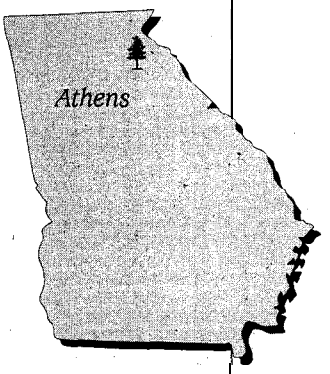
1. a better understanding of the environmental factors and ecological processes influencing establishment and growth of forest reproduction which is needed to fully develop silvicultural alternatives for upland forests in the Midsouth;
2. silvicultural alternatives for, regenerating and managing upland 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

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

SRS-4104, Disturbance and the Manage'ment 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 Atlantic Coastal Plain.

SRS-4505, Insects and Diseases of Southern Forests. The unit conducts research to provide the knowledge about insects and microorganisms needed to manage productive, healthy seed orchards, nurseries, plantations, and native forests. interactions of land use and forest management practices on arthropod populations are studied with regard to their functional role as decomposers, as pollinators of rare plants, and as prey for endangered species, such as the red-cockaded woodpecker. The unit also works to develop control measures for nonnative, invasive species, such as the fungi that cause dogwood anthracnose and butternut canker.

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

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

Our Scientists at Work: Programs, People, Facilities

SRS-4802

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

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 products and the economics of innovaon forestry. The unit also analyzes tive silvicultural practices for southern export markets for southern softwood , forests.

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

Alexandria Forery Center
2500 Shreveport Highway
Pineville, LA 71 360

The Alexandria Forestry Center in Pineville was constructed in 1963 to house the Forest Sciences Laboratory of **the** Southern Forest Experiment Station **(now** Southern Research Station), the Supervisor's Office of the Kisatchie National Forest, and Forest Pest Management of State and Private Forestry. The Center is located on about 27 acres and includes an insectary, two greenhouses, a forest products building, and a main office/laboratory building. The nearby Palustris Experimental Forest consists of .two separate tracts that total 7,500 acres.

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

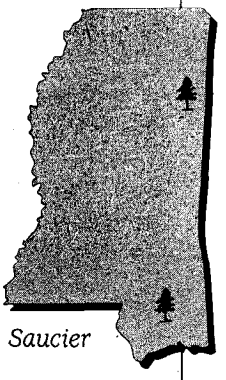
More information available at: http://www.srs.fs.fed.us

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



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 million acres of land with similar soils and topography in the South. The Institute is housed in some buildings. that date back to the mid-l 930s, constructed by the CWA, WPA, and CCC; four new laboratories for molecular genetic analyses on southern pines were recently added to the site.

SRS-41 53, **Southern Institute** of Forest Genetics (SIFG). Research at the SIFG focuses on developing procedures to improve the health, productivity and genetic diversity of southern forests through better understanding of the genetics, ecology and evolutionary relationships in forest ecosystems.

Website for SRS-41 53: www.srs.fs.fed.us/sifg/

SRS-4502 and SRS-4801

P.O. Box 6124
Mississippi State; MS 39762-6 12.4

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

SRS-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 EPA registration.

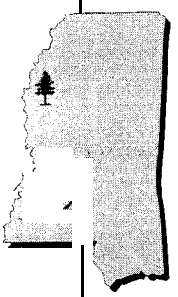
Website for SRS-4801: www.srsfia.usfs.msstate.edu

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4155

Southern Hardwoods Laboratory
P.O. Box 277
Stoneville, MS 38776



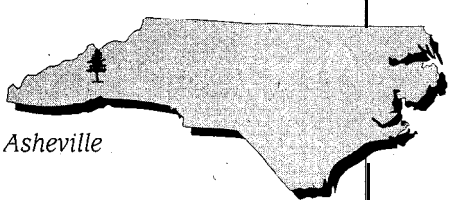
The Southern Hardwoods Laboratory is located on a 3.45acre site that is part of' the Mississippi State. Forestry and Agricultural Experiment Station. The 18,000-square-foot building houses offices, a photo lab, and lab facilities for plant pathology, entomology, plant physiology, and soils. The site also has 2,000 square feet of greenhouse space, and separate soils building, and an insectary. The 2,900-acre Delta Experimental Forest, 3 miles north of Stoneville, is the site of numerous research plots.

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



The headquarters of the Southern Research Station occupies 11 acres of land leased from the University of North Carolina and houses the Station Director and staff, administrative units, and SRS-4801. A Forest Health unit of the National Forest System's Southern Region is also located at this site.

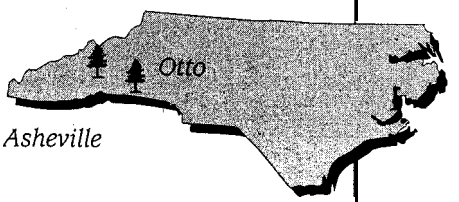
SRS-4801, Forest **Inventory** and Analysis. This unit develops, analyzes, and maintains forest resources information for Southern States and conducts research to provide improved inventory and evaluation techniques. In 1996, this unit became part of the Southern Research Station's new Southern Forest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

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

Our Scientists at Work: Programs, People; Facilities

SRS-4101

Bent Creek Experimental Forest
1577 Brevard Road
Asheville, NC 28806



The Bent Creek Experimental Forest is located near Asheville, North Carolina 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 derrionstration 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 hardwood forests.

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

SRS-4351

Coweeta Hydrologic Laboratory
3 160 Coweeta., Lab Road
Otto, NC 28763 .

The Coweeta Hydrologic Laboratory is located in the 5,400-acre Coweeta Basin, near Franklin, NC; watershed responses have been studied here for over 60 years. This world-renowned research operation was selected by the National Science Foundation as one of eleven Long-Term Ecological Research sites, and was included in the International Biological Program, the International Hydrologic Decade, and UNESCO's "Man and the Biosphere" Program.

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 ecosystem management practices, natural disturbances, and the atmospheric environment; and to identify practices which mitigate impacts on these watershed resources.

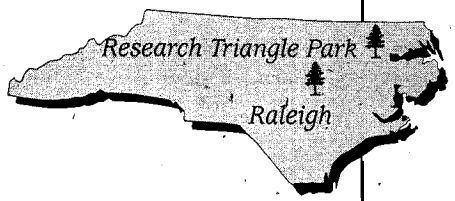
More information available at: http://www.srs.fs.fed.us

Caring for the Land and Serving People

Our Scientists at Work: Programs, People, Facilities

SRS-4852

Southern Global Change Program
1509 Varsity Drive
Raleigh, NC 27709



This unit is part of the Air Resources Consortium and is located on the North Carolina State University campus.

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://sgcp.arrc.ncsu.edu/index.html

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

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

The Forestry Sciences Laboratory was built in 1962 on a 26-acre tract donated by the Research Triangle Foundation. A greenhouse, nursery, and service buildings were added later. Its location enables close contact with the forestry schools and libraries at Duke University and North Carolina State University.

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 uses and values of forests in the South, including the function of land and resource markets; the effects of social change on forest conditions, measures of sustainable forestry, the formation of values for private and public forests, and the economic and social impacts of forest policies and programs.

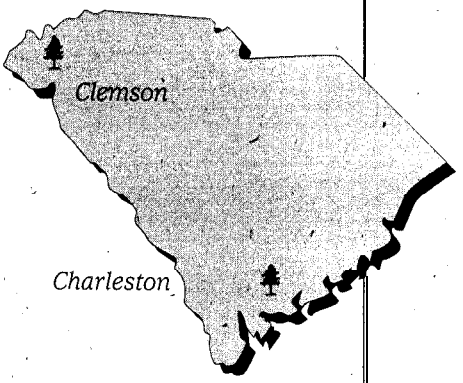
Website for SRS-4154: www.emapfhm.gov/soils/soilhome.htm
Website for SRS-4851: www.emapfhm.gov/econ/econhome.htm

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



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 6,1 00-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

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

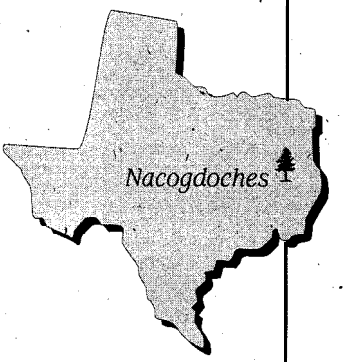
SRS-4201, Endangered, Threatened, and Sensitive Wildlife **and** Plant Species in Southern Forests. This unit's mission is to determine habitat and population relationships of wildlife and plant species associated with fragmented and isolated forest communities.

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

Our Scientists at Work: Programs, People, Facilities

SRS-4251

Wildlife Habitat and Silviculture Laboratory
Box 7600, SFA Station
506 Hayter Street
Nacogdqches, TX 7596 1



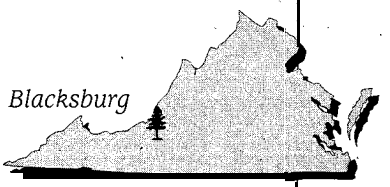
The Nacogdoches Wildlife Habitat and Silviculture Laboratory is located near the 2500-acre Stephen F. Austin Experimental Forest.

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 threatened 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



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/4202.htm

SRS-4702

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

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

Southern Pines

Wetlands, Bottomland Hardwoods, and Streams

The Southern Appalachians

The Interior Highlands

Large Scale Assessment and Modeling

Inventory and Monitoring

Foundation Programs

Our Most Important Product: Knowledge

Each year our scientists publish several hundred journal articles, book chapters, presentation papers, 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, and they support the three emphasis areas in our Strategic Framework as well. The final section lists materials that relate to multiple CCTs, and continue important studies that are in addition to the CCTs; they also contribute to the three emphasis areas. 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

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Our Most Important Product: Knowledge

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