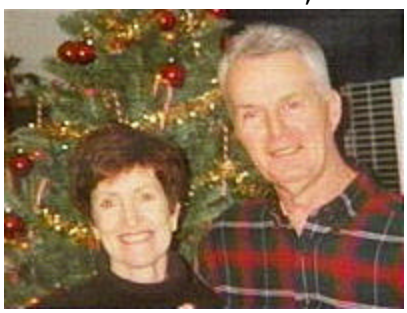
Compass–Spring 2002

The Southern Research Station
Recent Publications Catalogue

(http://www.srs.fs.fed.us/pubs/)

Dr. F. Thomas Lloyd, Research Forester, 1941-2002



Tom Lloyd, 60, a long-time scientist at the Southern Research Station, and his wife Carol Ann disappeared from their home near Marietta, SC on April 14, victims of an apparent abduction. Hikers found their bodies two weeks later in the Nantahala National Forest in North Carolina. It appears the couple had been shot the night they were abducted. Tom's son Aaron, who had a history of mental illness, later committed suicide. Aaron's roommate is in custody.

Tom earned his Ph.D. in Forestry in 1975 from North Carolina State University. He began his USDA Forest Service career in 1966 as a mathematical statistician at the Northeastern Forest Experiment Station, transferring to the Forestry Sciences Laboratory at Research Triangle Park, NC in 1967. Tom transferred to the Culture of Loblolly Pine and Wetland Forests unit in Charleston, SC in 1976. From 1987 to 1995 Tom served as project leader for the Silviculture and Management of Mixed Pine-Hardwood Stands in the Piedmont research unit in Clemson, SC. Since 1995, he had been with the Ecology and Management of Southern Appalachian Hardwoods research work unit in Asheville.

"Tom was a valued employee, held in the highest regard by his coworkers, both professionally and personally," said Station Director Pete Roussopoulos. "His applied research in mixed pine-hardwood systems provided a much better understanding of appropriate silviculture in those systems. His recent work focused on stand development modeling, data imputation, and the use of remote sensing and other advanced technologies. Tom was a very progressive thinker with regard to life and human interactions. He was a champion of the human rights perspective in the workforce and was active in promoting civil rights and concern for others. Tom and Carol Ann were victims of a tragic crime which deeply saddens all of us." The family prefers memorials be sent to the Slater Baptist Church Building Fund, P.O. Box 243, Slater, SC 29683.

Coweeta Hydrologic Laboratory

Forest Service Research establishes the commitment essential to soil studies 30-40 years in duration, research involving generations of hardwoods, long-term development of rust-resistant pines, water quality research stretching back to the 1930s. Given the academic and financial assurance that work can continue, the scientist can focus on research. Following a path can lead to a major breakthrough, a serendipitous discovery, or no significant findings. One might plot a course that becomes a model on which others build, or triggers vital scientific inquiry. When focusing on the benefits of long-term research in the South, Coweeta Hydrologic Laboratory stands out. Wayne T. Swank, emeritus scientist and project leader at Coweeta from 1984-1999, co-authored *Long-term Ecological Research: Coweeta History and Perspectives*. Published in *Holistic Science: The Evolution of the Georgia Institute of Ecology (1940-2000)*, Swank and co-authors Judith L. Meyer and Deyree A. (Dac) Crossley, Jr., University of Georgia (UGA), discuss Coweeta's historical significance, present activities, and future relevance. Eugene P. Odom, emeritus professor at UGA and the recognized father of ecology, served as the primary force in establishing UGA's Institute of Ecology in 1970. In 1988 Odum said Coweeta represents the longest continuous environmental study on any landscape in North America.

In 1934 the USDA Forest Service established Coweeta Hydrologic Laboratory in Otto, NC, south of Franklin. Scientists and graduate students work in the buildings and weirs constructed by Civilian Conservation Corps crews in the 1930s. In 1970 Forest Service and UGA scientists and administrators formally establish a framework for Coweeta and university scientists to collaborate on research projects and the education of graduate students. The first 30 years of land-use and hydrologic research at Coweeta provided a firm base for forest ecosystem studies at the watershed scale.

Swank, Meyer, and Crossley set three objectives for *Long-term Ecological Research: Coweeta History and Perspectives*:

- Provide a historical context that summarizes the maturation in research philosophy of the long-term research program at Coweeta
- Discuss the benefits and contributions of the collaboration with regard to education and training
- Suggest some ingredients required to sustain successful long-term ecosystem research

Request publication **14** to receive a copy of *Long-term Ecological Research: Coweeta History and Perspectives*. *Holistic Science: The Evolution of the Georgia Institute of Ecology (1940-1970)* retails for $45.

American Chestnut Restoration Update

In 1904 when the chestnut blight began sweeping through New York, no one suspected that the dying trees would be the first of millions to succumb throughout the Eastern United States. Losing the American chestnut (*Castanea dentate*) to a fungus not yet named *Cryphonectria parasitica* created urgency among foresters, legislators, people who depended on the tree and its nuts for their livelihood and sustenance, and wildlife. The chestnut comprised 25 percent of Southern Appalachian forests. Oak and other species now occupy the canopy where the chestnut once did, but the trees' needs differ.

Urgency still exists, along with hope, as researchers draw closer to establishing a blight-resistant American chestnut. Southern Research Station geneticist Tom Kubisiak works at the Southern Institute of Forest Genetics in Saucier, MS. Kubisiak cooperates with scientists in the American Chestnut Foundation and various eastern universities. The American Chestnut Foundation (TACF) has developed a vigorous backcross breeding program designed to introduce the resistance of Chinese chestnut into American chestnut; we now have a disease-free tree that is 15/16 pure American. TACF's initial efforts are focused on American chestnut trees in southwest Virginia, but the goal is to restore the species throughout its entire native range. Thus, Kubisiak explains, information regarding the amount and distribution of genetic variation in American chestnut would help to better estimate the number of American chestnut parents needed at each breeding location, as well as how many locations might be needed across the entire range.

Previously, little was known about how genetic variability is distributed across the landscape that comprises the natural range of this species. In an exploratory examination of genetic variability for American chestnut, Huang and others obtained results using genetic markers that suggest that as many as four regional metapopulations may exist. In light of the importance of regional structure to the breeding program, scientists at the Southern Institute of Forest Genetics felt compelled to embark on a more thorough examination of genetic variation in American chestnut using newly developed, highly variable, microsatellite DNA markers (Kubisiak and Roberds Submitted). A total of 993 trees collected from 23 sites across the species' natural range from Maine and Ontario in the north to South Carolina and Georgia in the south were assayed for genetic variation. Results of this study demonstrate that American chestnut still exists as a highly variable species throughout its entire native range in Eastern North America and that no apparent regional structure exists. Roughly 95 percent of the neutral genetic variation of the species can be captured by sampling within any one population of American chestnut. However, results based on neutral genetic loci do not necessarily reflect genetic differentiation based on adaptive genes or gene complexes. In other words, although trees growing in Virginia cannot be distinguished from those in Maine or Ontario based on the genetic markers, trees from Virginia will not necessarily be adapted to climatic conditions common to areas such as Maine or Ontario. Therefore, in order to assure that adaptive characters are also captured in conservation and breeding efforts, sampling should focus on unique morphological types or ecotypes. Kubisiak and Roberds (Submitted) suggest that a minimum of at

least three regional reservations, representing Northern, Central, and Southern Appalachia, be considered in conservation and breeding efforts for this species.

The following publications address the chestnut blight and the state of science as we approach bringing back the species, and a report on the Fraser fir.

29 Auckland, L.D.; Johnston, J.S.; Price, H.J.; Bridgwater, F.E. 2001. **Stability of nuclear DNA content among divergent and isolated populations of Fraser fir.** Canadian Journal of Botany. 79: 1375-1378.

32 Hepting, George H. 1974. **Death of the American chestnut.** Journal of Forest History. [Volume unknown] [Number unknown]: 60-67.

33 Huang, Hongwen; Dane, Fenny; Kubisiak Tom L. 1998. **Allozyme and RAPD analysis of the genetic diversity and geographic variation in wild populations of the American chestnut (Fagaceae).** American Journal of Botany. 85 (7): 1013-1021.

35 Kubisiak, T.L. 1996. **Molecular markers linked to resistance to *Cryphonectria parasitica* in chestnut.** Journal of the American Chestnut Foundation. 9 (2): 34-43.

36 Kubisiak, Tom L. 1999. **Using DNA markers to distinguish among chestnut species and hybrids**. Journal of the American Chestnut Foundation. 13(1): 38-42.

37 Kubisiak, T.L.; Hebard, F.V.; Nelson, C.D. [and others]. 1997. **Molecular mapping of resistance to blight in an interspecific cross in the genus *Castanea*.** Phytopathology. 87: 751-759.

38 Van Lear, D.H.; Vandermast, D.B.; Rivers, C.T. [and others]. 2002. **American chestnut, rhododendron, and the future Of Appalachian cove forests.** In: Outcalt, Kenneth W., ed. 2002. Proceedings of the eleventh biennial southern silvicultural research conference. Gen. Tech. Rep. SRS-48. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 214-220. [Editor’s note: Southern Research Station scientists D. B. Clinton and T.A. Waldrop co-authored this publication.]

FOREST SCIENCE IN THE SOUTH

***Prescribed Burning* Available on CD**

James Haywood, Southern Research Station, and Finis Harris, Kisatchie National Forest, Pineville, LA, joined resources with the Louisiana State University Agricultural Center and the Joint Fire Science Program to produce *Prescribed Burning.* This CD includes three options: a slide presentation, a Power Point presentation, and a script-only version. Staff members in the Ecology and Management of Even-aged Southern Pine Forests provided media assistance: Michel Elliott-Smith, soil scientist; Charlene Howell, secretary; and Dan Leduc, computer specialist. The people and sponsoring agencies and institutions wrapped a powerful and timely tool into a 30-45 minute delivery. You can view and download *Prescribed Burning* online at http://www.srs.fs.fed.us/pubs/misc/fire.htm.

A script (12 KB text file) accompanies the Power Point "slides" (14 MB PPT file) in the companion presentation. (All files on the CD comprise a 56.8 MB ZIP file.) You may use all or only a portion of the slides, as you see fit. However, please give credit to the USDA Forest Service, Southern Research Station and Kisatchie National Forest; Louisiana State University Agricultural Center; and the Joint Fire Science Program as the source of these materials and for funding this project. The United States Department of Agriculture and Department of Interior fund the Joint Fire Science Program. Participating Agencies include the USDA Forest Service represents the Department of Agriculture. Participating agencies in the Department of Interior include the Bureau of Land Management, the National Park Service, the Bureau of Indian Affairs, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey. For more information about the Joint Fire Science Program, contact http://www.nifc.gov/joint_fire_sci/jointfiresci.html or call 208.387.5349. To receive a copy of *Prescribed Burning*, select number **31**.

GPS Measurement of Harvest Impacts

Southern Research Station scientists Tim McDonald and Emily Carter joined Steve Taylor, Auburn University, in using a global positioning system (GPS) to measure soil impacts caused by traffic from timber harvesting equipment. The technique produces high-resolution maps of traffic impacts that can be used as records of disturbance patterns, or as inputs for further analysis. McDonald, research engineer, Carter, research soil scientist, and Taylor, biosystems engineer, can compare the GPS-generated traffic patterns to other maps, for example, those displaying growth of the regenerated stand, to assess harvest impacts on soils. To get the complete story, read the following article.

21 McDonald, T.P.; Carter, E.A.; Taylor, S.E. 2002. **Using the global positioning system to map disturbance patterns of forest harvesting machinery.** Canadian Journal of Forest Research. 32: 310-319.

Southern Silviculture Conference Proceedings

The Southern Research Station's Biennial Southern Silvicultural Research Conference covers a broad range relevant to conifers and hardwoods. The topics addressed by the 11th conference include:

- nutrition
- nurseries/seed and seedlings
- ecophysiology
- fire
- thinning and spacing
- wood quality/technology
- competition
- natural and artificial regeneration
- biometrics
- understory
- site preparation
- site preparation and classification
- insects and disease/injury
- long-term ecophysiology
- ecosystems

To receive a copy of the proceedings, request the following publication:

38 Outcalt, Kenneth W., ed. 2002. **Proceedings of the eleventh biennial southern silvicultural research conference.** Gen. Tech. Rep. SRS-48. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 622 p.

Articles in GTR SRS-4 authored by Southern Research Station scientists include the following papers.

Allen, H.L.; Albaugh, T. J.; Johnsen K. *Water and Nutrient Effects on Loblolly Pine Production and Stand Development on a Sandhill Site*

Barnett, James P.; McGilvray, John M. *Improving Longleaf Pine Seedling Production By Controlling Seed and Seedling Pathogens*

Borders, B.E.; Will, R.; Hendrick, R. L.; Markewitz, D. Harrington, T. B.Teskey, R. O. Clark, A. *Consortium for Accelerated Pine Production Studies (CAPPS): Long-term Trends in Loblolly Pine Stand Productivity and Characteristics In Georgia*

Bragg, Don C. *Empirically Derived Optimal Growth Equations For Hardwoods and Softwoods in Arkansas*

Brose, Patrick; Tainter, Frank; Waldrop, Thomas. *Regeneration History of Three Table Mountain Pine/Pitch Stands in Northern Georgia*

Brose, Patrick; Wade, Dale. *Understory Herbicide as a Treatment For Reducing Hazardous and Extreme Fire Behavior in Slash Pine Plantations*

Butry, David T.; Pye, John M.; Prestemon, Jeffrey P. *Prescribed Fire In the Interface: Separating The People From The Trees*

Cain, Michael D.; Shelton, Michael G. *Glaze Damage in 13- To 18-Year-Old, Natural, Even-Aged Stands of Loblolly Pines in South*

Clark III, Alexander; McMinn, James W. *Impact of Sustainable Forest Management on Harvest, Growth, and Regeneration of Southern Pine in the Piedmont After 5 Years of Monitoring*

Connor, Kristina F.; Sowa, Sharon. *Recalcitrant Behavior of Temperate Forest Tree Seeds: Storage, Biochemistry, and Physiology*

Ellis, Lisa E.; Waldrop, Thomas A.; Tainter, Frank H. *Ectomycorrihizae of Table Mountain Pine and the Influence of Prescribed Burning on their Survival*

Fisher, Ronald K.; Gardiner, Emile S.; Stanturf, John A.; Portwood, C. Jeffrey. *Disking Effects of Fifth-Year Volume Production of Four Eastern Cottonwood Clones Established on an Afforestation Site, Sharkey County, Mississippi*

Gardiner, Emile S. *Photosynthetic Light Response of Bottomland Oak Seedlings Raised Under Partial Sunlight*

Goelz, J.C.G.; Leduc, Daniel J. *A Model Describing Growth and Development of Longleaf Pine Plantations: Consequences of Observed Stand Structures of Structure of the Model*

Gough, Christopher; Seiler, John; Johnsen, Kurt; Sampson, David Arthur. *GPP in Loblolly Pine: A Monthly Comparison of Empirical and Process Models*

Gray, Ellen A.; Rennie, John C.; Waldrop, Thomas A.; Hanula, James L. *Patterns of Seed Productions in Table Mountain Pine*

Grayson, Kenneth J.; Wittwer, Robert F.; Shelton, Michael G. *Cone Characteristics and Seed Quality 10 Years After An Uneven-Aged Regeneration Cut In Shortleaf Pine Stands*

Groom, Les; Newbold, Ray; Guldin, Jim. *Effect of Silviculture on the Yield and Quality of Veneers*

Guldin, James M.; Farrar, Jr., Robert M. *The Plantation Conversion Demonstration at the Crossett Experimental Forest—Implications For Converting Stands From Even-Aged to Uneven-Aged Structure*

Guo, Yanfei; Shelton, Michael G.; Heitzman, Eric. *Effects of Flood Duration and Depth on Germination of Cherrybark, Post, Southern, White and Willow Oak Acorns*

Guo, Yanfei; Shelton, Michael G.; Zhang, Hui. *Effects of Light Regimes on 1-Year-Old Sweetgum and Water Oak Seedlings*

Haywood, James D. *Delayed Prescribed Burning in a Seedling and Sapling Longleaf Pine Plantation in Louisiana*

Haywood, James D.; Tiarks, Allan E. *Response of Second-Rotation Southern Pines to Fertilizer and Planting on Old Beds—Fifteenth-Year Results*

Hennessey, T.; Dougherty, P.; Wittwer, R.; Lynch, T.; Clark, A.; Lorenzi, E.; Heinemann, R.; Holeman, R. *Long-Term Trends in Productivity and Stand Characteristics Following Thinning of a Loblolly Pine Stand in S.E. Oklahoma*

Hess, Nolan J.; Otrosina, William J.; Carter, Emily A.; Steinman, Jim R.; Jones, John P.; Eckhardt, Lori G.; Weber, Ann M.; Walkinshaw, Charles H. *Assessment of Loblolly Pine Decline in Central Alabama*

Huebschmann, Michael M.; Tilley, Daniel S., Lynch, Thomas B.; Lewis, David K.; Guldin, James M. *Economic Evaluation of Restoring the Shortleaf Pine-Bluestem Grass Ecosystem on the Ouachita National Forest*

Kormanik, Paul P.; Sung, Shi-Jean S.; Kass, Donald; Zarnoch, Stanley J. *Effect Of Seedling Size And First-Order Lateral Roots On Early Development Of Northern Red Oak On A Mesic Site: Eleventh-Year Results*

Leininger, Theodor D. *Responses Of Tree Crown Conditions To Natural And Induced Variations In Throughfall*

Liechty, Hal O.; Sawyer, Valerie L.; Shelton, Michael G. *Alteration Of Nutrient Status By Manipulation Of Composition And Density In A Shortleaf Pine-Hardwood Stand*

Lynch, Thomas B.; Nkouka, Jean; Huebschmann, Michael M.; Guldin, James M. *Estimating The Probability Of Achieving Shortleaf Pine Regeneration At Variable Specified Levels*

McNab, W. Henry. *Accuracy Of Eastern White Pine Site Index Models Developed in the Southern Appalachian Mountains*

Meadows, James S.; Goelz, J.C.G. *Fourth-Year Effects of Thinning on Growth and Epicormic Branching in a Red Oak-Sweetgum Stand on a Minor Streambottom Site in West-Central Alabama*

Meadows, James S.; Leininger, Theodor D.; Nebeker, T. Evan. *Thinning To Improve Growth And Control The Canker Decay Fungus Inonotus hispidus In A Red Oak-Sweetgum Stand In The Mississippi Delta*

Otrosina, William J.; Walkinshaw, Charles H.; Zarnoch, Stanley J.; Sung, Shi-Jean; Sullivan, Brian T. *Root Disease, Longleaf Pine Mortality, and Prescribed Burning*

Randles, Russell B.; Van Lear, David H.; Waldrop,Thomas A.; Simon, Dean M. *Periodic Burning In Table Mountain-Pitch Pine Stands*

Renschin, Michele L.; Liechty, Hal O.; Shelton, Michael G. *Impacts Of Long-Term Prescribed Fire On Decomposition And Litter Quality In Uneven-Aged Loblolly Pine Stands*

Schexnayder, Jamie C.; Dean, Thomas J.; Baldwin, Jr., V. Clark. *Diameter Growth Of A Slash Pine Spacing Study Five Years After Being Thinned To A Constant Stand Density Index*

Shelton, Michael G.; Cain, Michael D. *Do Cones In Tops Of Harvested Shortleaf Pines Contribute To The Stand's Seed Supply*

So, Chi-Leung; Groom, Leslie H.; Rials, Timothy G.; Snell, Rebecca; Kelley, Stephen S.; Meglen, Robert. *Rapid Assessment Of The Fundamental Property Variation Of Wood*

Spetich, Martin A.; Liechty, Hal O.; Stanturf, John A.; Marion, Daniel A.; Luckow, Kenneth; Meier, Calvin E. Guldin James M. *Coarse Woody Debris Of A Pre-restoration Shortleaf Pine-Bluestem Forest*

Sung, Shi-Jean S.; Kormanik, Paul P.; Zarnoch, Stanley J. *Growth And Development Of First-Year Nursery-Grown White Oak Seedlings of Individual Mother Trees*

Sword, M.A.; Chambers, J. L.; Tang, Z.; Dean, T. J.; Goelz, J. C. *Long-Term Trends In Loblolly Pine Productivity And Stand Characteristics In Response To Stand Density And Fertilization In The Western Gulf Region*

Van Lear, D.H.; Vandermast, D.B.; Rivers, C.T.; Baker, T.T.; Hedman, C.W.; Clinton, D.B.; Waldrop, T.A. *American Chestnut, Rhododendron, and the Future Of Appalachian Cove Forests*

Waldrop, Thomas A.; Brose, Patrick H.; Welch, Nicole Turrill; Mohr, Helen H.; Gray, Ellen A.; Tainter, Frank H.; Ellis, Lisa E. *High-Intensity Fires May Be Unnecessary For Stand Replacement Of Table Mountain Pine: An Overview Of Current Research*

Walkinshaw, Charles H.; Otrosina, William J. *Food Reserves In Mountain Longleaf Pine Roots During Shoot Elongation*

Warriner, Michael D.; Nebeker, T. Evan; Leininger, Theodor D.; Meadows, James S. *The Effects of Thinning on Beetles (Coleoptera: Carabidae, Cerambycidae) in Bottomland Hardwood Forests*

Southern Station Summary

Forest Science in the South reports on the Southern Research Station's accomplishments and products from October 2000 through September 2001, fiscal year 2001. This report (Science Update SRS-002) highlights longleaf pine restoration, forest operations research, the Bent Creek Experimental Forest, Coweeta Hydrologic Laboratory, and the life cycle of wood. Emerging research priorities include:

- Knowledge gaps identified in the Southern Forest Resource Assessment
- Hypertext encyclopedia
- Urban Forestry Research and Technology Center
- Wildland-urban interface
- Fire
- Forest Inventory and Analysis

Request number **40** to learn more about *Forest Science in the South*.

STATION NEWS

Leadership Change at Utilization of Southern Forest Resources Research Unit

Les Groom moved into the position of project leader for the Utilization of Southern Forest Resources when **Tim Rials** accepted a position as head of the University of Tennessee's Forest Products Center. Research products generated by scientists in this Pineville, LA unit focus on a broad continuum, ranging from the microscopic components of wood fiber to discovering potential elements of wood utilization. Joining basic and applied science enables the Utilization of Southern Forest Resources research unit to address these problem areas:

- The gap in understanding fundamental physical properties central to the biological/ecological significance of plant polyphenols or terpenes
- A need to improve composite properties by evaluating the physical and mechanical properties of primary wood constituents
- New composite material development limited by an inadequate understanding of interfacial structure and properties
- Optimal utilization of the forest resource through understanding and utilizing relationships between tree growth variables, fundamental wood properties, and end-product performance
- Effective utilization of wood from difficult-to-recycle and intensively managed sources into high performance composite products

Groom joined the unit in 1989 as research forest products technologist. His research focuses on the relationship between wood quality and composite performance. This issue of *Compass* includes:

1 Groom, Les; Mott, Laurence; Shaler, Stephen. 2002. **Mechanical properties of individual southern pine fibers. Part I. Determination and variability of stress-strain curves with respect to tree height and juvenility.** Society of Wood Science and Technology. 34 (1): 14-27.

Walker Receives Grant to Study Longleaf Regeneration

The Strategic Environmental Research and Development Program (SERDP) awarded **Joan Walker**, Southern Research Station plant ecologist, a grant for $436,000

for a 3 year period to evaluate methods to restore longleaf pine stands on moist, poorly drained sites along the Coastal Plain of the Carolinas. SERDP collaborators—the Department of Defense (DOD), the Department of Energy (DOE), and the Environmental Protection Agency (EPA)—created the group to address DOD's environmental challenges.

Walker, a member of the Endangered, Threatened, and Sensitive Wildlife and Plants unit in Clemson, SC, will conduct most of the research for the project at Camp Lejeune, a Marine Corps base located about 50 miles north of Wilmington, NC. Camp Lejeune and other DOD installations in the Coastal Plain include former longleaf pine lands and remnant longleaf pine habitats that support federally protected plants and animals, including the endangered red-cockaded woodpecker and rough-leaved loosestrife. Walker's research represents a cooperative effort between the USDA Forest Service and DOD to explore alternative methods to restore longleaf pine stands in these unique areas. Susan Cohen, biological scientist from the SRS Biological Foundations of Southern Forest Productivity and Sustainability unit in Research Triangle Park, NC, serves as co-principal investigator on the project.

Research News At Your Fingertips

The Southern Research Station announces *Research News*, an electronic bulletin about our scientific activities. Edited by Zoë Hoyle, the semi-monthly alert appears online at http://www.srs.fs.fed.us/researchnews/latest.htm. We welcome all subscribers; visit http://www.srs.fs.fed.us/list/.

SOUTHERN PINE ECOSYSTEMS

1 Groom, Les; Mott, Laurence; Shaler, Stephen. 2002. **Mechanical properties of individual southern pine fibers. Part I. Determination and variability of stress-strain curves with respect to tree height and juvenility.** Society of Wood Science and Technology. 34 (1): 14-27.

This paper is the first in a three-part series investigating the mechanical properties of loblolly pine fibers. This paper outlines the experimental method and subsequent variation of latewood fiber mechanical properties in relation to tree position. Subsequent papers will deal with differences between earlywood and latewood fibers and effect of juvenility and tree height on global fiber properties. In this paper, the mechanical properties were determined on individual wood fiber with a user-built tensile testing apparatus. Cross-sectional areas of post-tested fibers were determined with a confocal scanning laser microscope and used to convert acquired load-elongation curves into stress-strain curves. The modulus of elasticity and ultimate tensile stress of loblolly pine latewood fibers tested in this study ranged from 6.55 to 27.5 GPa and 410 to 1,422 MPa, respectively. Fibers from the juvenile core of the main stem were on the low end of the mechanical property scale, whereas fibers beyond the twentieth growth ring were near the high end of the scale. Coefficient of variation for fiber stiffness and strength averaged around 20 to 25 percent. The shape of the fiber stress-strain curves is dependent on their growth ring origins: mature fibers were linear from initial loading until failure, whereas juvenile fibers demonstrated curvilinearity until about 60 percent of maximum load followed by linear behavior to failure.

2 Maier, C.A.; Zarnoch, S.J.; Dougherty, P.M. 1998. **Effects of temperature and tissue nitrogen on dormant season stem and branch maintenance respiration in a young loblolly pine (*Pinus taeda*) plantation.** Tree Physiology. 18: 11-20.

We measured dormant season (November through February) maintenance respiration rates (R_m) in stems and branches of 9-year-old loblolly pine (*Pinus taeda* L.) growing in plots under conditions of controlled nutrient and water supply in an effort to determine the relationships between R_m and tissue size (surface area, sapwood volume, sapwood dry weight), tissue nitrogen content, and temperature. Dormant season R_m per unit size (i.e., surface area, μmol m^{-2} s^{-1}; sapwood volume, μmol m^{-3} s^{-1}; or sapwood dry weight, nmol g^{-1} s^{-1}) varied with tissue size, but was constant with respect to tissue nitrogen content (μmol mol^{-1} N s^{-1}). Cambium temperature accounted for 61 and 77 percent of the variation in stem and branch respiration, respectively. The basal respiration rate (respiration at 0°C) increased with tissue nitrogen content, however, the Q_{10} did not. Improved nutrition more than doubled stem basal respiration rate and increased branch basal respiration by 38 percent. Exponential equations were developed to model stem and branch respiration as a function of cambium temperature and tissue nitrogen content. We conclude that failure to account for tissue nitrogen effects on respiration rates will result in serious errors when estimating annual maintenance costs.

3 Saenz, Daniel; Baum, Kristen A.; Conner, Richard N. [and others]. 2002. **Large-scale translocation strategies for reintroducing red-cockaded woodpeckers.** Journal of Wildlife Management. 66 (1): 212-221.

Translocation of wild birds is a potential conservation strategy for the endangered red-cockaded woodpecker (*Picoides borealis*). We developed and tested 8 large-scale translocation strategy models for a regional red-cockaded woodpecker reintroduction program. The purpose of the reintroduction program is to increase the number of red-cockaded woodpeckers by moving subadult birds from large populations to smaller populations that are unlikely to increase on their own. A major problem in implementing the program is determining where birds will be moved because the larger donor populations cannot supply enough birds for all small recipient populations each year. Our goals were to develop translocation strategies and model which ones would (1) result in the most groups of woodpeckers in a given amount of time; (2) most quickly reach the goal of at least 30 groups of woodpeckers in every population; and (3) result in the fewest population extinctions. We developed lump-sum strategies that moved all the translocated birds to 1 population each year, and partitioning strategies that divided the birds among several populations every year. In our simulations, the lump-sum strategies resulted in the most woodpeckers for the overall program and the highest number of population extinctions. Partitioning strategies had the lowest population extinction rate buy produced the lowest rate of increase in the number of woodpecker groups. The model that partitioned birds to the 6 largest recipient populations with fewer than 30 groups was the best overall strategy for meeting our goals because it reached 30 groups in every population the fastest, produced many birds, and had only a moderate population extinction rate. We suggest that adhering to a single strategy that meets the goals of the participants should simplify the program and reduce its cost.

4 Shelton, Michael G.; Cain, Michael D. 2002. **Potential carry-over of seeds from 11 common shrub and vine competitors of loblolly and shortleaf pines.** Canadian Journal of Forest Research. 32: 412-419.

Many of the competitors of the regeneration of loblolly and shortleaf pines *(Pinus taeda* L. and *Pinus echinata* Mill., respectively) develop from seed disseminated on the site after reproduction cutting or from the seed bank. To evaluate the potential carry-over of the seeds from 11 shrub and vine competitors of these two important southern pines, we designed packets so that fruits could be deposited on the forest floor and subsequently extracted over a 3-year period. After extraction, repeated cycles of 60 days of germination testing followed by 60 days of stratification were conducted over a maximum of 42 months to determine the potential for seed carry-over and the germination characteristics of the species. Seeds of privet *(Ligustrum vulgare* L.) showed no viability after the first winter of field storage, while seeds of rattan vine *(Berchemia scandens* (Hill) K. Koch) and Japanese honeysuckle *(Lonicera japonica* Thunb.) had low viability (1–3

percent) after the third year. In contrast, seeds of smooth sumac *(Rhus glabra* L.), devils-walkingstick *(Aralia spinosa* L.), pepper vine *(Ampelopsis arborea* (L.) Koehne), and blackberry *(Rubus argutus* Link) were moderate in viability (7–19 percent) after the third year of field storage, while seeds of beautyberry *(Callicarpa americana* L.), common greenbrier *(Smilax rotundifolia* L.), and summer grape *(Vitis aestivalis* Michx.) showed a high viability (31–55 percent). Cumulative germination of seeds of deciduous holly *(Ilex decidua* Walt.) was greater after 3 years of field storage (8 percent) than after only 1 year (4 percent); for the first removal from field storage, no germination occurred until the ninth germination cycle. Results indicate that new seedlings of some species of shrubs and vines rely mostly on seeds dispersed shortly before or after disturbance, while seedlings of other species appear to develop from seeds that have been stored for long periods in the seed bank. Results of this study can be useful in developing ecologically sound strategies for controlling competing vegetation in forest stands of the Southeastern United States.

5 Strom, B.L.; Goyer, R.A.; Ingram, L.L., Jr. [and others]. 2002. **Oleoresin characteristics of progeny of loblolly pines that escaped attack by southern pine beetle.** Forest Ecology and Management. 158: 169-178.

Oleoresin characteristics of first-generation (F_1) progeny of loblolly pines *(Pinus taeda* L.) that escaped mortality from the southern pine beetle, *Dendroctonus frontalis* Zimmermann (Coleoptera: Scolytidae), despite heavy mortality of neighbors, were evaluated and compared to trees from a general (i.e., trees produced from bulk seed sources) population over the course of two and a half years in South-central Mississippi (USA). Trees were 21-25 years old and growing in a common-garden type planting when sampled. The relative concentrations of five monoterpenes, five resin acids, and one phenylpropanoid were determined from oleoresin collected on five dates over 18 months. Multivariate analysis of variance showed that the concentration of 11 oleoresin chemical components did not differ between trees from escape and general populations ($P > 0.619$), providing evidence against the importance of this potential resistance factor. Univariate analyses on three individual resin constituents that were deemed important prior to the study—α-pinene, 4-allylanisole, and limonene—showed that only 4-allylanisole ($P < 0.0339$) varied significantly between populations; however, its concentration was higher in trees from the general population ***(ASK SANDRA TO ENTER SYMBOL*** = 1.4 vs. 0.9 percent of oleoresin weight), which does not support the hypothesis that higher concentrations of 4-allylanisole in oleoresin facilitated escape from *D. frontalis* attack. Oleoresin flow, on the other hand, was significantly higher in escape trees—averaging 1.65 times higher than general population trees over the course of 28 months (eight sampling times). This strongly supports the hypothesis that oleoresin flow can impact the host selection process of *D. frontalis,* and suggests that increased flow can improve survival under heavy pressure from *D. frontalis.* These results also may provide an indirect estimate of the magnitude of increase in flow necessary for producing a “real world” impact on the outcome of the interaction between *D. frontalis* and a preferred host.

6 Zarnoch, S.J.; Abrahamson, D.A.; Dougherty, P.M. 2002. **Sampling throughfall and stemflow in young loblolly pine plantations.** Res. Pap. SRS-27. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 6 p.

Throughfall and stemflow estimates were obtained on a rain-event basis for small (0.09-ha) plots established in a young loblolly pine (*Pinus taeda* L.) plantation in North Carolina. The plots were exposed to specific fertilization and irrigation treatments, which resulted in a wide range of basal areas and leaf area indices. Coefficients of variation were also determined, which revealed a negative exponential relationship with rain-event magnitude. Throughfall was substantially less variable than stemflow. Recommended sample-size curves were developed for throughfall and stemflow to achieve 5 percent accuracy at the 0.80, 0.90, and 0.95 probability levels.

WETLANDS, BOTTOMLANDS, AND STREAMS

7 Harrison, Charles A.; O'Ney, Susan. 2002. **Design and modification of an installation method to stabilize small trapezoidal flumes in drainage ditches.** Res. Note SRS-11. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 4 p.

We developed procedures for installing prefabricated trapezpoidal flumes in deep (10 to 12 feet) drainage ditches to monitor hydrologic functions and provide gauge locations for sampling discharge. Flows from the instrumented basins were generally low, but the ditches were occasionally subject to high flows caused by rain events of 2 to 3 inches or more. These high flow events caused severe erosion and undercut the flumes when they were installed in the usual manner, washing two of the flumes downstream. Our modifications to the installation procedure included four main elements: (1) securing the flume to a concrete pad; (2) bolting entrenched wooden barriers to the flume's inlet and outlet; (3) placing a plastic apron beneath the flume's outflow opening; and (4) surrounding the flume with sandbags. Flumes installed using these elements have been significantly more stable and resistant to undercut and bank erosion than those we installed using the normal methods. As a result, the modified installation procedures have reduced necessary maintenance and data loss, making the additional cost and increased initial effort well worthwhile.

8 Meadows, James S.; Hodges, John D. 2002. **Sapwood area as an estimator of leaf area and foliar weight in cherrybark oak and green ash.** Forest Science. 43 (1): 69-76.

The relationships between foliar weight/leaf area and four stem dimensions (d.b.h., total stem cross-sectional area, total sapwood area, and current sapwood area at breast height) were investigated in two important bottomland tree species of the Southern United States, cherrybark oak (*Quercus falcata*

var. *pagodifolia* Ell.) and green ash *(Fraxinus pennsylvanica* Marsh.). In all models tested and for both species, total sapwood area was consistently more highly correlated with foliar weight and leaf area than were the other three measures. However, there was little difference in accuracy among simple linear, multiple, and nonlinear models that used total sapwood area to predict either foliar weight or leaf area. Accuracy was improved slightly through the addition of total height and live crown ratio to the linear model. Foliar weight of both species was best described as a function of total sapwood area and live crown ratio (r^2 = 0.97, n = 16 for both species). Leaf area of cherrybark oak was best described as a function of total sapwood area, total height, and live crown ratio (r^2 = 0.96, n = 16), whereas leaf area of green ash was best described as a nonlinear function of total sapwood area (r^2 = 0.95, n = 16). In contrast with other studies on upland oaks in relatively cool climates, we found that current sapwood area was only a fair estimator of foliar weight and leaf area in cherrybark oak and was a poor estimator in green ash. These results lead to the speculation that more of the sapwood than just the most recent one or two growth rings may be active in water conduction in bottomland species in warm climates. Specific leaf area was highest in the lower crowns of trees of both species and was highest among trees of the lower crown classes. Although based on a limited sample size of four trees per crown class per species, we found that the vertical distribution of foliage within the crown differed among crown classes in both species. Most of the foliage on dominant and codominant trees of both species was concentrated in the upper one-third of the crown, with only a very small proportion of the foliage in the lower one-third of the crown. Intermediate and overtopped cherrybark oaks and intermediate green ash trees had a more even distribution of foliage throughout their crowns, while the foliage of overtopped green ash trees was highly concentrated in the lower one-third of the crown. The leaf area:sapwood area ratio did not differ significantly among crown classes in either species, but averaged 0.67 m^2 cm^{-2} in cherrybark oak and 0.24 m^2 cm^{-2} in green ash.

9 Stanturf, John A.; van Oosten, Cees; Netzer, Daniel A. [and others]. 2002. **Ecology and silviculture of poplar plantations.** In: Dickmann, D.I.; Isebrands, J.G.; Eckenwalder, J.E.; Richardson, J., eds. Poplar culture in North America, part A, chapter 5. Ottawa: NRC Research Press, National Research Council of Canada: 153-206.

Poplars are some of the fastest growing trees in North America and foresters have sought to capitalize on this potential since the 1940s. Interest in growing poplars has fluctuated, and objectives have shifted between producing sawlogs, pulpwood, or more densely spaced "woodgrass" or biofuels. Currently, most poplar plantations are established for pulpwood or chip production on rotations of 10 years or less, but interest in sawlog production is increasing. Sid McKnight characterized cottonwood as a *prima donna* species: under ideal conditions, growth rates are just short of spectacular. Just as this can be applied to all poplars, it is equally true that all poplars are demanding of good sites and careful establishment. Growing poplars in plantations is challenging, and good establishment the first year is critical to long-term success. If a grower lacks the commitment or resources to provide

needed treatments at critical times, then species other than poplars should be considered. Our objective in this chapter is to provide growers with current information for establishing and tending poplar plantations, as practiced in North America. Where we have sufficient information, differences between the poplar-growing regions of the United States and Canada will be noted. Mostly information is available on eastern and black cottonwood and their hybrids.

MOUNTAIN AND HIGHLAND ECOSYSTEMS

10 Elliott, Katherine J.; Hitchcock, Stephanie L.; Krueger, Lisa. **Vegetation response to large scale disturbance in a Southern Appalachian forest: Hurricane Opal and salvage logging.** Journal of the Torrey Botanical Society. 129 (1): 48-59.

Disturbance such as catastrophic windthrow can play a major role in the structure and composition of Southern Appalachian forests. We report effects of Hurricane Opal followed by salvage logging on vegetation dynamics (regeneration, composition, and diversity) the first three years after disturbance at the Coweeta Hydrologic Laboratory in Western North Carolina. The objective of this study was to compare species composition and diversity of understory and groundlayer species in a hurricane + salvage logged (H+S) forest to an adjacent undisturbed forest. Abundance of groundlayer species was much higher in the H+S forest than in the undisturbed forest, and abundance increased over time. Percent cover, density, and species richness were significantly higher in the H+S forest than in the undisturbed forest. In addition, percent cover increased by approximately 85 percent between 1997 and 1999 in the H+S plots.

Shannon's index of diversity (H′) based on percent cover was significantly higher in the H+S forest than the undisturbed forest by the third year after disturbance. However, there was no significant difference in H′ based on density between H+S forest and the undisturbed forest in either year. In the undisturbed forest, 59 species and 50 genera represented 30 families. By 1999 (the third year after disturbance), the H+S forest retained 93 species, 72 genera, and 42 families. The Asteraceae and Liliaceae had the highest number of species in both sampled forests, with more species of Liliaceae in the H+S plots. Micro-relief created from pit and mound topography from uprooting of windthrown trees, shade from the slash-debris left on site from the salvage logging, and shade from the remaining overstory trees created a mosaic of environmental conditions. This environmental heterogeneity could be responsible for the mix of early (shade intolerant) and late (shade tolerant) successional herbaceous species, and a higher species richness and diversity than the undisturbed forest.

11 Elliott, Katherine J.; Vose, James M.; Clinton, Barton D. 2002. **Growth of eastern white pine (*Pinus strobus* L.) related to forest floor consumption by prescribed fire in the Southern Appalachians.** Southern Journal of Applied Forestry. 26 (1): 18-25.

Chainsaw felling, burning, and planting of eastern white pine (*Pinus strobus* L.) have been prescribed on degraded pine/hardwood stands in the Southern Appalachians to improve overstory composition and productivity. The desired future condition of the overstory is a productive pine/hardwood mixture, with white pine, which is resistant to southern pine beetle (*Dendroctonus frontalis*), as the dominant pine. We evaluated the growth of white pine planted after fell-and-burn treatments through eight growing seasons after planting on three sites that differed in their fire characteristics and carbon and nitrogen losses. The three sites (JE [Jacob Branch East], JW [Jacob Branch West], and DD [Devil's Den]) differed in heat penetration and forest floor consumption. Although very little consumption of the Oe [fermentation] +Oa humus layer occurred during burning, consumption of the Oi litter layer was 94 percent, 94 percent, and 63 percent at JE, JW, and DD, respectively. Corresponding to the forest floor layer consumption (Oi and Oe+Oa combined), 46 percent of forest floor N was lost at JE, 45 percent of forest floor N was lost at JW, and less than 0.1 percent of the forest floor N was lost at DD. Biomass and density of woody competitor species were not significantly related to white pine size or growth. By the eighth growing season, no differences in white pine size or growth were detected between JE and JW, but DD had significantly smaller white pine trees. The size difference between DD and the other two sites was attributed to the replanting of seedlings at DD in 1992. However, relative growth rate (RGR) was significantly higher on DD in 1998 than the other two sites. Eight growing seasons after planting, white pine growth was negatively related to percent Oi layer consumed on the JE and JW sites. We also found significant relationships between white pine RGR and percent Oi consumed using data from all three sites. Although fire severity had a long-term effect on pine growth, fire severity was considered low overall on these sites because there were limited losses from the forest floor Oe+Oa layer. However, white pine increment and RGR were significantly related to percent forest floor Oi mass and N loss. This loss of site N capital could have a significant negative effect on growth of planted white pine over the long term.

12 Ford, W. Mark; Menzel, Michael A.; McCay, Timothy S.; Laerm, Joshua. 2001. **Contiguous allopatry of the masked shrew and southeastern shrew in the Southern Appalachians: segregation along an elevational and habitat gradient.** Journal of the Elisha Mitchell Scientific Society. 117 (1): 20-28. (USDA Forest Service contributed funding for this research effort.)

Southeastern shrew *(Sorex longirostris)* and masked shrew *(Sorex cinereus*) distributions converge in the Southern Appalachians. A 306,454-pitfall-trapnight survey in Alabama, Georgia, North Carolina, and South Carolina documented the presence of southeastern shrews in the Cumberland Plateau, Ridge and Valley, Upper Piedmont, and Blue Ridge physiographic provinces. Southeastern shrews occur at low elevations ***SANDRA, I CAN'T FIND THIS SYMBOL!*** = 524.9 m), primarily in xeric upland hardwood, mixed pine (*Pinus* spp.)-hardwood, and pine forests. Masked shrews only occur in the Blue Ridge at high elevations (***SANDRA, I CAN'T FIND THIS SYMBOL!*** = 1,069.6 m), primarily in mesic cove hardwood, northern hardwood, and montage streamside forests. Upper elevation limits of southeastern shrew and lower elevational limits of masked shrew show an inverse relation with latitude relative to

shrew collections from farther north along the Appalachians. Southeastern shrews and masked shrews are allopatric in the Southern Appalachians except in the Blue Ridge, where the species exhibits contiguous allopatry, based on elevation and habitat associations.

13 McNab, W. Henry; Loftis, David L. 2002. **Probability of occurrence and habitat features for oriental bittersweet in an oak forest in the Southern Appalachian Mountains, USA.** Forest Ecology and Management. 155: 45-54.

Oriental bittersweet (*Celastrus orbiculatus*), an introduced vine from Southeast Asia, has become a serious threat to native forests in the Eastern United States. It is typical of many exotic species in that quantitative ecological relationships are unavailable for assessment or management. We devised a rapid survey technique useful for hazard rating and modeled the probability of occurrence of oriental bittersweet in relation to environment, competition, and disturbance in stands of deciduous hardwoods in mountainous terrain. Oriental bittersweet was present on 39 percent of the study area, which has been managed by the selection system of silviculture and was recently disturbed by hurricane-force winds. Bittersweet was significantly associated with (1) topographic variables indicative of mesic environments, (2) density of midstory arborescent vegetation, (3) overstory canopy gaps, (4) past silvicultural harvests, (5) overstory canopy composition, and (5) scarification of the forest floor. Search distance from plot center to the first individual of bittersweet was significantly less ($P = 0.04$) on mesic than xeric sites. We developed a logistic regression model with five significant ($P < 0.05$) variables that classified correctly 87 percent of the sample plots. Variables in the model are biologically interpretable and indicate that the probability of occurrence of oriental bittersweet increases with (1) overstory canopy not dominated by oaks (*Quercus* spp.), (2) scarification of the forest floor, (3) concavity of the landscape around the site, (4) wind disturbance, and (5) increasing elevation. Using an independent data set from the same study area, the model classified correctly 88 percent of sample plots. Land management options in forests, where oriental bittersweet is present, are broadest on dry sites where its probability of occurrence is lowest and its growth response resulting from release should be least. Although herbicides can be effective in a program of intensive control, because of its biological characteristics, we suggest that oriental bittersweet will present an increasing problem to land managers throughout the Eastern United States.

14 Swank, Wayne T.; Meyer, Judith L.; Crossley, Deyree A., Jr. 2001. **Long-term ecological research: Coweeta history and perspectives**. In: Barrett, Gary W.; Barrett, Terry L. Holistic Science: The Evolution of the Georgia Institute of Ecology (1940-2000). Ann Arbor, MI: Sheridan Books: 143-163.

The Coweeta Hydrologic Laboratory–Institute of Ecology cooperative research program is one of the longest continuous collaborations on forest-ecosystem structure and function between a Federal agency and academia in the country. Formally established in 1968, the program continues to mature in

scientific scope, interdisciplinary expertise, administrative challenges, and relevance for natural resource and environmental management.

Our objectives in this chapter are to (1) provide a historical context that summarizes the maturation in research philosophy of the long-term research program at Coweeta, and identifies the people who led the effort; (2) discuss the benefits and contributions of the collaboration with regard to education and training; (3) and, based on these lessons, suggest some of the ingredients required to sustain successful long-term ecosystem research into the future. We are frequently asked what is "long-term" research: we consider the minimum window of investigation for forest ecosystems to include the life span of the forest of interest. This time frame usually encompasses at least one generation of scientists and frequently two or more generations.

15 Swank, W.T.; Vose, J.M.; Haines, B.L. 2001. **Long-term nitrogen dynamics of Coweeta forested watersheds in the Southeastern USA.** [abstract and poster]. In: N2001: The second international nitrogen conference: optimizing nitrogen management in food and energy production and environmental protection. Washington, DC: Ecological Society of America: 116.
http://esa.sdsc.edu/n2001 [Date accessed unknown].

Long-term data (25 years) were analyzed for trends and dynamics of NO_3 and NH_4 deposition and loss for mature mixed hardwood forest stands. Watershed N saturation was evaluated in the context of altered N cycles and stream inorganic N responses associated with management practices (cutting prescriptions, species replacement, and prescribed burning) and with natural disturbances (drought and wet years, insect infestation, hurricane damage, and ozone episodes). Reference watersheds were highly retentive of inorganic N with deposition of inorganic N < 9.9 kg/ha/yr and stream water exports below 0.25 kg/ha/yr. Reference watersheds were in transition between stage 0 and stage 1 of watershed N saturation, as evidenced by significant time trend increases in annual flow-weighted concentrations of NO_3 in stream water and increases in the seasonal amplitude and duration of NO_3 concentrations during 1972–1994. These stream water chemistry trends were partially attributed to significant increases in NO_3 and NH_4 concentrations in bulk precipitation over the same period and/or reduced biological demand due to forest maturation. Evidence for stage 3 of N saturation (the watershed is a net source of N rather than a N sink) was found for the most disturbed watershed at Coweeta.

16 Vose, James M.; Ryan, Michael G. 2002. **Seasonal respiration of foliage, fine roots, and woody tissues in relation to growth, tissue N, and photosynthesis.** Global Change Biology. 8: 182-193.

Autotrophic respiration may regulate how ecosystem productivity responds to changes in temperature, atmospheric [CO_2], and N deposition. Estimates of autotrophic respiration are difficult for forest ecosystems, because of the large amount of biomass, different metabolic rates among tissues, and

seasonal variation in respiration rates. We examined spatial and seasonal patterns in autotrophic respiration in a *Pinus strobus* ecosystem, and hypothesized that seasonal patterns in respiration rates at a common temperature would vary with [N] for fully expanded foliage and fine roots, with photosynthesis for foliage, and with growth for woody tissues (stems, branches, and coarse roots). We also hypothesized that differences in [N] would largely explain differences in maintenance or dormant-season respiration among tissues.

For April–November, mean respiration at 15°C varied from 1.5 to 2.8 μmol kg^{-1} s^{-1} for fully expanded foliage, 1.7–3.0 for growing foliage, 0.8–1.6 for fine roots, 0.6–1.1 (sapwood) for stems, 0.5–1.8 (sapwood) for branches, and 0.2–1.5 (sapwood) for coarse roots. Growing season variation in respiration for foliage produced the prior year was strongly related to [N] (r^2 = 0.94), but fine root respiration was not related to [N]. For current-year needles, respiration did not covary with [N]. Night-time foliar respiration did not vary in concert with previous-day photosynthesis for either growing or fully expanded needles. Stem growth explained about one-third of the seasonal variation in stem respiration (r^2 = 0.38), and also variation among trees (r^2 = 0.43). We did not determine the cause of seasonal variation in branch and coarse root respiration, but it is unlikely to be directly related to growth, as the pattern of respiration in coarse roots and branches was not synchronized with stem growth. Seasonal variations in temperature-corrected respiration rates were not synchronized among tissues, except foliage and branches. Spatial variability in dormant-season respiration rates was significantly related to tissue N content in foliage (r^2 = 0.67), stems (r^2 = 0.45), coarse roots (r^2 = 0.36), and all tissues combined (r^2=0.83), but not for fine roots and branches. Per unit N, rates for *P. strobus* varied from 0.22 to 3.4 μmol mo1$N^{-1}s^{-1}$ at 15°C, comparable to those found for other conifers. Accurate estimates of annual autotrophic respiration should reflect seasonal and spatial variation in respiration rates of individual tissues.

17 Williams, Lance R.; Taylor, Christopher M.; Warren, Melvin L., Jr.; Clingenpeel, J. Alan. 2002. **Large-scale effects of timber harvesting on stream systems in the Ouachita Mountains, Arkansas, USA.** Environmental Management. 29 (1): 76-87.

Using Basin Area Stream Survey (BASS) data from the USDA Forest Service, we evaluated how timber harvesting influenced patterns of variation in physical stream features and regional fish and macroinvertebrate assemblages. Data were collected for three years (1990-1992) from six hydrologically variable streams in the Ouachita Mountains, AR, USA that were paired by management regime within three drainage basins. Specifically, we used multivariate techniques to partition variability in assemblage structure (taxonomic and trophic) that could be explained by timber harvesting, drainage basin differences, year-to-year variability, and their shared variance components. Most of the variation in fish assemblages was explained by drainage basin differences, and both basin and year-of-sampling influenced macroinvertebrate assemblages. All three

factors modeled, including interactions between drainage basins and timber harvesting, influenced variability in physical stream features. Interactions between timber harvesting and drainage basins indicated that differences in physical stream features were important in determining the effects of logging within a basin. The lack of a logging effect on the biota contradicts predictions for these small, hydrologically variable streams. We believe this pattern is related to the large scale of this study and the high levels of natural variability in the streams. Alternatively, there may be time-specific effects we were unable to detect with our sampling design and analyses.

LARGE-SCALE ASSESSMENT AND MODELING

18 Brockway, Dale G.; Gatewood, Richard G.; Paris, Randi B. 2002. **Restoring grassland savannas from degraded pinyon-juniper woodlands: effects of mechanical overstory reduction and slash treatment alternatives.** Journal of Environmental Management. 64: 179-197.

Although the distribution and structure of pinyon-juniper woodlands in the Southwestern United States are thought to be the result of historic fluctuations in regional climatic conditions, more recent increases in the areal extent, tree density, soil erosion rates, and loss of understory plant diversity are attributed to heavy grazing by domestic livestock and interruption of the natural fire regime. Prior to 1850, many areas currently occupied by high-density pinyon-juniper woodlands, with their degraded soils and depauperate understories, were very likely savannas dominated by native grasses and forbs and containing sparse tree cover scattered across the landscape. The purpose of this study was to evaluate the effectiveness of mechanical overstory reduction and three slash treatment alternatives (removal, clustering, and scattering) followed by prescribed fire as techniques for restoring grassland savannas from degraded woodlands. Plant cover, diversity, biomass and nutrient status, litter cover, and soil chemistry and erosion rates were measured prior to and for two years following experimental treatment in a degraded pinyon-juniper woodland in Central New Mexico. Treatment resulted in a significant increase in the cover of native grasses and, to a lesser degree, forbs and shrubs. Plant species richness and diversity increased most on sites where slash was either completely removed or scattered to serve as a mulch. Although no changes in soil chemistry or plant nutrient status were observed, understory biomass increased over 200 percent for all harvest treatments and was significantly greater than controls. While treatment increased litter cover and decreased soil exposure, this improvement did not significantly affect soil loss rates. Even though all slash treatment alternatives increased the cover and biomass of native grasses, scattering slash across the site to serve as a mulch appears most beneficial to improving plant species diversity and conserving site resources.

19 Conner, Richard N.; Shackelford, Clifford E.; Saenz, Daniel; Schaefer, Richard R. 2001. **Interactions between nesting pileated woodpeckers and wood ducks.** Wilson Bulletin. 113 (2): 250-253.

We observed interactions between a nesting pair of pileated woodpeckers (*Dryocopus pileatus)* and what appeared to be four pairs of wood ducks (*Aix sponsa).* Wood ducks regularly approached and attempted to enter an active pileated woodpecker nest cavity that contained three fully feathered young pileated woodpeckers. The male pileated woodpecker often perched on a snag near their nest cavity to guard the entrance from wood ducks. Female wood ducks attempted to enter the pileated woodpecker nest cavity on at least 12 occasions and typically were intercepted by the male pileated woodpecker before they reached the lip of the nest cavity. On two occasions the male pileated woodpecker entered his nest cavity and forcibly evicted female wood ducks that had slipped into the cavity. These incidents suggest that large cavities in snags may be in high demand by wood ducks during the nesting season. Our observations suggest that some pileated woodpeckers may be able to resist attempts by wood ducks to usurp nest cavities during the breeding season.

20 Johnson, D.W.; Knoepp, J.D.; Swank, W.T. [and others]. 2002. **Effects of forest management on soil carbon: results of some long-term resampling studies.** In: Mickler, Robert A.; McNulty, Steven G., guest eds. Special issue supplement to 116/3: Terrestrial Carbon—Part II. Environmental Pollution. 116 (1): S201-S208.

The effects of harvest intensity (sawlog, SAW; whole tree, WTH; and complete tree, CTH) on biomass and soil carbon (C) were studied in four forested sites in the Southeastern United States: (mixed deciduous forests at Oak Ridge, TN and Coweeta, NC; *Pinus taeda* at Clemson, SC; and *P. eliottii* at Bradford, FL). In general, harvesting had no lasting effects on soil C. However, intensive temporal sampling at the North Carolina and South Carolina sites revealed short-term changes in soil C during the first few years after harvesting, and large, long-term increases in soil C were noted at the Tennessee site in all treatments. Thus, changes in soil C were found even though lasting effects of harvest treatment were not. There were substantial differences in growth and biomass C responses to harvest treatments among sites. At the Tennessee site, there were no differences in biomass at 15 years after harvest. At the South Carolina site, greater biomass was found in the SAW than in the WTH treatment 16 years after harvest, and this effect is attributed to be due to both the nitrogen (N) left on site in foliar residues and to the enhancement of soil physical and chemical properties by residues. At the Florida site, greater biomass was found in the CTH than in the WTH treatment 15 years after harvest, and this effect is attributed to be due to differences in understory competition. Biomass data were not reported for North Carolina. The effects of harvest treatment on ecosystem C are expected to magnify over time at the South Carolina C and Florida sites as live biomass increases, whereas the current differences in ecosystem C at the Tennessee site (which are due to the presence of undecomposed residues) are expected to lessen with time.

21 McDonald, T.P.; Carter, E.A.; Taylor, S.E. 2002. **Using the global positioning system to map disturbance patterns of forest harvesting machinery.** Canadian Journal of Forest Research. 32: 310-319.

A method was presented to transform sampled machine positional data obtained from a global positioning system (GPS) receiver into a two-dimensional raster map of number of passes as a function of location. The effect of three sources of error in the transformation process were investigated: path sampling rate (receiver sampling frequency); output raster resolution; and GPS receiver errors. Total accuracy of traffic maps across a site (the summed areas receiving one, two, three, etc. passes) was not greatly affected by the error sources. The estimate of number of passes at a specific point, however, was heavily dependent on the presence of errors in the input data. Adding random offsets to each GPS position, for example, resulted in less than a 35 percent chance that an individual pixel would be classified correctly following transformation when compared with a reference raster. Although the absolute accuracy of the GPS–transformation system was not defined, it was concluded that data derived from applying it could be used to make estimates of total site disturbance and to identify regions of higher or lower disturbance but was less effective when applied in defining number of passes at a given point in a stand.

22 McNulty, Steven G. 2002. **Hurricane impacts on U.S. forest carbon sequestration.** In: Mickler, Robert A.; McNulty, Steven G., guest eds. Special issue supplement to 116/3: Terrestrial Carbon—Part II. Environmental Pollution. 116 (1): S17-S24.

Recent focus has been given to United States forests as a sink for increases in atmospheric carbon dioxide. Current estimates of United States forest carbon sequestration average approximately 20 Tg (i.e., 10^{12} g) year. However, predictions of forest carbon sequestration often do not include the influence of hurricanes on forest carbon storage. Intense hurricanes occur two out of three years across the Eastern United States. A single storm can convert the equivalent of 10 percent of the total annual carbon sequestrated by United States forests into dead and downed biomass. Given that forests require at least 15 years to recover from a severe storm, a large amount of forest carbon is lost either directly (through biomass destruction) or indirectly (through lost carbon sequestration capacity) due to hurricanes. Only 15 percent of the total carbon in destroyed timber is salvaged following a major hurricane. The remainder of the carbon is left to decompose and eventually return to the atmosphere. Short-term increases in forest productivity due to increased nutrient inputs from detritus are not fully compensated by reduced stem stocking and the recovery time needed to recover leaf area. Therefore, hurricanes are a significant factor in reducing short-term carbon storage in United States forests.

23 Mickler, R.A.; Earnhardt, T.S.; Moore, J.A. 2002. **Regional estimation of current and future forest biomass.** In: Mickler, Robert A.; McNulty, Steven

G., guest eds. Special issue supplement to 116/3: Terrestrial Carbon—Part II. Environmental Pollution. 116 (1): S7-S16.

The 90,674 wildland fires that burned 2.9 million ha at an estimated suppression cost of $1.6 billion in the United States during the 2000 fire season demonstrated that forest fuel loading has become a hazard to life, property, and ecosystem health as a result of past fire exclusion policies and practices. The fire regime at any given location in these regions is a result of complex interactions between forest biomass, topography, ignitions, and weather. Forest structure and biomass are important aspects in determining current and future fire regimes. Efforts to quantify live and dead forest biomass at the local to regional scale has been hindered by the uncertainty surrounding the measurement and modeling of forest ecosystem processes and fluxes. The interaction of elevated CO^2 with climate, soil nutrients, and other forest management factors that affect forest growth and fuel loading will play a major role in determining future forest stand growth and the distribution of species across the Southern United States. The use of satellite image analysis has been tested for timely and accurate measurement of spatially explicit land use change and is well suited for use in inventory and monitoring of forest carbon. The incorporation of Landsat Thematic Mapper data coupled with a physiologically based productivity model (PnET), soil water holding capacity, and historic and projected climatic data provides an opportunity to enhance field plot-based forest inventory and monitoring methodologies. We use periodic forest inventory data from the USDA Forest Service's Forest Inventory and Analysis (FIA) project to obtain estimates of forest area and type to generate estimates of carbon storage for evergreen, deciduous, and mixed forest classes for use in an assessment of remotely sensed forest cover at the regional scale for the Southern United States. The displays of net primary productivity (NPP) generated from the PnET model show areas of high and low forest carbon storage potential and their spatial relationship to other landscape features for the Southern United States. At the regional scale, predicted annual NPP in 1992 ranged from 836 to 2181 g/m^2/year for evergreen forests and 769-2634 g/m^2/year for deciduous forests with a regional mean for all forest land of 1448 g/m^2/year. Prediction of annual NPP in 2050 ranged from 913 to 2076 g/m^2/year for evergreen forest types, to 1214-2376 g/m^2/year for deciduous forest types, with a regional mean for all forest land of 1659 g/m^2/year. The changes in forest productivity from 1992 to 2050 are shown to display potential areas of increased or decreased forest biomass. This methodology addresses the need for spatially quantifying forest carbon in the terrestrial biosphere to assess forest productivity and wildland fire fuels.

24 Mickler, Robert A.; Earnhardt, Todd S.; Moore, Jennifer A. 2002. **Modeling and spatially distributing forest net primary production at the regional site.** Journal of Air & Waste Management Association. 52: 174-185.

Forest, agricultural, rangeland, wetland, and urban landscapes have different rates of carbon sequestration and total carbon sequestration potential under alternative management options. Changes in the proportion and spatial distribution of land use could enhance or degrade that area's ability to sequester carbon in terrestrial ecosystems. As the ecosystems

within a landscape change due to natural or anthropogenic processes, they may go from being a carbon sink to a carbon source or vice versa. Satellite image analysis has been tested for timely and accurate measurement of spatially explicit land use change and is well suited for use in inventory and monitoring of terrestrial carbon. The coupling of Landsat Thematic Mapper (TM) data with a physiologically based forest productivity model (PnET-II) and historic climatic data provides an opportunity to enhance field plot-based forest inventory and monitoring methodologies. We use periodic forest inventory data from the U.S. Department of Agriculture (USDA) Forest Service's Forest Inventory and Analysis (FIA) Program to obtain estimates of forest area and type and to generate estimates of carbon storage for evergreen, deciduous, and mixed-forest classes. The area information is used in an accuracy assessment of remotely sensed forest cover at the regional scale. The map display of modeled net primary production (NPP) shows a range of forest carbon storage potentials and their spatial relationship to other landscape features across the Southern United States. This methodology addresses the potential for measuring and projecting forest carbon sequestration in the terrestrial biosphere of the Southern United States.

INVENTORY AND MODELING

25 Conner, Roger C.; Sheffield, Raymond M. 2001. **South Carolina's forest resources—2000 update.** Resour. Bull. SRS-65. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 31 p.

This bulletin highlights the principal findings of an annual inventory of South Carolina's forest resources. Data summaries are based upon 60 percent of the plots in the State. Additional data summaries and bulletins will be published as the full set of plots are completed.

26 Johnson, Tony G.; Wells, John L. 2002. **Georgia's timber industry—an assessment of timber product input and use, 1999.** Resour. Bull. SRS-68. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 40 p.

In 1999 industrial roundwood output from Georgia's forests totaled 1.24 billion cubic feet, 3 percent less than in 1997. Mill byproducts generated from primary manufacturers declined 1 percent to 474 million cubic feet. Almost all plant residues were used, primarily for fuel and fiber products. Pulpwood was the leading roundwood product at 594 million cubic feet; saw logs ranked second at 509 million cubic feet; veneer logs were third at 75 million cubic feet. The number of primary processing plants increased from 186 in 1997 to 188 in 1999. Total receipts declined 7 percent to 1.3 billion cubic feet.

27 Long, Zhiling; Picone, Joseph; Rudis, Victor A. 2000. **The optimization of edge and line detectors for forest image analysis.** In Callaos, N.; Lombardo,

P.; Huber, R., eds. Proceedings: Image, acoustic, speech, and signal processing: part I of the 4th world multiconference on systemics, cybernetics, and informatics. Orlando, FL: International Institute of Informatics and Systemics: 171-176. http://www.isip.msstate.edu/publications/conferences/iiis_sci/2000/line_detection/doc/paper_v6.pdf. [Date accessed unknown].

Automated image analysis for forestry applications is becoming increasingly important with the rapid evolution of satellite and land-based remote imaging industries. Features derived from line information play a very important role in analyses of such images. Many edge and line detection algorithms have been proposed but few, if any, comprehensive studies exist that evaluate performance in a scientifically meaningful way. In this paper, we introduce an objective evaluation paradigm. We also demonstrate, using this paradigm, improved performance on edge and line detection. We reduced the detection error rate from 42 percent to 29 percent for 159 manually labeled forest images.

28 Rosson, James F., Jr. 1994. ***Quercus stellata* growth and stand characteristics in the *Quercus stellata-Quercus marilandica* forest type in the Cross Timbers region of Central Oklahoma.** In: Fralish, James H. [and others]. Proceedings of the North American conference on savannas and barrens: living on the edge. Chicago: U.S. Environmental Protection Agency, Great Lakes National Program Office: 329-333. http://www.epa.gov/glnpo/oak/Proceedings/Rosson.html [Date accessed unknown].

The author reports a baseline forest survey of Central and West Oklahoma to obtain tree and stand growth rates for harvest sustainability, standing volume estimates for biomass assessments, and stand structure to provide other pertinent data for exploring management options. This report focused on the *Quercus stellata-Quercus marilandica* forest type in the Cross Timbers region at the western fringe of upland tree growth. *Quercus stellata* diameter growth was also analyzed to determine if there was any relationship among the rate of diameter growth, tree size, and stand basal area. The FIA sample design was placed on Soil Conservation Service (SCS)[National Conservation Research Service [NCRS] plots in cooperation with the SCS [NCRS] and the Oklahoma Department of Forestry.

FOUNDATION PROGRAMS

29 Auckland, L.D.; Johnston, J.S.; Price, H.J.; Bridgwater, F.E. 2001. **Stability of nuclear DNA content among divergent and isolated populations of Fraser fir.** Canadian Journal of Botany. 79: 1375-1378.

Fraser fir *(Abies fraseri* (Pursh) Poir.) is an endemic species consisting of six major disjunct populations in the Appalachian Mountains, U.S.A. Nuclear DNA content was measured with laser flow cytometry to determine if genome size differences could be detected among the disjunct populations of Fraser

fir and its close relatives, balsam fir *(Abies balsamea* (L.) Mill.) and Canaan fir *(A. balsamea* var. *phanerolepsis* Fern.). The mean DNA content for Fraser fir was 17.2 pg/C, which was similar to the two related fir species. There were no significant differences among disjunct Fraser-fir populations. Mean DNA content differences for fir species in the Southern Appalachian Mountains were similar even with speciation events (7000 B.P.) and subsequent population isolation. In the absence of polyploidy or large chromosomal rearrangements, genome size changes in conifers occur on a broad evolutionary time scale.

30 Cordell, H. Ken; Herbert, Nancy G. 2002. **The popularity of birding is still growing.** Birding. 34 (1): 54-61.

Cordell and Herbert discuss the changing demographics of birders, birding as a catalyst for ecotourism, and the revenue birding brings to local economies. The authors suggest interventions to benefit and promote the well being of both birds and birders.

31 Haywood, James; Harris, Finis. 2002. **Prescribed burning** [CD-ROM]. Pineville, LA: U.S. Department of Agriculture, Forest Service, Southern Research Station and Kisatchie National Forest.

This presentation on prescribed burning is a cooperative effort of the USDA Forest Service, Southern Research Station and Kisatchie National Forest; Louisiana State University Agricultural Center; and the Joint Fire Science Program. The CD includes three methods of delivery: slides, Power Point presentation, and script only.

32 Hepting, George H. 1974. **Death of the American chestnut.** Journal of Forest History. [Volume unknown] [Number unknown]: 60-67.

Hepting describes the significance of the American chestnut to the American landscape, culture, and economy prior to the introduction of the *Cryphonectria parasitica* fungus in 1904. He details the progression of the disease from New York to Georgia, and relates the blight’s impacts on eastern forests, people dependent on the chestnut for subsistence, the forest products industry, and the science of plant pathology.

33 Huang, Hongwen; Dane, Fenny; Kubisiak Tom L. 1998. **Allozyme and RAPD analysis of the genetic diversity and geographic variation in wild populations of the American chestnut (Fagaceae).** American Journal of Botany. 85 (7): 1013-1021.

Genetic variation among 12 populations of the American chestnut (*Castanea dentata*) was investigated. Population genetic parameters estimated from allozyme variation suggest that *C. dentata* at both the population and species level has narrow genetic diversity as compared to other species in the genus. Average expected heterozygosity was relatively low for the

population collected in the Black Rock Mountain State Park, GA (H_e = 0.096 ± 0.035), and high for the population in East Central Alabama (H_e = 0.196 ± 0.048). Partitioning of the genetic diversity based on 18 isozyme loci showed that ~10 percent of the allozyme diversity resided among populations. Cluster analysis using unweighted pair-group method using arithmetric averages of Rogers' genetic distance and principal components analysis based on allele frequencies of both isozyme and RAPD loci revealed four groups: the southernmost population, South-central Appalachian populations, North-central Appalachian populations, and Northern Appalachian populations. Based on results presented in this study, a conservation strategy and several recommendations related to the backcross breeding aimed at restoring *C. dentata* are discussed.

34 Kabir, Mohammed F.; Schmoldt, Daniel L.; Schafer, Mark E. 2002. **Time domain ultrasonic signal characterization for defects in thin unsurfaced hardwood lumber.**
Wood and Fiber Science: 34 (1): 165-182.

One of the major users of thin, unsurfaced hardwood lumber is the pallet manufacturing industry. Almost all manufactured products spend part of their life cycle on a pallet during transportation. This makes pallets a critical component of both the transportation and manufacturing sectors of the econ-omy. Many newly constructed wooden pallets, however, are not currently manufactured to deliver the best performance (strength, durability, and safety)—despite interest by pallet users and pallet manufacturers—because manual grading and sorting of parts is impractical due to processing speeds and volume, labor costs, and laborer skill. This paper describes initial work aiming to create an automated grading/sorting system for hardwood pallet parts using ultrasonic. Experiments were conducted on yellow-poplar *(Liriodendron tulipifera* L.) and red oak *(Quercus rubra* L.) deckboards using pressure-contact, rolling transducers in a pitch-catch arrangement. Sound and unsound knots, cross grain, bark pockets, holes, splits, and decay were characterized using six ultrasound variables calculated from the received waveforms. Our scanning system shows good data-collection repeatability, and scanning rate has little effect on the calculated variables. For each defect type, at least one ultrasonic variable demonstrated significant capability to discriminate between that defect and clear wood. Energy loss variables exhibited the greatest sensitivity to many defect types. Based on the empirical relationships identified in this study, we are now developing models to classify defects using ultrasonic signal characteristics. Scanning properties of the prototype apparatus suggest that it can readily be translated into a commercial product.

35 Kubisiak, T.L. 1996. **Molecular markers linked to resistance to *Cryphonectria parasitica* in chestnut.** Journal of the American Chestnut Foundation. 9 (2): 34-43.

Kubisiak describes how he came to work on the chestnut blight problem. He touches on the underlying theory behind recombinational linkage mapping,

mentions some current results in work with chestnut, and discusses how these results compare to prior knowledge regarding the suspected pattern of inheritance of blight resistance. Finally, the author looks ahead and suggests where efforts might be focused next.

36 Kubisiak, Tom L. 1999. **Using DNA markers to distinguish among chestnut species and hybrids**. Journal of the American Chestnut Foundation. 13(1): 38-42.

Tom Kubisiak of the USDA Forest Service's Southern Institute of Forest Genetics and Robert Bernatzky of the University of Massachusetts have been using molecular genetic markers to pinpoint hot spots of American chestnut genetic diversity. Using samples collected on a roughly 135 mile grid covering the entire range of the tree, the two researchers are analyzing chestnut DNA to assess overall levels of diversity and to map out the sources of the greatest genetic variation. This paper grew out of an analysis of a sample from a Maine chestnut conducted as part of that study.

37 Kubisiak, T.L.; Hebard, F.V.; Nelson, C.D. [and others]. 1997. **Molecular mapping of resistance to blight in an interspecific cross in the genus *Castanea*.** Phytopathology. 87: 751-759.

A three-generation American chestnut × Chinese chestnut pedigree was used to construct a genetic linkage map for chestnut and to investigate the control of resistance to *Endothia parasitica* (chestnut blight fungus). DNA genotypes for 241 polymorphic markers (eight isozymes, 17 restriction fragment length polymorphisms [RFLPs], and 216 random amplified polymorphic DNAs [RAPDs]) were assayed on an F_2 family consisting of 102 individuals. Of these markers, 196 were segregating as expected and, subsequently, used for primary linkage mapping. Two isozymes, 12 RFLPs, and 170 RAPDs were mapped to 12 linkage groups
spanning a total genetic distance of 530.1 Kosambi centimorgans. F_2 plants were evaluated for a response to *E. parasitica* infection by directly inoculating them with two unique fungal isolates and measuring canker expansion over a period of 3.5 months. Results were compared with the marker genotype data, thereby identifying genomic regions significantly associated with a resistance response. Single-marker or nonsimultaneous analyses of variance identified seven genomic regions that appear to have an effect on host response. Multiple-marker or simultaneous models suggest that three of these regions have a significant effect on host response, together explaining as much as 42.2 percent of the total variation for canker size. At each of the three putative resistance loci, alleles derived from the Chinese chestnut grandparent were associated with smaller canker size, or higher levels of resistance.

38 Outcalt, Kenneth W., ed. 2002. **Proceedings of the eleventh biennial southern silvicultural research conference.** Gen. Tech. Rep. SRS-48.

Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 622 p.

One hundred and twenty-four papers and three poster summaries address a range of issues affecting southern forests. Papers are grouped in 19 sessions that include pine nutrition, nurseries/seed and seedlings, ecophysiology, fire, pine thinning and spacing, wood quality/technology, hardwood thinning and spacing, hardwood nutrition, competition, pine natural regeneration, hardwood artificial regeneration, hardwood natural regeneration, biometrics, understory, site preparation, site preparation and classification, insects and disease/injury, long-term ecophysiology, and ecosystems.

39 Smith, David R.; Schiff, Nathan M. 2002. **A review of the sircid woodwasps and their Ibaliid parasitoids (Hymenoptera: Siricidae, Ibaliidae) in the Eastern United States, with emphasis on the Mid-Atlantic Region.** Proceedings of the Entomological Society of Washington. 104 (1): 174-194.

Keys are presented for the five genera and 15 species of adult Siricidae and one genus and two species of their parasitoids of the family Ibaliidae that occur in or may be adventive in the Eastern United States. Sircid larvae are wood borers in conifers and broadleafed trees. Notes on their biology, fungal symbionts, distributions, and host associations are given. Data from collections in the Middle Atlantic States include seasonal occurrence of both Siricidae and Ibaliidae.

40 USDA Forest Service, Southern Research Station. 2002. **Forest Science in the South.** Science Update SRS-002. Asheville, NC: USDA Forest Service, Southern Research Station. 87 p.

This publication synthesizes the Southern Research Station’s major accomplishments and research products during the period from October 2000 through September 2001, FY 01. *Forest Science in the South* presents emerging research priorities and highlights research work units and experimental forests, including collaborative research and budget allocations.