COMPASS

Recent Publications
of the Southern Research Station

The Southern Research Station of the USDA Forest Service produces Compass, a quarterly catalog of recent publications and technologies. The Southern Station works with universities, other Government agencies, corporations, and non-government organizations on studies that contribute to the sustainability of southern forest resources. We employ about 150 research scientists in disciplines ranging from tree physiology to the social sciences, from genetics to landscape ecology. Each year, our scientists' names appear as authors on 500 to 600 journal articles, research papers, resource assessments, handbooks, videotapes, and computer programs.

In addition to featuring a few highlights, Compass lists our most recent publications. You can order hard copies, or download electronic versions from our Web site **(www.srs.fs.usda.gov)** by using the reference number in bold print. We welcome input on the quality of our research program and our success in offering products that meet customer needs. For more information, contact Claire Payne at 828-257-4392.

Compass Winter 2004

Fire Ecology, Prevention, and Management

Fire plays powerful roles in forest regeneration. When fire suppression became standard practice on Federal lands, understory species and forest floor litter accumulated as fuel, waiting for ignition. The fires in Florida in 1998 and the 2000 fire season in the West focused the attention of the public, land managers, fire fighters, Federal and State policymakers, and Congress. Television footage of wildfires advancing on homes in Florida and San Diego forced another look at how we deal with fire. Primarily using prescribed fire, southern land managers treated 935,000 acres of forest land for hazardous fuels build up last year. Despite population growth and the expanding wildland-urban interface, the South leads the Nation in efforts to reduce hazardous fuels and maintain healthy ecosystems through fire. Several sensitive or threatened and endangered species, including the red-cockaded woodpecker, depend on the fire-dependent longleaf pine ecosystem for survival. Deer and other wildlife require forest clearings to browse. Managers conduct prescribed burns during specific weather circumstances, preventing the loss of the entire forest floor litter. Reducing intensity and severity of wildfires encourages a significantly higher survival rate in southern pine forests because regular burning reduces the risk of crown fires.

Managing the threat of wildfires requires integrated approaches linking fuel distribution, fuel moisture, and fire climate models to better predict fire risk and behavior, and to mitigate smoke hazards. Smoke plays a significant role in deterring the use of prescribed fire, especially in the wildland-urban interface. In the wake of the 1998 wildfires, the State of Florida enacted legislation protecting responsible burners from civil liability unless a court demonstrates the burner was “grossly negligent.” The critical need to manage fire at the wildland-urban interface calls for reducing risks and optimizing opportunities: to prescribe and act rather than react and respond to catastrophic fire events.

31 Brenner, J.; Wade, D. 2003. **Florida's revised prescribed fire law: protection for responsible burners.** Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G. Misc. Pub. No. 13. Tallahassee, FL: Tall Timbers Research Station: 132-136.

16 Clinton, B.D.; Vose, J.M.; Knoepp, J.D.; Elliott, K.J. 2003. **Stream nitrate response to different burning treatments in Southern Appalachian forests.** In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G., eds. Misc. Pub. No. 13. Tallahassee, FL: Tall Timbers Research Station: 174-181.

7 Outcalt, K.W. 2003. **Decay of fire-caused snags in Ocala sand pine.** In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G. (eds.) Misc. Pub. No. 13. Tallahassee, FL: Tall Timbers Research Station: 50-54.

22 Outcalt, Kenneth W.; Wade, Dale D. 2004. **Fuels management reduces tree mortality from wildfires in Southeastern United States.** Southern Journal of Applied Forestry. 28(1): 23-34.

11 Waldrop, Thomas A.; Brose, Patrick H.; Welch, Nicole Turrill. [and others]. 2003. **Are crown fires necessary for table mountain pine?** In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G. (eds.) Misc. Pub. No. 13. Tallahassee, FL: Tall Timbers Research Station: 157-163.

Striking Back at the Southern Pine Beetle

The southern pine beetle (SPB), the most destructive forest pest in the South, has devastated huge swaths of forests. Many of these degraded stands pose significant challenges to land managers faced with the task of reducing fuels and wildfire risk, restoring stands to ecologically sustainable conditions, and protecting other resources such as water quality and wildlife habitat and species. Land managers need ecologically based approaches to reduce fuels and create new stand conditions that substantially reduce susceptibility of stands to future southern pine beetle outbreaks and hazardous fuel accumulations, yet provide habitat diversity and conditions that support dependent species and communities. A broad range of work challenges scientists, land managers, private land owners, and State and Federal policymakers:

- determining genetic resistance and the role of SPB natural enemies;
- discovering compounds and visual deterrents that affect SPB host selection;
- identifying candidate pesticides with activity against SPB;
- generating approaches to restore SPB-damaged stands

Genetic research demonstrates pine trees that most effectively resist attack from the southern pine beetle produce large quantities of oleoresin in the absence of exogenous factors. This constitutive oleoresin serves to prevent or impede infestation. Abundant resin flow appears to deter invasion by serving as a wound-cleansing agent that expels or entraps beetles, and by enhancing delivery of toxic compounds to attack sites. High resin flow also retards beetle reproductive success. Environmental and genetic factors affect the quantity of oleoresin flow in loblolly pines, the species studied by

Southern Research Station scientists James Roberds, L. H. Lott, and Brian Strom, collaborating with State and university colleagues. Little had been known about the genetic contribution to phenotypic variation in this trait, but these scientists discovered that a positive and moderately high genetic correlation exists between oleoresin yield and growth traits. To read more about advances in the battle against southern pine beetles, select the articles listed below.

8 Roberds, J.H.; Strom, B.L.; Hain, F.P. [and others] 2003. **Estimates of genetic parameters for oleoresin and growth traits in juvenile loblolly pine.** Canadian Journal of Forest Research. 33: 2469-2476.

10 Sullivan, B.T.; Dalusky, M.J.; Berisford, C.W. 2003. **Interspecific variation in host-finding cues of parasitoids of the southern pine beetle (Coleoptera: Scolytidae).** Journal of Entomological Science. 38(4): 631-643.

Southern Station Reports Accomplishments

Forest Science in the South summarizes the Southern Station's products, partnerships, and accomplishments during the period from October 2003 through September 2004. The Station collaborated with 112 organizations, and disbursed $16,641,315 in research grants and awards to States, universities, and other Federal agencies. Station scientists produced 253 articles in refereed publications. They presented research findings at more than 600 scientific and professional societies and almost 200 lay organizations. Scientists engaged in almost 100 international activities. We reached 3,000 people through the Conservation Education Intern Program. To learn more, request the annual report for fiscal year 2003, available in hard copy with a searchable CD, or find it online at www.srs.fs.usda.gov/about/annual_report/2003/index.htm.

35 United States Department of Agriculture, Southern Research Station. 2004. **Forest science in the South.** Science Update SRS-005. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 65 p.

On the Bookshelf

Tropical Tree Seed Manual Debuts as a Favorite

The *Tropical Tree Seed Manual* covers tree species found in all of tropical America from Canada to Colombia. Since work on the project began in April 1996, 63 scientists from 19 countries contributed by providing species descriptions, chapters, translations, drawings, herbarium specimens, and references. Published as Agriculture Handbook 721, the *Tropical Tree Seed Manual* includes technical chapters and species descriptions. A Spanish edition is being produced. The depth of detail provided in technical information, descriptions, and illustrations make the *Tropical Tree Seed Manual* a valuable asset for students, technicians, and scientists. **Only a small number of books are available.** Request a copy from Jack Vozzo, Southern Research Station, 310 Thompson Hall, Mississippi State University, MS 39762. You can contact Dr. Vozzo by e-mail: jvozzo@fs.fed.us.

Station News

Wildland-Urban Interface Unit Opens in Florida

The Southern Research Station proudly announces the opening of the Wildland-Urban Interface unit (SRS 4951) in Gainesville, FL. Critical interface issues include wildland fire, watershed health and management, land use planning and policy, and wildlife conservation and management. As the unit's project leader, **Ed Macie** focuses on the effects of public policy and urbanization on forest ecosystems. Ed also serves as the Southern Region's urban forester. **Wayne Zipperer** joins the unit as research scientist. **Annie Hermansen** coordinates technology transfer, a pivotal component of the unit's functions. InterfaceSouth, the Web site developed by **Ignacio Paz Posse**, provides a forum to heighten awareness and provide information. Visit the site through a link from the Southern Station at www.srs.fs.usda.gov/units/index.htm, or log on at www.interfacesouth.org. Join a listserv, learn about events and resources, and view and order publications. You can download more than 30 brochures about fire, smoke, safety, and preparedness.

Station Names Two New Project Leaders

Congratulations to **Dana Nelson** and **Jim Hanula**, two new Southern Research Station project leaders. Dana Nelson heads up the Southern Institute of Forest Genetics (SRS 4153) in Saucier, MS. Research focuses on improving the health, productivity, and genetic diversity of southern forests through better understanding of genetics, ecology, and evolutionary relationships in forest ecosystems. As a research geneticist, Dana's interests target host-pathogen genetics, population and quantitative genetics, DNA marker development and genome marking, and comparative genomics.

Jim Hanula leads the Insects and Diseases of Southern Forests (SRS 4505) unit in Athens, GA. Researchers provide information needed to manage national forests for the diversity of benefits they provide. Scientists study the effects of management practices on insects and other arthropods that serve as prey for endangered species, such as the red-cockaded woodpecker, or as pollinators for rare and endangered species. The unit provides expertise to develop environmentally acceptable management strategies to support a stable forest economy, and to decrease the probability of importing exotic pests. Jim’s interests as a research entomologist include the impact of natural and man-made forest disturbances on insect communities and the role of coarse woody debris in maintaining insect populations.

Southern Pine Ecosystems

1 Coyle, David R.; Nowak, John T.; Fettig, Christopher J. 2003. **Irrigation and fertilization effects on Nantucket pine tip moth (Lepidoptera: Tortricidae) damage levels and pupal weight in an intensively managed pine plantation.** Journal of Entomological Science. 38 (4): 621-630.

The widespread application of intensive forest management practices throughout the Southeastern United States has increased loblolly pine, *Pinus taeda* L., yields and shortened conventional rotation lengths. Fluctuations in Nantucket pine tip moth, *Rhyacionia frustrana* (Comstock), population density, and subsequent damage levels have been linked to variations in management intensity. We examined the effects of two practices, irrigation and fertilization, on *R. frustrana* damage levels and pupal weights in an intensively managed *P. taeda* plantation in South Carolina. Trees received intensive weed control and one of the following treatments: irrigation only, fertilization only, irrigation + fertilization, or control. Mean whole-tree tip moth damage levels ranged from <1 to 48 percent during this study. Damage levels differed significantly among treatments in two tip moth generations in 2001, but not 2000. Pupal weight was significantly heavier in fertilization compared to the irrigation treatment in 2000, but no significant differences were observed in 2001. Tree diameter, height, and aboveground volume were significantly greater in the irrigation + fertilization than in the irrigation treatment after two growing seasons. Our data suggest that intensive management practices that include irrigation and fertilization do not consistently increase *R. frustrana* damage levels and pupal weights, as is commonly believed. However, tip moth suppression efforts in areas adjacent to our study may have partially reduced the potential impacts of *R. frustrana* on this experiment.

2 Kubisiak, T.L.; Roberds, J.H.; Spaine, P.C.; Doudrick, R.L. 2004. **Microsatellite DNA suggests regional structure in the fusiform rust fungus *Cronartium quercuum* f. sp. *fusiforme*.**

This paper reports results obtained from microsatellite DNA analysis of genetic structure for populations of the native fungus *Cronartium quercuum* f. sp *fusiforme* infecting loblolly pine (*Pinus taeda* L.) over much of this host's natural range. Mostly all fusiform rust galls formed under field conditions are produced as a result of infection and colonization by haploid mycelium originating from a single basidiospore of *C. quercuum fusiforme*. If multiple infections do occur, then only a single haplotype must ultimately dominate and be responsible for gall formation. High levels of microsatellite variability exist in *C. quercuum fusiforme*, and most of this variation occurs within local populations (average 88.4 percent). A statistically

significant proportion, however, is found among populations, and the magnitude of this differentiation is closely associated with geographic distance between populations. Unweighted pair-group mean analysis and principal components analysis both indicate that at least four genetically distinct regional groups of *C. quercuum fusiforme* exist in the South Atlantic and Gulf Coastal Plains. In summary, the distribution of genetic variability in *C. quercuum fusiforme* is consistent with a hypothesis of at least four metapopulations, with gene flow occurring less among regions than among populations within regions, and where overall levels of gene migration are related to geographic distance between populations.

3 Kush, John S.; Pitt, Douglas G.; Craul, Phillip J.; Boyer, William D. 2004. **Quantifying forest soil physical variables potentially important for site growth analyses.** 2004. Southern Journal of Applied Forestry. 28 (1): 5-11.

Accurate mean plot values of forest soil factors are required for use as independent variables in site-growth analyses. Adequate accuracy is often difficult to attain because soils are inherently widely variable. Estimates of the variability of appropriate soil factors influencing growth can be used to determine the sampling intensity required to secure accurate mean plot values. A study was conducted to determine the plot means and variation of bulk density, texture, and gross moisture weights within plots associated with the longleaf pine (*Pinus palustris* Mill.) forest type in South Alabama. Included in the study were three different soil series (Troup, Norfolk, and Esto), at each of three topographic positions (lower, mid, and upper slope). Soil texture was the most variable among the properties studied and gross moisture weights the least variable. Results provide a means of estimating forest soil sampling intensity for use in site growth analyses.

4 Lait, C.G.; Miller, D.R.; Bates, S.L. [and others] 2003. **Biochemical assay detects feeding damage to loblolly pine seeds caused by the leaffooted pine seed bug (Hemiptera: Coreidae).** Journal of Entomological Science. 38(4): 644-653.

A large number of proteins in salivary gland extracts of the leaffooted pine seed bug, *Leptoglossus corculus* Say, were strongly recognized by a polyclonal antibody-based assay developed for detecting saliva of the western conifer seed bug, *Leptoglossus occidentalis* Heidemann, in lodgepole pine, *Pinus contorta* var. *latifolia* Engelmann, seeds. An average of approximately 85 percent of loblolly pine, *Pinus taeda* L., seeds exposed to feeding by *L. corculus* for 1 to 4 weeks in the laboratory contained detectable amounts of salivary proteins when the antibody assays were performed weekly on samples (n =

10)of seed. In comparison, radiography of exposed seed detected an average of approximately 63 percent damaged seed over the same 4 week period, indicating that the antibody assay increased sensitivity of damage detection by approximately one third. Depletion of insoluble polypeptides and proliferation of soluble polypeptides = 23.5 kDa was apparent after SDS-PAGE and quantitative assays were performed on proteins extracted from seeds that were damaged by exposure to *L. corculus* feeding. Our data suggest that the antibody-based test could be used to obtain accurate estimates of seed losses attributable to *L. corculus* feeding in southern pine seed orchards.

5 Miller, J.H.; Zutter, B.R.; Newbold, R.A. [and others] 2003. **Stand dynamics and plant associates of loblolly pine plantations to midrotation after early intensive vegetation management—a Southeastern United States regional study.** Southern Journal of Applied Forestry. 27(4): 221-236.

Increasingly, pine plantations worldwide are grown using early control of woody and/or herbaceous vegetation. Assured sustainable practices require long-term data on pine plantation development detailing patterns and processes to understand both crop-competition dynamics and the role of stand participants in providing multiple attributes such as biodiversity conservation and wildlife habitat. This study examined loblolly pine (*Pinus taeda* L.) plantations across 13 southeastern sites grown for 15 years with near-complete control of woody, herbaceous, and woody plus herbaceous components during the first 3-5 years compared to no plant control. This multiple objective experiment (the COMProject) documents stand dynamics at the extreme corners of a response surface that encompasses most conditions of woody and herbaceous competition common to pine plantations in the region. This is the first of two companion reports. After 15 years, patterns of stand development remained significantly altered by early control treatments and were influenced most by the amounts of hardwoods and shrubs present or controlled. Herbaceous components were more similar across the region. Associated plants in these plantations included 68 species of trees, 33 species/genera of shrubs, and 140 genera of herbaceous and semi-woody plants, woody vines, clubmoss, and ground lichen—241 total taxa or an estimated 490 total species—more richness than previously reported or assumed. Hardwood rootstock numbers were on average maintained at fairly constant levels from years 1-15 when not controlled, with no initial lag phase evident for reestablishment, indicating prior stand origin. Dynamics of associated vegetation were significantly altered with woody control initially increasing herbaceous cover, while herbaceous control increased hardwood cover and decreased shrub cover. After early herbaceous control, hardwood basal area (BA) was increased by an average of 28 percent. After rapid early colonization, herbaceous plants began to decline on all

treatments about year 8 as pine and/or hardwood canopy cover reached a total of 50-60 percent, while woody vines continued to increase. By age 15, plant component richness remained significantly changed by early treatments at all locations, most notably fewer tree species after early woody control.

6 Miller, J.H.; Zutter, B.R.; Zedaker, S.M.; [and others] 2003. **Growth and yield relative to competition for loblolly pine plantations to midrotation—a Southeastern United States regional study.** Southern Journal of Applied Forestry. 27(4): 237-252.

Loblolly pine (*Pinus taeda* L.) plantations were studied across 13 southeastern sites grown for 1.5 years with near-complete control of woody, herbaceous, and woody plus herbaceous components during the first 3-5 years. This multiple objective experiment (the COMProject) documents stand dynamics at the extreme corners of the response surface that encompasses most competition conditions common to pine plantations. This is the second of two companion reports. Merchantable pine volume after 15 years with early, near complete competition control reached 2,350-4,415 ft^3/ac by site compared to 1,132-2,965 ft^3/ac on the no controls. With control of both woody and herbaceous competition, 15 year volumes were increased by 23-121 percent and gains increased as hardwoods and shrubs increased on the no controls. Early woody control increased merchantable pine volume on 11 sites by 14-118 percent, while herbaceous control yielded somewhat less on average, a 17-50 percent increase on 10 sites. No gains and some volume losses occurred when control of one component released severe competition from an enhanced remaining component; otherwise, gains were generally additive for control of both components. Pine volume was decreased by about 1 percent for each 1 ft^2/ac of hardwood basal area (BA) present at age 15. Annual measurements determined that culmination of current annual increment (CAI) with control of both competition components occurred in years 8-11 at 250-470 ft^3/ac/yr. CAIs for pine height, BA, and volume were decreased by about 5-27 percent when growing season rainfall (March-October) was less than 36 inches. Mean annual increment had not culminated for any treatment at any location by year 15 and ranged from 195-250 ft^3/ac/yr with both woody and herbaceous control. Fusiform rust mainstem galls (*Cronartium quercuum* (Berk.) *Miyabe* ex *Shirai* f. sp. fusiforme (Hedge. & Hunt) Burdsall & Snow) in high severity areas increased additively with control of both components, more so with herb control. Contrary to the widespread assumption that hardwood out-competes pine, the hardwood proportion of stand BA decreased from year 5-15 on sites where hardwood BA in year 5 exceeded 10 ft^2.

7 Outcalt, K.W. 2003. **Decay of fire-caused snags in Ocala sand pine.** In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G. (eds.) Misc. Pub. No. 13. Tallahassee, FL: Tall Timbers Research Station: 50-54.

Sand pine (*Pinus clausa*) scrub is adapted to, and regenerated by, periodic stand-replacement wildfire, which consumes the understory and kills the overstory. The heat of the fire opens the serotinous cones of Ocala sand pine (*P. clausa* var. *clausa*), releasing quantities of seed that reestablish the overstory, while the understory regenerates by sprouting or from soil-stored seed. Resource managers attempt to mimic this process by clear cutting and direct seeding, which seems to work quite well. However, this method results in far fewer snags, which may have important functions in the sand pine scrub ecosystem. Because sand pine is a short-lived species with very little heartwood, it is believed that these snags would be a temporary feature of the system, and thus were not that critical. My study tests this assumption by documenting the life of snags following a stand-replacement fire in sand pine scrub on the Ocala National Forest, Florida. Three stands were burned, one by a prescribed burn in May 1993 and two by natural fire in August 1993. Prior to the fire, there were 520 Ocala sand pine/ha, 96 oaks/ha, and 137 snags/ha. The fire killed all of the sand pine and most of the oaks. Decay proceeded more slowly than expected in the resulting snags. After 2 years 69 percent retained most of the bark, 27 percent had lost all bark and most of the limbs, and only 4 percent had visible sapwood decay. The first snags fell between 12 and 18 months following the fire, but it took 5 years for 50 percent of the snags to fall. At the end of 7 years following the fire, 32 percent of the sand pine snags were still standing. Thus, the snags in sand pine scrub occur as part of the structure of the sand pine ecosystem for much longer than expected. Managers may need to consider more prescribed fire in wilderness areas to generate these snags.

8 Roberds, J.H.; Strom, B.L.; Hain, F.P. [and others] 2003. **Estimates of genetic parameters for oleoresin and growth traits in juvenile loblolly pine.** Canadian Journal of Forest Research. 33: 2469-2476.

In southern pines of the United States, resistance to attack by southern pine beetle, *Dendroctonus frontalis* Zimmermann, is believed to principally involve flow of oleoresin to beetle attack sites. Both environmental and genetic factors are known to affect the quantity of oleoresin flow in loblolly pine, *Pinus taeda* L., but little is known about the genetic contribution to phenotypic variation in this trait. Here we report estimates of genetic variation in oleoresin flow and growth traits for a population of this species. Oleoresin yield, total height, and diameter were measured on 10- and 11-year-old trees from an

experimental test in Santa Rosa County, FL. Trees were from 72 full-sib families produced by mating 48 parents according to a disconnected partial diallel mating design. Resin yield was determined from breast-height samples collected at two times: once in the summer of 1999 when latewood was being produced (summer resin flow), and once in the spring of 2000 during earlywood formation (spring resin flow). All traits studied were found to be highly genetically variable and to have much greater additive than dominance variance. Estimates of narrow-sense heritability for spring and summer resin flow were in the moderate range and are comparable to values obtained for the growth traits. Additive genetic correlations between oleoresin yield and the growth traits were positive and moderately high, suggesting that directional selection to improve growth in loblolly pine will also result in increased production of oleoresin.

9 Sampson, D.A.; Albaugh, T.J.; Johnsen, K.H. [and others]. 2003. **Monthly leaf area index estimates from point-in-time measurements and needle phenology for *Pinus taeda*.** Canadian Journal of Forest Research. 33: 2477-2490.

Leaf area index (LAI) of loblolly pine (*Pinus taeda* L.) trees of the Southern United States varies almost twofold interannually; loblolly pine, essentially, carries two foliage cohorts at peak LAI (September) and one at minimum (March–April). Herein, we present an approach that may be site invariant to estimate monthly LAI for loblolly pine using point-in-time measurements from a LI-COR LAI-2000 plant canopy analyzer (PCA). Our analyses used needle accretion and abscission data from monthly needle counts and destructive harvest data from a replicated 2 ? 2 factorial experiment of water and nutrition amendments. No significant treatment effects on relative needle accretion or abscission were observed. Cohort (interannual) differences in needle accretion were found but appeared trivial. Cohort year had variable effects on needle abscission. Abscission of current-year foliage began in July and continued through November of the third year; however, only 7 to 9 percent remained 23 months following bud initiation. A treatment-invariable regression of PCA measurements on cohort foliage biomass (r^2 ~ 0.98) was used to estimate annual cohort LAI. We derived monthly estimates of LAI from cohort accretion and abscission and cohort LAI. Monthly estimates of LAI for loblolly pine, using point-in-time measurements from the PCA, appear possible, although further testing is required.

10 Sullivan, B.T.; Dalusky, M.J.; Berisford, C.W. 2003. **Interspecific variation in host-finding cues of parasitoids of**

the southern pine beetle (Coleoptera: Scolytidae). Journal of Entomological Science. 38(4): 631-643.

Experiments were performed with host-associated olfactory attractants of the larval parasitoids of the southern pine beetle, *Dendroctonus frontalis* Zimmermann, to elucidate both their biological origin and their chemical composition. Sticky-screen traps were erected in an active *D. frontalis* infestation and baited with parts of *D. frontalis*-infested loblolly pines (*Pinus taeda* L.) or their extracts. The diversity of parasitoid species landing on trees infested with larval *D. frontalis* was substantially greater than that attracted to traps baited with wood and bark taken from similar infested trees. Females of four parasitoid species, *Spathius pallidus* (Ashmead), *Roptrocerus xylophagorum* (Ratzeburg), *Dinotiscus dendroctoni* (Ashmead), and *Eurytoma tomici* Ashmead, were attracted to bark infested with *D. frontalis* larvae. Two of these species, *R. xylophagorum* and *S. pallidus*, were attracted to debarked wood from host-infested trees, although this tissue was free of hosts and host frass. *Spathius pallidus* were more attracted to the excised bark (containing *D. frontalis* larvae and frass) than the debarked wood from *D. frontalis*-infested pine bolts, while *R. xylophagorum* were attracted in similar numbers to both materials. When traps were baited with steam/water-distilled extracts of *D. frontalis*-infested bark, *R. xylophagorum* strongly preferred extracts from bark containing early in star larvae over extracts from bark infested with either younger (egg-stage) or older (late-instar larval and pupal) brood. In contrast, *S. pallidus* responded significantly only to extracts of late larval/pupal bark. Coupled gas chromatograph/mass spectrometer (GC-MS) analyses of the bark extracts revealed that the concentrations of numerous extract constituents correlated positively with trap catch of *S. pallidus*, but no such relationships were identified for *R. xylophagorum*. These data provide further evidence that members of the parasitoid complex associated with *D. frontalis* differ in their strategies for locating trees infested with susceptible hosts.

11 Waldrop, Thomas A.; Brose, Patrick H.; Welch, Nicole Turrill. [and others]. 2003. **Are crown fires necessary for table mountain pine?** In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G. (eds.) Misc. Pub. No. 13. Tallahassee, FL: Tall Timbers Research Station: 157-163.

Ridgetop pine communities of the Southern Appalachian Mountains have historically been maintained by lightning- and human-caused fires. Because of fire suppression for several decades, these stands are entering later seral stages. Such stands typically have an overstory of Table Mountain pine (*Pinus pungens*) that is being replaced by shade tolerant chestnut oaks (*Quercus prinus*). The shrub layer consists of dense mountain laurel (*Kalmia*

latifolia). Previous research suggests that restoration of these communities can be accomplished with high-intensity fires that open the forest canopy and expose mineral soil. Three recent studies examined plant-community response to high-intensity prescribed fires. A series of four supporting studies helps to explain some of the results of these field studies. High intensity and medium-high intensity fires provided adequate sunlight for pine seedlings, whereas medium-low and low intensity fires did not. Post-burn duff was deep (< 5 cm) and did not vary by fire intensity. We observed sufficient seedling densities to restore pine-dominated stands (< 9,000/ha) after all but the highest intensity fires. Many seedlings survived the first growing season as their roots penetrated duff to reach mineral soil. Hardwood rootstocks resprouted on sites treated with all fire intensities and may out-compete pine seedlings. High intensity fires may have reduced mycorrhizal abundance and moisture availability for new germinants. Fires of lower intensity than previously recommended or multiple fires of very low intensity may provide the best conditions for pine regeneration.

Wetlands, Bottomlands, and Streams

12 Haag, Wendell R.; Staton, J. Leann. 2003. **Variation in fecundity and other reproductive traits in freshwater mussels**. Freshwater Biology. 43: 2118-2130.

1. Life histories of the highly diverse and endangered North American freshwater mussel fauna are poorly known. We investigated reproductive traits of eight riverine mussel species in Alabama and Mississippi, U.S.A.: *Amblema plicata*, *Elliptio arca*, *Fusconaia cerina*, *Lampsilis ornata*, *Obliquaria reflexa*, *Pleurobema decisum*, *Quadrula asperata*, and Q. *pustulosa*, and compare our results with existing life history information for other species.
2. These eight species had reproductive traits characteristic of large, outcrossing populations: hermaphrodites were rare, we found no evidence of protandry, and sex ratios were even or slightly male-biased.
3. Age at sexual maturity varied among species, ranging from < 1 to 2 years for *L. ornata* to 3 to 9 years for *Q. asperata*. In all species, most mature females participated in reproduction and fertilization success was high.
4. Fecundity was related positively to both length and age, but length was the best predictor. In six species, fecundity increased exponentially with increasing size; in two species the rate of increase in fecundity declined in larger animals. In four species, fecundity declined in older animals. These latter results indicate weak reproductive senescence; however, in all

species, older individuals continued to produce large numbers of offspring. Mean annual fecundity differed widely among species ranging from 9647 to 325,709. Within-species differences in fecundity were found among rivers and among populations within a river.
5. The wide variation in reproductive traits among species indicates the existence of widely divergent life history strategies in freshwater mussels.

13 Sargent, R.A.; Kilgo, J.C.; Chapman, B.R.; Miller, K.V. 2003. **Nesting ecology of wood thrush (Turdidae: Passeriformes) in hardwood forests of South Carolina**. Southeastern Naturalist. 2(2): 217-222.

We studied nesting success of the wood thrush (*Hylocichla mustelina*) in bottomland and upland hardwood forests in South Carolina. Twenty-one of 26 nests (80.8 percent) were located in bottomland sites, and 76.2 percent of these nests were in narrow (< 150 m wide) bottomland corridors. No nests were found in upland sites enclosed by fields. The Mayfield success rate for 20 nests was 35.3 percent. All nest failures were attributed to predation; no nests were parasitized by brown-headed cowbirds (*Molothrus ater*). Nest sites were characterized by a dense overstory and a moderately developed understory. Bottomland hardwoods, especially relatively narrow corridors, appear to provide suitable nesting habitat for wood thrush in this region. Brood parasitism by brown-headed cowbirds does not appear to be a significant factor in the failure of wood thrush nests in these sites.

Mountain and Highland Ecosystems

14 Bragg, D.C.; Guldin, J.M. 2003. **Differences in optimal growth equations for white oak in the Interior Highlands.** NC-234. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 361-366 p.

Optimal growth equations are fundamental to many ecological simulators, but few have been critically examined. This paper reviews some of the behavior of the Potential Relative Increment (PRI) approach. Models for white oak were compared for Arkansas River Valley (ARV), Boston Mountains (BoM), Ouachita Mountains (OM), and Ozark Highlands (OH) ecological sections of the Interior Highlands. Noticeable divergence in equation shape was observed in the section and pooled models. PRI curves for the ARV and OM models predicted poor optimal growth, especially in the smallest size classes. The OH equation predicted high juvenile performance but limited large tree optima, while the

BoM model peaked at intermediate diameters. These distinctions may arise from differences in physiological potential between sections, or, more likely, from inadequate sample distributions. Our study supports pooling to improve optimal growth modeling if phenotypic conditions do not vary substantially.

15 Clinton, B.D. 2003. **Light, temperature, and soil moisture responses to elevation, evergreen understory, and small canopy gaps in the Southern Appalachians.** Forest Ecology and Management. 186: 243-255.

Small canopy openings often alter understory microclimate, leading to changes in forest structure and composition. It is generally accepted that physical changes in the understory (i.e., microclimatic) due to canopy removal drive changes in basic forest processes, particularly seedling recruitment, which is intrinsically linked to soil moisture availability, light and, to a lesser extent, temperature. We examined the impact of small canopy gaps of the type (snags) and size (~300 m^2) most frequently observed in the Southern Appalachians on the understory microclimate. We created artificial canopy gaps at two elevations above mean sea level (a.m.s.l.) by girdling trees in areas with and without a *Rhododendron maximum* L. (rosebay rhododendron) understory. Soil and air temperature (°C), photosynthetically active radiation (PAR; µmol m^{-2} s^{-1}), and volumetric soil water content (%WC) in the upper 15 cm of soil were measured along transects generally running north to south through each gap. Overall, PAR was substantially less in rhododendron gaps than in non-rhododendron gaps. We found a slight increase in PAR in non-rhododendron gaps during spring and summer compared to controls. Very little seasonal variation in PAR was observed in rhododendron gaps compared with non-rhododendron gaps. In general, %WC in rhododendron gaps was lower than in non-rhododendron gaps and less variable. We also found a gap response in incident PAR during the spring and summer seasons. There was no significant effect of gap creation on %WC, nor were there site (elevation) differences or effects due to the presence of rhododendron. Further, there was no significant gap effect on mean, maximum, or minimum soil and air temperature; however, there were significant effects from the presence of rhododendron and between sites for PAR and soil and air temperature during certain seasons of the year. Although there is some certainty about measurable responses in key microclimatic variables in rhododendron and non-rhododendron gaps found in this study, we could not be certain if responses represent a significant enough departure from values in undisturbed conditions to elicit a tree recruitment response. Our results indicate that for openings of the size examined here, topography and evergreen understory are the primary

determinants of spatial and temporal heterogeneity in understory microclimate.

16 Clinton, B.D.; Vose, J.M.; Knoepp, J.D.; Elliott, K.J. 2003. **Stream nitrate response to different burning treatments in Southern Appalachian forests.** In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G., eds. Misc. Pub. No. 13. Tallahassee, FL: Tall Timbers Research Station: 174-181.

Southern Appalachian forests are undergoing considerable change due to altered disturbance regimes. For example, fire exclusion has had a major impact on the structure and function of pine-hardwood ecosystems. Recently, fire has been prescribed for a variety of applications: (1) stand replacement in the form of a mimicked wildfire, (2) site preparation as part of a fell-and-burn prescription, and (3) understory burning for fuels reduction and wildlife habitat improvement. Assessing watershed-scale responses to burning requires identification of key parameters indicative of changes in structure and function. In the Southern Appalachians, nitrogen in the form of NO_3 is a key indicator of ecosystem change or response to disturbance. We compared stream NO_3-N responses among stand-replacement fires (Wine Spring Creek and Hickory Branch), a fell-and-burn prescription (Jacobs Branch), and a wildfire in an old-growth deciduous forest (Joyce Kilmer). Nitrate-nitrogen concentration increased following two of the four fires. Concentrations following the fell-and-burn prescription fire increased from < 0.01 to a maximum of 0.075 mg L^{-1} and remained elevated for 8 months. Similarly, stream NO_3 concentration increased approximately 2 weeks following the old-growth deciduous wildfire from 0.04 to a maximum of 0.50 mg L^{-1} and remained elevated for 6 weeks. There were no significant differences in NO^3 following one of the stand-replacement fires or between treatment and control or pre-burn and post-burn following the other stand-replacement fire due to maintenance of an unburned riparian area. Although the old-growth deciduous wildfire was essentially an understory burn, the magnitude of stream N response suggests that unavailable recalcitrant forms of N may have been released during the wildfire, as well as a reflection of the potential inefficiency of old-growth forests at sequestering mobilized nutrients. In all cases, hydrologic losses of NO_3-N were insignificant with respect to effects on water quality and site depletion of N.

17 Greenberg, Cathryn H.; Forrest, T.G. 2003. **Seasonal abundance of ground-occurring macroarthropods in forest and canopy gaps in the Southern Appalachians**. Southeastern Naturalist. 2 (4): 591-608.

Arthropods compose a large proportion of biological diversity and play important ecological roles as decomposers, pollinators, predators, prey, and nutrient cyclers. We sampled ground-occurring macroarthropods in intact gaps created by wind disturbance, in salvage-logged gaps, and in closed canopy mature forest (controls) during June 1998-May 1999 using drift fences with pitfall traps. Basal area of live trees, shade, and leaf litter coverage and depth were highest in controls and lowest in salvaged gaps. Coarse woody debris (CWD) cover was greater in intact gaps than in salvaged gaps or controls, but decay was more advanced and CWD had less bark in controls than gaps. We captured 2,390 grams (dry biomass) of > 28,000 macroarthropods in 21 orders and 66 identified families. Among orders, Coleoptera (36.4 percent), Hymenoptera (12.2 percent), Orthoptera (11.7 percent), Araneae (7.1 percent), Julida (5.9 percent), Spirobolida (5.7 percent), and Scolopendromorpha (5.5 percent) were numerically dominant, whereas Coleoptera (44.0 percent), Spirobolida (19.9 percent), Orthoptera (12.8 percent), Julida (6.8 percent), and Scolopendromorpha (5.0 percent) composed the majority of dry biomass. Total macroarthropod abundance and biomass were greater in forested controls than in intact or salvage-logged gaps, and were highest in summer, followed by fall, then spring, and lowest in winter. Differences among treatments were attributable to a higher abundance of Carabidae, Julida, Scolopendromorpha, Spirobolidae, and Araneae in forested controls than in gaps. Sclerosomatidae and Gryllidae were more abundant in salvaged gaps than in intact gaps or controls. Overall, mid-sized macroarthropods were more abundant than small (< 5 mm) or large (2 ? 30 mm) macroarthropods, but those > 15.0 mm were more abundant in the controls. Small macroarthropods were most abundant in fall and winter, but those ? 5.0 mm were most abundant in summer and fall. Important questions that remain include whether reductions in macroarthropod numbers and biomass at the levels observed are likely to adversely impact vertebrate predators, and at which scales do impacts become a conservation issue.

18 Perry, R.W.; Thill, R.E. 2003. **Initial effects of reproduction cutting treatments on residual hard mast production in the Ouachita Mountains.** Southern Journal of Applied Forestry. 27(4): 253-258.

We compared indices of total hard mast production (oak and hickory combined) in 20 second-growth, pine-hardwood stands under five treatments to determine the effects of different reproduction treatments on mast production in the Ouachita Mountains. We evaluated mast production in mature unharvested controls and stands under four reproduction cutting methods (single-tree selection, group selection, shelterwood, and clearcut with wildlife tree retention) during the first 6 years

after initial harvest. Mean Whitehead mast production indices were greater in shelterwoods and clearcuts with wildlife tree retention than in unharvested stands 5 of the 6 years of study, indicating individual trees in these stands produced greater amounts of hard mast. Stand production values for the 6 years combined indicated group selections generally produced the greatest amounts of total hard mast, probably because competing pines in the matrix were thinned and hard mast-producing tree densities were unchanged after harvest. However, wide variation in residual density of mast trees existed among stands of the same treatment. Our results indicate hard mast production can be affected by different silvicultural treatments and managers should consider the importance of residual mast production along with other objectives when determining silvicultural treatments to apply.

Large-Scale Assessment and Modeling

19 Bragg, Don C.; Roberts, David W.; Crow, Thomas R. 2004. **A hierarchical approach for simulating northern forest dynamics**. Ecological Modelling. 173: 31-94.

Complexity in ecological systems has challenged forest simulation modelers for years, resulting in a number of approaches with varying degrees of success. Arguments in favor of hierarchical modeling are made, especially for considering a complex environmental issue like widespread eastern hemlock regeneration failure. We present the philosophy and basic framework for the *NORTH*ern *W*oodland *D*ynamics *S*imulator (NORTHWDS) *I*ntegrated *H*ierarchical *M*odel *S*ystem (*NIHMS*). NIHMS has an individual tree component [the *NORTHWDS I*ndividual *R*esponse *M*odel (*NIRM*)], a mesoscale stand simulator (*NORTHWDS*), and a landscape model [*NORTHWDS L*andscape *M*odel (*NLM*, presented in another paper)]. *NIRM* predicts the behavior of a tree given the physical and biotic environment that constrains its performance, using process-response functions at a scale larger than the individual plant. The *NORTHWDS* model integrates both the structure of the individual tree model (including tree growth and mortality functions) with a series of ecosystem processes (e.g., competition, site biogeochemistry, small-scale disturbance, deer browsing) and even larger scale events (e.g., catastrophic windthrow) to predict long-term stand dynamics on a 5-year simulation cycle. The boundaries in time and space between the *NIRM*, *NORTHWDS*, and *NLM* models are not discrete, but overlap due to the multiscale expression of ecological and physiological processes. For example, the *NORTHWDS* model represents both the intersection between the *NIRM* and *NLM* models with additional unique mesoscale processes (e.g., intertree competition). At the highest level of *NIHMS*, *NLM* provides the

environmental context for *NORTHWDS*, with all levels operating in an internally consistent and parsimonious manner. Three case study scenarios are used to illustrate some of the potential applications of NIRM.

20 Hager, E. Bradley; Hammett, AL.; Araman, Philip A. 2003. **PROACT user's guide: how to use the pallet recovery opportunity analysis computer tool.** Gen. Tech. Rep. SRS-69. Asheville, NC: U.S. Department of Agriculture, Forest Service. 30 p.

Pallet recovery projects are environmentally responsible and offer promising business opportunities. The Pallet Recovery Opportunity Analysis Computer Tool (PROACT) assesses the operational and financial feasibility of potential pallet recovery projects. The use of project-specific information supplied by the user increases the accuracy and the validity of the feasibility study. Different scenarios of the same project can also be compared easily because changes in input are instantly reflected in the feasibility study results. PROACT is designed for use with Microsoft® Excel®—the most widely used spreadsheet program on the market today. It is easy to use, even for those unfamiliar with computer spreadsheet programs. PROACT is a workbook with three worksheets. This guide provides users with a complete tour of two of these worksheets—inputs and reports—by describing cells, defining terms, illustrating all on-screen tables and charts, and using an example project.

21 Michael, J. 2002. **Impact of herbicides on the forest ecosystem, aquatic ecosystems, and wildlife: the American experience.** Revue Forestiere Francaise. 6: 593-608.

The impact of forestry herbicides on ecosystems, terrestrial and aquatic, is a subject which has received much attention. That attention increased with the publication of Rachel Carson's book *Silent Spring* in 1962. At that time, several chlorinated hydrocarbons were in wide spread use in the United States and around the world, the best well known of which is DDT. Although many of the claims in Carson's book are still highly controversial, it is clear that DDT posed a threat to constituents of some ecosystems. While DDT was banned for use in the United States in 1972, its beneficial uses for protecting human health were recognized, and it even has a place in the world arena today. According to the World Health Organization, its beneficial uses in controlling disease vectors far outweigh any human health risks, and the decision to use DDT until an acceptable replacement can be found has been made, even in the face of considerable opposition due to its known or suspected environmental impacts.

The DDT story has scared many people, but there are good lessons to be learned. The first is that science is not perfect. The second is that the vigilance of science as applied in the corporate, private, public, educational institution, and government sectors is essential in assuring safety of every technology that affects humans and the environment in which they live. It is not possible for any individual segment of the research society to test every factor or combination of factors to determine that any new technology is safe. Indeed it is not possible under tenets of science to “prove” anything. In the face of this conundrum, “how can we be sure of the safety of technology when our science is unable to prove the safety,” we must find alternative methods of making decisions about new scientific developments and the role they will play in society. Currently the most widely accepted alternative is risk assessment.

22 Outcalt, Kenneth W.; Wade, Dale D. 2004. **Fuels management reduces tree mortality from wildfires in Southeastern United States.** Southern Journal of Applied Forestry. 28(1): 23-34.

The objective was to determine the effectiveness of a regular prescribed burning program for reducing tree mortality in southern pine forests burned by wildfire. This study was conducted on public and industry lands in Northeast Florida. On the Osceola National Forest, mean mortality was 3.5 percent in natural stands and 43 percent in plantations two growing seasons after a June 1998 wildfire. Burn history significantly affected mortality, with those stands that were prescribe-burned 1.5 years prior to the wildfire having the lowest mortality, while stands prescribe-burned 2 or more years prior had higher mortality. Although significant tree mortality did occur on the Osceola National Forest, with all trees killed in some stands, many trees in other burned stands did survive. The overall mortality was lower in both plantations and natural stands on the Osceola than at Tiger Bay, where prescribed burning had been less frequent. The highest mortality rates occurred on the Luke Butler Forest, where prescribed burning had not been used since plantation establishment. Thus, a regular prescribed burning program will reduce mortality following wildfires in both natural and planted stands of southern pines on flatwoods sites, even when wildfires occur under severe drought conditions.

23 Vose, J.M.; Harvey, J.G.; Elliott, K.J.; Clinton, B.D. 2003. **Measuring and modeling tree and stand level transpiration.** In: McCutcheon, Steven C.; Schnoor, Jerald L. Phytoremediation: transformation and control of contaminants. Hoboken, NJ: John Wiley & Sons, Inc.: 263-282.

Transpiration is a key process in the application of phytoremediation to soil or groundwater pollutants. To be successful, vegetation must transpire enough water from the soil or groundwater to control or take up the contaminant. Transpiration is driven by a combination of abiotic (climate, soil water availability, and groundwater depth) and biotic (leaf area, stomatal functions, root amount and distribution, and hydraulic characteristics) that need to be evaluated when considering appropriate site and species combinations. The protocols are not trivial, but transpiration can be measured at a variety of scales using techniques such as direct measurements of sap flow on individual trees, eddy flux gradient analyses, or gauged watersheds. Alternatively, models can be used to estimate transpiration, but these usually require on-site calibration or parameterization to produce accurate predictions. Case study analyses across a range of site conditions and species indicate a maximum transpiration capacity of approximately 7.5 x 10^6 liters of water per hectare per year (8 ? 10^5 gallons of water per acre per year), with a range of 1.5 ? 10^6 to 7.5 ? 10^6 liters per hectare per year (1.6 ? 10^5 to 8 ? 10^5 gallons per acre per year). Variation among sites is related to species, tree size, and stocking (i.e., vegetation density) differences. Application of a physiologically based and site-specific parameterized model suggests reasonable agreement between measured and predicted transpiration estimates for the Air Force Plant 4 site in central Texas.

24 Wear, David N.; Murray, Brian C. 2004. **Federal timber restrictions, interregional spillovers, and the impact on U.S. softwood markets.** Journal of Environmental Economics and Management. 47: 307-330.

An econometric model of the United States softwood lumber and timber markets is estimated and used to simulate the price, trade, and welfare effects of reductions in Federal timber sales in the Western United States commencing in the late 1980s. Results indicate that the timber sale reductions increased lumber prices by roughly 15 percent in the mid-1990s. Lumber consumers were the unambiguous losers from the policy, while lumber and timber producers were net welfare gainers as the quantity-induced losses to western lumber producers were more than offset by price increases and quantity gains to Southern United States and Canadian lumber producers and timber producers in all regions.

25 Winn, M.F.; Wynne, R.H.; Araman, P.A. 2004. **ALOG: A spreadsheet-based program for generating artificial logs.** Forest Products Journal. 54(1): 62-66.

Log sawing simulation computer programs can be valuable tools for training sawyers, as well as for testing different sawing patterns. Most available simulation programs rely on databases from which to draw logs and can be very costly and time consuming to develop. ALOG (Artificial LOg Generator) is a Microsoft Excel®-based computer program that was developed to accurately generate random, artificial log data and to serve as an alternative to using a log database. Information obtained from the analysis of actual red oak (*Quercus rubra* L.) logs was incorporated into the program to ensure the validity of the generated log data. Generated log feature information includes length, small and large inside-bark diameters, amount of sweep or crook, and defects. External defect attributes include type, location, length, width, and height. Internal defect information, including depth, volume, and angle, is also given for the most common defect types that exhibited a significant linear relationship between external and internal defect attributes within the sample data. The user has the option of specifying the grade of the log, as well as the position of the log in the tree, or having the features drawn randomly from known distributions. Finally, a grading algorithm is incorporated into the program to check the grade of the generated log.

Inventory and Monitoring

26 Bechtold, W.A. 2003. **Crown position and light exposure classification—an alternative to field-assigned crown classes**. Northern Journal of Applied Forestry. 20(4): 154-160.

Crown class, an ordinal tree-level mensuration attribute used extensively by foresters, is difficult to assign in the field because definitions of individual classes are confounded by ambiguous references to the position of the tree in the canopy and amount of light received by its crown. When crown class is decomposed into its two elements—crown position and crown light exposure—field assignments are more repeatable, and crown class can be assigned by algorithm with the same degree of accuracy that it can be estimated in the field. Replacing traditional crown class with the two proposed alternative variables yields more specific information about each tree. Crown position and crown light exposure add information potentially useful for modeling and other applications.

27 Bechtold, W.A. 2003. **Crown-diameter prediction models for 87 species of stand-grown trees in the Eastern United States.** Southern Journal of Applied Forestry. 27(4): 269-278.

The mean crown diameters of stand-grown trees were modeled as a function of stem diameter, live-crown ratio, stand basal area, latitude, longitude, elevation, and Hopkins bioclimatic index for 87 tree species in the Eastern United States. Stem diameter was statistically significant in all models, and a quadratic term for stem diameter was required for some species. Crown ratio and/or Hopkins index also improved the models for many species. Coefficients of variation from the regression solutions ranged from 18 to 35 percent, and model *r*-square values ranged from 0.15 to 0.88. Simpler models, based only on stem diameter and crown ratio, are also presented.

28 Brown, Mark J. 2004. **Forest statistics for North Carolina, 2002**. Resour. Bull. SRS-88. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 78 p.

This report summarizes a 2002 inventory of the forest resources of the 100-county area of North Carolina. Major findings are highlighted in text and graphics; detailed data are presented in 49 tables.

29 Brown, Mark J.; Sheffield, Raymond M. 2004. **Forest statistics for the mountains of North Carolina, 2002**. Resour. Bull. SRS-87. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 59 p.

This report summarizes a 2002 inventory of the forest resources of a 21-county area of North Carolina. Major findings are highlighted in text and graphics; detailed data are presented in 49 tables.

30 Brown, Mark J.; Sheffield, Raymond M. 2004. **Forest statistics for the Piedmont of North Carolina, 2002**. Resour. Bull. SRS-86. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 61 p.

This report summarizes a 2002 inventory of the forest resources of a 35-county area of North Carolina. Major findings are highlighted in text and graphics; detailed data are presented in 49 tables.

Urban Forestry/Wildland-Urban Interface

31 Brenner, J.; Wade, D. 2003. **Florida's revised prescribed fire law: protection for responsible burners.** In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G. Misc. Pub. No. 13. Tallahassee, FL: Tall Timbers Research Station: 132-136.

In Florida, natural communities require periodic fires for maintenance of their ecological integrity. Because of public concerns, wildfires can no longer be allowed to perform this mandatory function, so prescribed burning is essential to manage these plant and animal communities. We discuss the importance of prescribed fire in Florida; outline a history of the State's interest and involvement in promoting the judicious use of prescribed fire; describe the situation that led to Florida's fire management statutes; and provide an overview of the 1977 and 1990 statutes and the 1999 changes to the 1990 Prescribed Burning Act that significantly strengthen the law. The State of Florida passed landmark legislation in 1990 to protect responsible burners from civil liability with one goal in mind: to increase the number of acres treated with prescribed fire. The reason for introducing this bill was the clear message coming from the land management community that "burning the land was too risky," not because of potential fire control problems, but because of potential smoke management problems that were beyond the control of the burner. During a Florida land managers' conference on prescribed burning issues held January 1999, the four most common reasons cited by land managers for not using prescribed fire pertained to liability. The 1990 Prescribed Burning Act has been nationally recognized as landmark legislation protecting a landowner's right to use fire as a management tool. In the wake of the disastrous 1998 fire season in Florida, which was partially blamed on abnormal fuel accumulations, the Florida legislature modified this law so that a prescribed burner cannot be found civilly liable unless a court demonstrates that the burner was "grossly negligent." This unprecedented modification is a huge step in protecting the right to prescription burn in Florida.

Foundation Programs

32 Conner, Richard N.; Saenz, Daniel; Schaefer, Richard R. [and others]. 2004. **Group size and nest success in red-cockaded woodpeckers in the West Gulf Coastal Plain: helpers make a difference.** Journal of Field Ornithology. 75 (1): 74-78.

We studied the relationships between red-cockaded woodpecker (*Picoides borealis*) group size and nest productivity. Red-cockaded woodpecker group size was positively correlated with fledging success. Although the relationships between woodpecker group size and nest productivity measures were not statistically significant, a pattern of increasing clutch size and number of hatchlings with increasing group size was apparent. The presence of helpers appeared to enhance the survival of nestlings between hatching and fledging. The contribution that helpers make to nestling feeding and incubation, cavity excavation, and territory defense appears to have a positive effect on nest

productivity. A threshold number of helpers may be necessary before a significant benefit for fledging success is realized. Nests with four and five group members fledged more young than nests with two or three group members. Whether partial brood loss occurred or not within a nest was primarily a function of clutch size and the number of hatchlings. Although partial brood loss did affect the number of young fledged from individual nests by removing young from nests with high numbers of hatchlings, woodpecker group size appeared to be the primary determinant of fledging success.

33 DiCosty, R.J.; Weliky, D.P.; Anderson, S.J.; Paul, E.A. 2003. **^{15}N-CPMAS nuclear magnetic resonance spectroscopy and biological stability of soil organic nitrogen in whole soil and particle-size fractions.** Organic Geochemistry. 34: 1635-1650.

Soil organic nitrogen was quantified by solid-state ^{15}N cross-polarization nuclear magnetic resonance spectroscopy (NMR) during a 14-month laboratory incubation of a sandy loam soil amended with ^{15}N-clover. In whole soil and particle-size fractions, the clover-derived N was always 85-90 percent amide, 5-10 percent guanidinium N of arginine, and 5 percent amino. Quantitativeness of these results was suggested by (1) analysis of a standard containing a complex mixture of organic ^{15}N, and (2) correlation of spectral intensities with ^{15}N concentrations. Based on the unchanging proteinaceous NMR signature of clover-derived N throughout the incubation, differences in the mineralization/immobilization kinetics of clover-N among the different particle-size fractions appeared not to be linked to organic functional group. Kinetic analysis of the mineralization of ^{15}N, with correction of rate constants for field temperatures, suggested that the proteinanceous ^{15}N in the clay and fine silt fractions observed here had a mean residence time of 7 years in the field.

34 Rudolph, C.; Burgdorf, S.J.; Conner, R.N.; [and others] 2002. **Prey handling and diet of Louisiana pine snakes (*Pituophis ruthveni*) and black pine snakes (*P. melanoleucus lodingi*), with comparisons to other selected colubrid snakes.** Herpetological Natural History. 9(1): 57-62.

Diet and prey handling behavior were determined for Louisiana pine snakes (*Pituophis ruthveni*) and black pine snakes (*P. melanoleucus lodingi*). Louisiana pine snakes prey heavily on Baird's pocket gophers (*Geomys breviceps*), with which they are sympatric, and exhibit specialized behaviors that facilitate handling this prey species within the confines of burrow systems. Black pine snakes, which are not sympatric with pocket gophers, did not exhibit these specialized behaviors. For

comparative purposes, prey handling of *P. sayi sayi* and *Elaphe obsoleta lindheimeri* was also examined.

35 United States Department of Agriculture, Southern Research Station. 2004. **Forest science in the South.** Science Update SRS-005. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 65 p.

This report summarizes the Southern Station's products, partnerships, and accomplishments during the period from October 2003 through September 2004. The volume includes a searchable CD.

36 United States Department of Agriculture, Southern Research Station. 2004. **Special forest products: a southern strategy for research & technology transfer** [brochure]**.** Science Update SRS-006. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. [Not paged].

This document outlines four strategic goals and actions designed to advance the knowledge base needed to manage forest resources for special forest products. The guide is intended to provide strategic direction for Southern Research Station research on the ecological, economic, and social sustainability of market and nonmarket special forest products, the inventory and monitoring of these products on public and private forest lands, and technology transfer efforts in the Southern Region, State and Private Forestry, and the National Forest System.

Research Work Units

Location & Project Leader	Unit	Name & Web Site	Phone
Asheville, NC David Loftis	4101	Ecology and Management of Southern Appalachian Hardwood Forests **www.srs.fs.usda.gov/bentcreek**	828-667-5261
Athens, GA John Stanturf	4104	Disturbance and the Management of Southern Pine Ecosystems **www.srs.fs.usda.gov/disturbance**	706-559-4315
Athens, GA Paula Spaine	4505	Insects and Diseases of Southern Forests **www.srs.fs.usda.gov/4505**	706-559-4285
Athens, GA Ken Cordell	4901	Assessing Trends, Values, and Rural Community Benefits from Outdoor Recreation and Wilderness in Forest Ecosystems **www.srs.fs.usda.gov/trends**	706-559-4264
Auburn, AL Charles McMahon	4105	Vegetation Management Research and Longleaf Pine Research for Southern Forest Ecosystems **www.srs.fs.usda.gov/4105**	334-826-8700
Auburn, AL Robert Rummer	4703	Biological/Engineering Systems and Technologies for Ecological Management of Forest Resources **http://www.srs.fs.usda.gov/forestops**	334-826-8700
Blacksburg, VA Andrew Dolloff	4202	Coldwater Streams and Trout Habitat in the Southern Appalachians **www.trout.forprod.vt.edu**	540-231-4016
Blacksburg, VA Philip Araman	4702	Integrated Life Cycle of Wood: Tree Quality, Processing, and Recycling **www.srs4702.forprod.vt.edu**	540-231-4016

Research Work Units

Location & Project Leader	Unit	Name & Web Site	Phone
Charleston, SC Carl Trettin	4103	Center for Forested Wetlands Research **www.srs.fs.usda.gov/charleston**	843-727-4271
Clemson, SC Susan Loeb	4201	Endangered, Threatened, and Sensitive Wildlife and Plant Species in Southern Forests **www.srs.fs.usda.gov/4201**	864-656-3284
Coweeta, NC James Vose	4351	Evaluation of Watershed Ecosystem Responses to Natural, Management, and Other Human Disturbances	828-524-2128
Knoxville, TN James Perdue	4801	Forest Inventory and Analysis **www.srsfia.usfs.msstate.edu**	865-862-2027
Monticello, AR James Guldin	4106	Managing Upland Forest Ecosystems in the Midsouth **www.srs.fs.usda.gov/4106**	870-367-3464
Nacogdoches, TX Ronald Thill	4251	Integrated Management of Wildlife Habitat and Timber Resources **www.srs.fs.usda.gov/wildlife**	936-569-7981
New Orleans, LA James Granskog	4802	Evaluation of Legal, Tax, and Economic Influences on Forest Resource Management **www.srs.fs.usda.gov/4802**	504-589-6652
Pineville, LA James Barnett	4111	Ecology and Management of Even-Aged Southern Pine Forests **www.srs.fs.usda.gov/4111**	318-473-7215

Research Work Units

Location & Project Leader	Unit	Name & Web Site	Phone
Pineville, LA Kier Klepzig	4501	Ecology, Biology, and Management of Bark Beetles and Invasive Forest Insects of Southern Conifers **www.srs.fs.usda.gov/4501**	318-473-7232
Pineville, LA Les Groom	4701	Utilization of Southern Forest Resources **www.srs.fs.usda.gov/4701**	318-473-7268
Raleigh, NC Steven McNulty	4852	Southern Global Change Program **www.sgcp.ncsu.edu**	919-513-2974
Research Triangle Park, NC Kurt Johnsen	4154	Biological Foundations of Southern Forest Productivity and Sustainability **www.rtp.srs.fs.usda.gov/soils/soilhome.htm**	919-549-4092
Research Triangle Park, NC Greg Reams	4803	Forest Health Monitoring **http://willow.ncfes.umn.edu/fhm/fhm_hp.htm**	919-549-4014
Research Triangle Park, NC David Wear	4851	Economics of Forest Protection and Management **www.rtp.srs.fs.usda.gov/econ**	919-549-4093
Saucier, MS Floyd Bridgwater	4153	Southern Institute of Forest Genetics	228-832-2747
Starkville, MS Terry Wagner	4502	Wood Products Insect Research **www.srs.fs.usda.gov/termites**	662-338-3100
Stoneville, MS Ted Leininger	4155	Center for Bottomland Hardwoods Research **www.srs.fs.usda.gov/cbhr**	662-686-3154

The Forest Service, United States Department of Agriculture (USDA), is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.