

**USDA Forest Service
Southern Research Station
Recent Publications—December 1999**

Proceedings of the Tenth Biennial Southern Silvicultural Research Conference—A Seriously Valuable Series Continues

The **Proceedings of the Tenth Biennial Southern Silvicultural Research Conference** includes 122 papers and 3 poster summaries that address a range of issues affecting southern forests. Program chair James D. Haywood, research forester with the Ecology and Management of Even-Aged Southern Pine Forests in Pineville, LA, edited the proceedings. Papers are grouped in 15 sessions that included upland hardwoods, intensive management of bottomland hardwoods, intermediate hardwood management, hardwood and bottomland regeneration, ecological relationships, water and soil hydrology, site preparation for pine establishment, artificial and natural regeneration of pines, intensive management of pines, pine fertilization, biometrics, insects and diseases, and landscape management. To receive a copy of the **Proceedings of the Tenth Biennial Southern Silvicultural Research Conference**, please request number 6.

The Eleventh Biennial Southern Silvicultural Research Conference in March 2001 will continue the tradition of providing a forum for the exchange of information among silviculturists and researchers in related areas, research coordination, review of research in progress, and new approaches or techniques of general interest. Knoxville, TN will host the conference March 19-22, 2001. If you want to contribute a paper, please contact Ken Outcalt, research plant ecologist with the Disturbance and Management of Southern Pine Ecosystems research work unit in Athens, GA. You can reach Dr. Outcalt by calling 706.559.4312 or sending an e-mail to koutcalt/srs_athens@fs.fed.us.

Forest Plants and Wildlife Uses

James H. Miller, USDA Forest Service, Southern Research Station forest ecologist, and Karl V. Miller, wildlife ecologist at the University of Georgia's School of Forest Resources in Athens, collaborated to write **Forest Plants of the Southeast and Their Wildlife Uses**. Published by the Southern Weed Science Society, this field-durable manual describes 330 plant species of the Southeast and summarizes wildlife uses for each plant genus. **Forest Plants of the Southeast and Their Wildlife Uses** includes 644 color photographs of herbaceous plants, grasses, shrubs, woody vines, palms, and ferns common to forests, rights-of-way, and natural areas. The book includes native, wetland, and exotic plants. Descriptions and photographs of plants appear on facing pages, making identification easier. Extra-high resolution photographs will appear in the companion CD, available in February 2000.

Southeastern forests include complex communities of plants, animals, insects, and microorganisms. The critical need to better understand the intricate relationships that have evolved over millions of years—and the effects of humans on the entire ecosystem—helped motivate James Miller and Karl Miller to write **Forest Plants of the Southeast and Their Wildlife Uses**. Foresters, botanists, and wildlife

biologists will find this book helpful in the classroom and in the field. Natural resource managers, private landowners, and naturalists will also be comfortable with this manual.

You can purchase **Forest Plants of the Southeast and Their Wildlife Uses** for \$36 (includes shipping and handling) by contacting the Southern Weed Science Society. Please send your request and check to 1508 West University Avenue, Champaign, IL 61821-3133. You can call (217.352.4212) or send an e-mail to raschwssa@aol.com. Proceeds will support the Society's graduate programs.

James Miller, honored by the Southern Weed Science Society as the 1999 Scientist of the Year, performs research at the Southern Research Station's Vegetation Management Research and Longleaf Pine Ecosystems research work unit at Auburn University. Co-author Karl Miller is widely recognized for his research related to the impacts of forest management practices on wildlife habitat. With John C. Kilgo and Winston P. Smith, Miller co-authored **Effects of group-selection timber harvest in bottomland hardwoods on fall migrant birds**. Select number **8** to receive a copy of this publication.

Annual Report for the Southern Research Station

Research generates knowledge, our most important product. We want you to know what the Southern Research Station accomplishes, and the **Annual Report for 1998–Southern Research Station** provides a concise picture of our work for the period from October 1997 through September 1998. The annual report also details the strategies we have developed with you for the 21st century and explains how we spend your tax dollars. Increasing knowledge about forested environments of the South and transferring that information to you comprise two of our most important goals. Please request **AR** so we can share our progress report with you.

Tax Tips for Forest Landowners

Larry Bishop of the USDA Forest Service Southern Region comes through again with concise information to help forest landowners prepare their taxes. **Tax Tips for Forest Landowners for the 1999 Tax Year** covers basis and tax records; passive loss rules; reforestation tax credit and amortization; capital gains and self-employment taxes; cost-share payments; conservation reserve program; casualty losses; and management and maintenance expenses. The Southern Region's web site includes this report; go to www.r8web.com, then to [taxtips](#). You can also print **Tax Tips for Forest Landowners for the 1999 Tax Year** by visiting the Southern Research Station Web site, www.srs.fs.fed.us; click on the USDA Forest Service site, then go to the Southern Region site.

Recent Publications–December 1999

Burke, Marianne K.; Lockaby, B. Graeme; Conner, William H. 1999. **Aboveground production and nutrient circulation along a flooding gradient in a South Carolina Coastal Plain forest.** Canadian Journal of Forest Research. 29: 1402-1418.

Relative to effects of flooding, little is known about the influence of hydrology-nutrient interactions on aboveground net primary production (NPP) in forested wetlands. The authors found that nutrient circulation and NPP were closely related along a complex physical, chemical, and hydrologic gradient in a bottomland hardwood forest with four distinct communities. Aboveground biomass, NPP, biomass partitioning to stem production, growth efficiency, and soil macronutrient availability were greatest in the flooded zone, possibly because of the stable hydrologic regime. In the wet transition zone, trees were least productive, nutrient use efficiency was highest, and N retranslocation from foliage before abscission was "complete." Wet and dry transition zones had the lowest litterfall quality. Soil organic matter was negatively correlated with extractable $\text{NH}_4\text{-N}$ plus $\text{NO}_3\text{-N}$ before in situ incubations and positively correlated with litterfall lignin/N ratios. Lignin/P and C/N ratios were positively correlated with exchangeable soil Ca and Mg, cation exchange capacity, and clay content, and negatively correlated with extractable soil P. The scientists concluded that periodic flooding and associated widely fluctuating soil chemistry resulted in disequilibrium between the plant community and environmental conditions, which led to nutrient deficiency and low NPP in the transition zones compared with the continuously flooded and mesic zones. (1)

Cain, Michael D. 1999. **Woody and herbaceous competition effects on stand dynamics and growth of 13-year-old natural, precommercially thinned loblolly and shortleaf pines.** Canadian Journal of Forest Research. 29: 947-959.

Stand dynamics of naturally regenerated, even-aged, loblolly pines (*Pinus taeda* L.) and shortleaf pines (*P. echinata* Mill.) were examined on the Upper Coastal Plain of southeastern Arkansas, U.S.A., following four levels of competition control. Treatments included a check (Ck) with no competition control, woody control (WC), herbaceous control (HC), and total control (TC) of nonpine vegetation. After pines became established from natural seeding, herbicides were used to control herbaceous plants for four consecutive years and woody plants for five consecutive years. At age five, 1235 crop pines/ha were retained and all noncrop pines >1.5 m tall were precommercially hand thinned. Although 93 percent of crop pines on Ck plots were judged free-to-grow 13 years after establishment, crop pines on vegetation control plots were larger ($P \leq 0.001$) in mean diameter at breast height, total height, and volume per tree. From age 5 through 13 years, crop pine diameter growth increased on WC plots and decreased on HC plots because of hardwood competition in the latter treatment. At age 13, mean pine volume production was 48 percent greater ($P < 0.01$) on plots that received competition control than on Ck plots ($160 \text{ m}^3 \text{ ha}^{-1}$); TC resulted in 31 percent more ($P < 0.01$) volume ($282 \text{ m}^3 \text{ ha}^{-1}$) than the mean of WC and HC plots; and there was no difference ($P = 0.15$) between the latter two treatments. (2)

Elliott, Katherine J.; Vose, James M.; Swank, Wayne T.; Bolstad, Paul V. 1999. **Long-term patterns in vegetation-site relationships in a southern Appalachian forest.** Journal of the Torrey Botanical Society. 126(4): 320-334.

The authors used permanent plot inventories from 1969-1973 and 1988-1993 to describe forest species distribution patterns of the Coweeta Hydrologic Laboratory, a 2,185 ha basin in Western North Carolina, USA. They used canonical correspondence analysis to explore the vegetation-site patterns for the 1970's and 1990's inventories combined. Site variables were determined by direct measurements or calculated by digital geographical information system mapping methods. Site variables were percent slope, elevation, terrain shape, precipitation, modified azimuth, soil organic matter content, soil depth, soil clay content, depth of A-horizon, potential solar radiation, and mean temperature during the growing season. Fifty percent of the variation in the vegetation distribution was explained by the site variables used in the canonical correspondence analysis. Soil organic matter, terrain shape, and elevation were the variables most strongly related to vegetation distribution. Species associated with convex terrain (upper slopes and ridges), such as *Pinus rigida*, *Quercus coccinea*, and *Quercus velutina*, decreased in abundance from the 1970's to the 1990's; species associated with soils having high organic matter content and deep A-horizons, such as *Liriodendron tulipifera*, *Rhododendron maximum*, and *Tsuga canadensis* increased in abundance. Individual species responded differently to site gradients. For example, *Acer rubrum*, *Quercus prinus*, *Oxydendrum arboreum*, and *Nyssa sylvatica* were located in the center of the ordination space (i.e., their occurrence was not related to any of the site variables), which suggests that these species are habitat generalists. (3)

Haines, Terry K.; Cleaves, David A. 1999. **The legal environment for forestry prescribed burning in the South: regulatory programs and voluntary guidelines.** Southern Journal of Applied Forestry. 23(3): 170-174.

Southern States vary widely in their approaches to regulation and liability protection for prescribed burning. Most State air quality laws exempt prescribed burning from many open burning rules; however, monetary penalties are established for the rules that do apply. Forest protection laws address escaped fire and require permits or notification in all but two States. So-called "certified burner" laws have been passed in six States to limit liability for experienced burners who attend training courses and adhere to applicable air quality and forest protection laws and regulations. (4)

Harrington, Timothy B.; Edwards, M. Boyd. 1999. **Understory vegetation, resource availability, and litterfall responses to pine thinning and woody vegetation control in longleaf pine plantations.** Canadian Journal of Forest Research. 29: 1055-1064.

In six 8- to 11-year-old plantations of longleaf pine (*Pinus palustris* Mill.) near Aiken, S.C., responses of understory vegetation, light, and soil water availability and litterfall were studied in relation to pine thinning (May 1994), herbicidal treatment of nonpine woody vegetation (1995-1996), or the combined treatments (treatment responses described below are in absolute units). Treatment differences in fifth-year (1998 herbaceous species density were as described below are in absolute units). Treatment

differences in fifth-year (1998) herbaceous species density were as follows: pine thinning > woody control = combined treatments > untreated (33, 30, 30, and 25 species per 40 m², respectively). Forb and grass covers were 13 and 8 percent greater, respectively, after pine thinning, and 7 and 9 percent greater after woody control. Pine thinning stimulated a large increase in third-year gap fraction (0.26), short-term increases in soil water content (1 percent), and a reduction in pine litterfall by half (–120 g·m⁻² per year). Woody control had no effect on gap fraction, decreased litterfall of nonpine woody vegetation (–32 g·m⁻² per year), and stimulated season-long increases in soil water content (1–2 percent). The ranking of factors affecting herbaceous vegetation responses was as follows: light > soil water > herbicides > litterfall. Herbaceous species density and cover can be promoted in longleaf pine plantations by intensive thinning of pines and herbicidal control of nonpine woody vegetation. (5)

Haywood, James D., ed. 1999. **Proceedings of the tenth biennial southern silvicultural research conference**; 1999 February 16-18; Shreveport, LA. Gen. Tech. Rep. SRS-30. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 618 p.

One hundred and twenty-two papers and three poster summaries address a range of issues affecting southern forests. Papers are grouped in 15 sessions that included upland hardwoods, intensive management of bottomland hardwoods, intermediate hardwood management, hardwood and bottomland regeneration, ecological relationships, water and soil hydrology, site preparation for pine establishment, artificial and natural regeneration of pines, intensive management of pines, pine fertilization, biometrics, insects and diseases, and landscape management. (6)

Howell, Michael; Ford, Eric. 1999. **Florida's timber industry—an assessment of timber product output and use, 1997**. Resour. Bull. SRS-43. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 32 p.

In 1997, volume of roundwood output from Florida's forests totaled 517 million cubic feet, 2 percent less than in 1995. Mill byproducts generated from primary manufacturers remained stable at 162 million cubic feet. Almost all plant residues were used primarily for fuel and fiber products. Pulpwood was the leading roundwood product at 288 million cubic feet; saw logs ranked second at 162 million cubic feet; veneer logs were third at 30 million cubic feet. Total receipts declined 6 percent to 532 million cubic feet. The number of primary processing plants declined from 113 in 1995 to 101 in 1997. (7)

Kilgo, John C.; Miller, Karl V.; Smith, Winston P. 1999. **Effects of group-selection timber harvest in bottomland hardwoods on fall migrant birds**. *Journal of Field Ornithology*. 70(3): 404-413.

Due to projected demands for hardwood timber, development of silvicultural practices that provide for adequate regeneration in southeastern bottomland hardwoods without causing undue harm to wildlife resources is critical. Group-selection silviculture involves harvesting a small group of trees, which creates a canopy gap (usually <2 ha in size). The objectives were to determine the extent of use of group-selection harvest gaps by fall migrant birds, to compare experimentally use of three sizes of gaps (10-m, 20-m, and 40-m radius), and to compare use of locations within gaps (center, edge, and adjacent

forest). The authors captured 210 birds of 36 species in 1692 mist-net hours. Total captures were greater in 40-m radius gaps than in 20- and 10-m radius gaps and were greater in gap centers than at gap edges and adjacent forest. Forest interior/interior-edge Neotropical migrants and interior-edge short-distance migrants were captured most often in the centers of the largest gaps. Kilgo, Miller, and Smith captured no interior-edge short-distance migrants or field-edge birds of any migratory group in the adjacent forest. A threshold gap size determining use by migrant birds may exist between 20 and 40 m in radius. Though reasons for greater capture success in gaps are unclear, forest interior Neotropical and short-distance migrants apparently shifted their habitat preferences during fall to include forest gap habitat. (8)

Klepzig, Kier D.; Schlyter, Fredrik. 1999. **Laboratory evaluation of plant-derived antifeedants against the pine weevil *Hylobius abietis* (Coleoptera: Curculionidae)**. Forest Entomology. 92(3): 644-650.

The authors assayed 12 plant-derived and 1 insect-produced allelochemicals—verbenone, borneol, bornyl acetate, carvone, cucurbitacin, myrcene, limonin, 4-allylanisole, α -pinene, β -pinene, limonene, and coumarin—for inhibition of feeding by the pine weevil *Hylobius abietis* L. Scots pine twigs were treated with these compounds dissolved in ethyl acetate solvent, and adult weevils were fed for 48 h on the twigs in both choice and no-choice assays. Coumarin, carvone, verbenone, and limonin were consistently inhibitory to feeding by both male and female *H. abietis*. Borneol and 4-allylanisole also demonstrated some activity as an antifeedant compound against *H. abietis*. The remainder of the compounds did not consistently inhibit weevil feeding. Sex of weevils or temperature in cold storage (10 or 5°C) did not consistently affect amount of bark feeding. A 48-h feeding period gave more distinct effects for active compounds than did a 24-h test. (9)

Kush, John S.; Meldahl, Ralph S.; Boyer, William D. 1999. **Understory plant community response after 23 years of hardwood control treatments in natural longleaf pine (*Pinus palustris*) forests**. Canadian Journal of Forest Research. 29: 1047-1054.

In 1973, a study was established in south-central Alabama, U.S.A., to determine the effects of hardwood control treatments on understory succession and overstory growth in natural stands of longleaf pine (*Pinus palustris* Mill.). The treatments were seasonal biennial burns and a no-burn check, each combined with three supplemental hardwood control treatments (one-time chemical, periodic mechanical, and untreated check). Green vegetation less than 1 cm d.b.h. and organic litter were destructively sampled to determine the effects of 23 years of treatments on understory vegetation and identify changes in this community since last sampled in 1982. Among the hardwood control treatments, the only significant differences occurred in the shrub and green biomass (total of tree, shrub, woody vine, and herbaceous species masses) component of the understory. There were significant differences for all vegetation components when comparing the burning to no-burn treatment. Green biomass estimates were variable but showed an increase for all but two of the 12 treatment combinations when compared to 1982 biomass. The major change occurred in the accumulation of organic litter, which increased 119 percent when averaged across all treatments. The chemical treatment did not eliminate any species when compared with the other hardwood control treatments. (10)

Landers, J. Larry; Boyer, William D. 1999. **An old-growth definition for upland longleaf and south Florida slash pine forests, woodlands, and savannas.** Gen. Tech. Rep. SRS-29. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 15 p.

Upland longleaf pine forests, woodlands, and savannas once occupied most of the Atlantic and Gulf Coastal Plains from southeastern Virginia south through the northern two-thirds of Florida and west to east Texas, with extensions into the Piedmont and mountains of Alabama and northwest Georgia. South Florida slash pine is native to the southern half of peninsular Florida. The probable structure of and variability in old-growth forests, woodlands, and savannas of these two overlapping and fire-dependent ecosystems are described based on all available information. A number of old-growth attributes are listed for both species, including estimates of the variability that can be expected in these attributes. **(11)**

Lo Bianco, Riccardo; Rieger, Mark; Sung, She-Jean S. 1999. **Activities of sucrose and sorbitol metabolizing enzymes in vegetative sinks of peach and correlation with sink growth rate.** Journal of the American Society of Horticulture Science. 124(4): 381-388.

Terminal portions of 'Flordaguard' peach roots (*Prunus persica* ((L.) Batsch) were divided into six segments and the activities of NAD⁺-dependent sorbitol dehydrogenase (SDH), sorbitol oxidase (SOX), sucrose synthase (SS), soluble acid invertase (AI), and soluble neutral invertase (NI) were measured in each segment 10, 15, and 20 days after seed germination. The same type of experiment was conducted with terminal portions of 'Flordaguard' and 'Nemaguard' peach shoots except that one of the six segments consisted of the leaflets surrounding the apex. Independent of the age of individual roots, activities of SDH and AI were consistently highest in the meristematic portion and decreased with tissue maturation. In shoots, AI was the most active enzyme in the elongating portion subtending the apex, whereas SDH was primarily associated with meristematic tissues. A positive correlation between SDH and AI activities was found in various developmental zones of roots ($r = 0.96$) and shoots ($r = 0.90$). Sorbitol and sucrose contents were low in roots regardless of distance from tip, while sucrose showed a decreasing trend with distance and sorbitol, fructose, and glucose increased with distance from the meristem in shoots. Activity of SDH in internodes, but not apices, correlated with shoot elongation rate of both cultivars, whereas activities of other enzymes did not correlate with shoot elongation rate. The authors conclude that AI and SDH are the predominant enzymes of carbohydrate catabolism and the best indicators of sink growth and development in vegetative sinks of peach. **(12)**

Michael, Jerry L.; Webber, E. Cliff; Bayne, David R.; and others. 1999. **Hexazinone dissipation in forest ecosystems and impacts on aquatic communities.** Canadian Journal of Forest Research. 29: 1170-1181.

Hexazinone (active ingredient) was aerially applied as a pellet (Velpar ULW) and as a liquid (Velpar L) to watersheds in the Piedmont of Alabama, U.S.A., at the rate of 6.72 kg·ha⁻¹ (three times the prescribed rate for this site). An untreated watershed served as a control. The authors determined hexazinone half-life in days for Velpar ULW (plants, 26-59; litter, 55; bare soil, 68; soil under litter, 74) and for Velpar L (plants, 19-36; litter, 56; bare soil, 77; soil under litter, 275). Maximum stream concentrations of hexazinone (422 µg·L⁻¹ for Velpar ULW;

473 $\mu\text{g}\cdot\text{L}^{-1}$ for Velpar L) were observed during application and resulted from direct overspray. Hexazinone stream concentrations peaked several times during stormflow in the first 30 days (56-70 $\mu\text{g}\cdot\text{L}^{-1}$ for Velpar ULW; 145-230 $\mu\text{g}\cdot\text{L}^{-1}$ for Velpar L) and were diluted three to five times 1.6 km downstream. Hexazinone metabolites were also monitored. Exposure of macroinvertebrates to hexazinone did not alter benthic community structure. Taxa richness, including pollution-sensitive insects, did not differ significantly between either hexazinone treatment and the control. Benthic macroinvertebrates in Piedmont streams of the southeastern United States appear insensitive to hexazinone at the exposures observed in this study. (13)

Miller, James H.; Boyd, Robert S.; and Edwards, M. Boyd. 1999. **Floristic diversity, stand structure, and composition 11 years after herbicide site preparation.** Canadian Journal of Forest Research. 29: 1073-1083.

This study tested for effects of site preparation herbicides applied at high labeled rates 11 years earlier on plant species richness, diversity, and stand structure and composition. Four study sites in three physiographic provinces were established in central Georgia in 1984. Six herbicide treatments were included on each site: hexazinone liquid, hexazinone pellets, glyphosate, triclopyr, picloram, and a mixture of dicamba and 2,4-dichlorophenoxyacetic acid (2,4-D). Herbicide and untreated plots were prescribed-burned and planted to loblolly pine (*Pinus taeda* L.). Eleven years after treatment, 177 total species were identified in these dense pine plantations; 99 species were forbs and grasses-grasslikes. Treated and check plots did not differ in species richness or diversity. Structurally, the total basal area of the tree canopy was not significantly altered, but the proportion of pine to hardwoods and shrub stem density were influenced by treatment. Latent effects were detected in the abundance and frequency of *Pinus taeda*, *Prunus serotina* Ehrh., *Quercus stellata* Wangenh., *Diospyros virginiana* L., *Vaccinium stamineum* L., *Vitis rotundifolia* Michx., and *Lespedeza bicolor* Turcz. Most are potential mast producers for wildlife. Herbicide site preparation had little influence on total species numbers or their diversity 11 years after treatment but affected composition by altering perennial species abundance. (14)

Outcalt, Kenneth W.; Williams, Marcus E.; Onokpise, Oghenekome. 1999. **Restoring *Aristida stricta* to *Pinus palustris* ecosystems on the Atlantic Coastal Plain, U.S.A.** Restoration Ecology. 7(3): 262-270.

Aristida stricta (wiregrass), a perennial bunchgrass, quickly accumulates dead leaves, which along with the shed needles of *Pinus palustris* (longleaf pine) provide the fuel for frequent surface fires. Thus, historically, wiregrass played a key role in many longleaf communities where it significantly influenced the natural fire regime and thereby the composition of the plant community. Reestablishment of wiregrass is, therefore, critical to restoring the native understory of Atlantic Coastal Plain longleaf pine ecosystems. This study measured the effects of different site preparations and fertilizer application on the survival and growth of wiregrass seedlings. Two-month-old seedlings were underplanted in existing longleaf pine stands on dry Lakeland soils at the Savannah River Site in South Carolina. Survival was acceptable at 51 percent after four years, although reduced owing to drought and small seedling size. Survival and growth could both be increased by using older seedlings with an initial height of at least 6 cm. Wiregrass leaves grew quite rapidly and attained an average length of 48 cm in four years on control plots. Basal area growth rate was greater than expected, averaging 40 percent on control treatments and 55 percent on cultivated and fertilized plots. (15)

Parresol, Bernard R. 1999. **Assessing tree and stand biomass: a review with examples and critical comparisons.** Forest Science. 45(4): 573-593.

There is considerable interest today in estimating the biomass of trees and forests for both practical forestry issues and scientific purposes. New techniques and procedures are brought together along with the more traditional approaches to estimating woody biomass. General model forms and weighted analysis are reviewed, along with statistics for evaluating and comparing biomass models. Additivity and harmonization are addressed, and weight-ratio and density-integral approaches are discussed. Subsampling methods on trees to derive unbiased weight estimates are examined, and ratio and difference sampling estimators are considered in detail. Error components for stand biomass estimates are examined. This paper reviews quantitative principles and gives specific examples for prediction of tree biomass. The examples should prove useful for understanding the principles involved and for instructional purposes. (16)

Perry, Roger W.; Thill, Ronald E. 1999. **Estimating mast production: an evaluation of visual surveys and comparison with seed traps using white oaks.** Southern Journal of Applied Forestry. 16(3): 164-169.

Perry and Thill compared five types of visual mast surveyed with seed trap data from 105 white oaks (*Quercus alba* L.) during 1996-1997 in the Ouachita Mountains of Arkansas. They also evaluated these visual survey methods for their usefulness in detecting differences in acorn density among areas. Indices derived from all five methods were highly correlated with acorn densities derived from traps, and the Koenig method had the highest r-values. Categorical surveys using fewer than six categories yielded significantly different acorn densities among all categories, whereas surveys using nine or ten categories did not. All survey methods detected moderate to large acorn density differences among four study areas. The authors found no difference in the effectiveness of visual survey in dense versus open-forested conditions. Visual surveys are an effective method for evaluating acorn production and may be superior to seed traps for comparisons of acorn production in tree canopies since they are not affected as greatly by wildlife removal. However, visual surveys can be biased by observer differences, whereas trap data are not. (17)

Reams, Gregory A.; Roesch, Francis A.; Cost, Noel D. 1999. **Annual forest inventory: cornerstone of sustainability in the South.** Journal of Forestry. 97(12): 21-26.

With many competing uses and large regional shifts in forestland use, the sustainability of southern forests is being questioned. The new Southern Annual Forest Inventory System (SAFIS) is being implemented to address regional, State, and national questions regarding past, current, and projected changes in the southern forest. The annual inventory system will provide the information needed to closely monitor and quantify the landscape dynamics of southern forests. These annual inventory data will form the basis of State, regional, and national forest sustainability assessments. (18)

Reams, Gregory A.; Van Deusen, Paul C. 1999. **The Southern Annual Forest Inventory System.** Journal of Agricultural, Biological, and Environmental Statistics. 4(4): 346-360.

The Southern Annual Forest Inventory System (SAFIS) is in various stages of implementation in 7 of the 13 southern states serviced by the Southern Research Station. The SAFIS design is an interpenetrating design where the n units (1/6 acre plots) are divided into $k = 5$ panels, each panel containing $m = n/k$ units. Panel 1 plots are measured in year 1, panel 2 in year 2, etc., such that all plots have been visited by the end of year 5. The panel cycle is repeated into perpetuity. Each panel, in effect, is a 5-year periodic survey with complete overlap of sample units. Numerous estimation schemes are possible, and the authors explore five possible options. The five options are (1) use existing periodic inventory programs to produce 5-year survey estimates by adjusting all five panels to a common year; (2) analyze each annual panel independently; (3) produce 5-year estimates by combining the five panel estimates by varying the weight given to each panel; (4) base inventory estimates on mixed estimation where actual and predicted values are combined; and (5) use imputation techniques such that unmeasured plots are filled in with imputed plots. A two-phase method for forest area estimation that uses the known map marginals from a thematic map is presented as an alternative to photo interpretation-based estimates. (19)

Roesch, Francis A.; Reams, Gregory A. 1999. **Analytical alternatives for an annual inventory system.** Journal of Forestry. 97(12): 33-37.

Methods for analyzing data from the Southern Annual Forest Inventory System (SAFIS) are discussed. Differences between the annual inventory approach and the more traditional periodic approach require that we revisit the previous assumption that there are no important spatial and temporal trends in the data. Over the next few years, the USDA Forest Service Southern Research Station will be evaluating models of varying complexity to determine the most efficient estimation approach for each variable, at all spatiotemporal scales of interest. (20)

Schmidting, R.C.; Carroll, E.; LaFarge, T. 1999. **Allozyme diversity of selected and natural loblolly pine populations.** Silvae Genetica. 48(1): 35-45.

Loblolly pine (*Pinus taeda* L.) megagametophytes and embryos were examined electrophoretically to compare the extent and distribution of genetic variability in allozymes of selected and wild populations. Range-wide collections of three different types were investigated in this study. These consisted of seed sampled from (1) a provenance test established in 1953; (2) bulk seed sampled from collections obtained from natural stands; and (3) seed harvested from clones used to produce improved seed in a tree improvement program.

All 18 loci tested were found to be polymorphic. The average number of alleles overall (N_a) was 3.8. Expected heterozygosities (H_e) varied from 0.193 in the 70-year old orchard clones, to 0.174 in the 40-year-old provenance test samples, to 0.163 in the embryos of the bulk collections. The maximum F_{ST} was 0.066 for the provenance test populations, which indicates that only a small proportion (6.6 percent) of the total variation in allozymes was attributed to population differences. In spite of this, the populations were well differentiated in multivariate analysis.

In controlled-pollinated progeny tests of the orchard selections, there was a negative association between growth and the presence of rare alleles in the parent. A rare allele at the IDH locus was

associated with slower growth, probably because it indicated hybridization with the slower-growing shortleaf pine (*P. echinata* Mill.).

Allozyme variation as well as variation in cortical monoterpenes and fusiform rust resistance suggests that loblolly pine resided in two refugia during the Pleistocene; one in south Texas/northeast Mexico and one in south Florida/Caribbean. The two populations migrated to the northern Gulf Coastal Plain at the beginning of the Holocene and merged just east of the Mississippi River. (21)

Schweitzer, Callie Jo. 1999. **Forest statistics for west central Tennessee, 1997**. Resour. Bull. SRS-44. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 52 p.

This report summarizes a 1997 inventory of the forest resources of an 11-county area of Tennessee. Major findings are highlighted in text and graphs; detailed data are presented in 51 tables. (22)

Strom, B.L.; L.M. Roton, Goyer, R.A.; Meeker J.R. 1999. **Visual and semiochemical disruption of host finding in the southern pine beetle**. Ecological Applications. 9(3): 1028-1038.

The importance of visual silhouettes for host finding by the southern pine beetle (SPB), *Dendroctonus frontalis* (Coleoptera: Scolytidae), and the potential for disruption of this process using visual deterrents were evaluated with multiple-funnel traps, painted white or black, and with clear, white, or black Plexiglas sticky panels. All traps and panels were baited with the SPB attractant frontolure. The effect of combined semiochemical and visual disruption was evaluated in funnel traps by including the antiaggregation pheromone verbenone, or the repellent/inhibitory host compound 4-allylanisole, in addition to the attractant. Visual treatments had a highly significant effect on catch of SPB and the predatory clerid beetle *Thanasimus dubius*. In attractant-baited traps, white paint alone reduced the average number of SPB caught by 72 percent in Florida and 68 percent in Louisiana. The repellent 4-allylanisole reduced catch of SPB by 56 percent in Florida and 45 percent in Louisiana. Verbenone was eluted at 25 percent of the targeted rate and did not affect total catch in either place. White panels trapped 79 percent fewer SPB than black, and 55 percent fewer than clear, with both differences significant. Clear panels also caught significantly fewer (-54 percent) SPB than black panels. Capture of *T. dubius* was reduced significantly by clear (-61 percent) or white (-56 percent) panels compared to black but did not differ significantly between clear and white panels. The percentage of female SPB captured was not significantly changed by visual treatments but was, as expected, reduced by verbenone. Neither visual nor semiochemical treatments influenced the sex ratio of *T. dubius*. The potential for using visual disruptants for protection of trees was assessed in front of a single SPB infestation by painting trees either white or black to 4.5 m. White trees showed fewer landings by SPB and a reduced density of successful and total SPB attacks within, but not above, the painted area. These results show that both SPB and *T. dubius* can be significantly affected by altering visual silhouettes, and that visual and semiochemical treatments, especially used in combination, may increase effectiveness of bark beetle disruption strategies. (23)

Trettin, C.C.; Johnson, D.W.; Todd, D.E., Jr. 1999. **Forest nutrient and carbon pools at Walker Branch watershed: changes during a 21-year period**. Soil Science Society of America Journal. 63: 1436-1448.

A 21-yr perspective on changes in nutrient and C pools on undisturbed upland forest sites is provided. Plots originally representing four cover types have been sampled three times. On each plot, forest biomass, forest floor, and soil, to a depth of 60 cm, were measured, sampled, and analyzed for Ca, Mg, C, N, and P. Exchangeable soil Ca and Mg have declined in most soils. Despite the low exchangeable Ca, cumulative sequestration in the biomass has exceeded the soil pool, suggesting that soil supplies below 60 cm are satisfying the biomass demand. Extractable soil P also declined, with means ranging from 4.2 to 18.2 kg ha⁻¹, as a result of reductions in the mineral soil and Oi horizon. The loss of extractable soil P exceeded biomass sequestration in all but one plot, suggesting abiotic soil processes as the removal mechanism. Soil C and N were either stable, although highly variable, or declined, which was unexpected in these undisturbed sites. The net C balance of these sites was controlled by aboveground sequestration, which offset changes in the soil and forest floor. Soil parent material and geomorphic setting strongly influenced the changes in soil properties during the 21-yr period, reflecting the importance of those factors in assessing soil nutrient and C cycles over that of forest cover type. The variability encountered in the periodic soil measurements highlights the difficulty in detecting temporal changes in soil chemical properties. (24)

Weng, C.; Kubisiak, T.L.; Stine, M. 1998. **Scar markers in a longleaf pine × slash pine F₁ family.** *Forest Genetics*. 5(4): 239-247.

Sequence characterized amplified region (SCAR) markers were derived from random amplified polymorphic DNAs (RAPDs) that segregate in a longleaf pine x slash pine F₁ family. Nine RAPD fragments, five from longleaf pine and four from slash pine, were cloned and end sequenced. A total of 13 SCAR primer pairs, with lengths between 17 and 24 nucleotides, were developed. Nine (for SCAR loci FGP004, FGP005, FGE006, FGE007, FGP008, FGE009, FGPO10, FGE011, and FGP012) were designed by extending the RAPD primers; three (for FGE001, FGP002, and FGE003) were based on the internal sequences of corresponding cloned RAPD fragments; and one (for FGP013) was based on the sequence of the original cloned RAPD fragment as well as the sequence of the cloned SCAR fragment amplified from the other parent. All SCAR primer pairs amplified bands of expected sizes. The primer pairs for FGP004, FGE006, and FGE007 amplified polymorphic bands between the parents. The primer pair for FGP013 revealed a polymorphism between the parents, but lost the within-tree polymorphism. The other nine primer pairs amplified monomorphic bands when separated on agarose gels. A polymorphism between the parents was identified for FGP005 by digesting the polymerase chain reaction (PCR) products with the restriction enzyme *Sma*I. FGP005 and FGPO12 were found to be polymorphic when the PCR products were separated on a 3 percent acrylamide sequencing gel. The segregation of four of the six polymorphic SCARs was confirmed in 64 longleaf x slash F₁ individuals. (25)