

**USDA Forest Service
Southern Research Station
Recent Publications -- September 1999**

Mountain Roads and Water Quality

Roads and sedimentation figure heavily in the water quality of streams on public and private lands. Lloyd W. Swift, Jr., research forester at Coweeta Hydrologic Laboratory, and Richard G. Burns, hydrologist at the National Forests in North Carolina in Asheville, take a pragmatic approach to improving existing roads and thereby causing less water runoff, erosion, and degradation of streams. **The Three R's of Roads: Redesign, Reconstruction, and Restoration**, written by Swift and Burns, appears in the August 1999 issue of *Journal of Forestry* devoted to roads. Swift and Burns state that many old roads in the Southern Appalachian Mountains were constructed along river and stream bottoms, prior to today's awareness of best management practices. In the Southern Appalachians, complexity of mixed ownership, the age of the roads, and the cost of road construction make improving roads a tough proposition. Swift and Burns offer practical, economical solutions based on good science and demonstrated on rugged terrain subject to sometimes severe weather. **The Three R's of Roads: Redesign, Reconstruction, and Restoration** can function as a great technology transfer tool for many geographic settings because, as the authors say, ". . . the principles and practices could apply wherever storms and roads are placing sediment in the stream and where the forest floor has the capability to absorb and filter runoff from roads." To get a copy of this publication, request number **40**.

Saving the Sycamore

T. D. Leininger, J.D. Solomon, A.D. Wilson, and N.M. Schiff, Southern Research Station scientists, worked with the Mississippi Agricultural and Forestry Experiment Station and the Southern Hardwood Forest Research Group Southern to produce **A Guide to Major Insects, Diseases, Air Pollution Injury, and Chemical Injury of Sycamore**. The sycamore, one of the largest and most distinctive in the eastern deciduous forests, grows fast, lives long, and ranges naturally from east of the Great Plains, except for Minnesota, from southern Ontario to southeastern Georgia. Homeowners, urban planners, and woodland managers value sycamore – its broad, dense crown provides shade; the white, exfoliating bark makes it attractive as an ornamental as far west as California; its rapid growth and biomass density favor its selection for timber. Unfortunately, the sycamore attracts numerous insects, suffers from a variety of diseases, and is showing the effects of air pollution and chemical injury. In 44 pages, **A Guide to Major Insects, Diseases, Air Pollution Injury, and Chemical Injury of Sycamore** presents information about the major threats to the sycamore and documents pests, disease stages, and injury states in 85 color plates.

T. D. Leininger and A.D. Wilson are research plant pathologists at the Southern Hardwoods Laboratory in Stoneville, MS. J.D. Solomon, research entomologist, emeritus, and Nathan Schiff is research entomologist at the Southern Hardwoods Laboratory. The authors have produced a book packed with details that can help a broad audience understand and recognize pests and diseases, and take action to protect and improve the health of the sycamore. To request your copy, ask for publication number **29**.

Pest Image Libraries for Southern Hardwoods on CD-ROM's

A.D. Wilson, research plant pathologist, and D.G. Lester, former biological science technician, at the Center for Bottomlands Hardwood Research, Stoneville, MS, have developed a series of Forest Insect and Disease Research (FIDR) pest recognition CD-ROM's. Written in Visual Basic (for Windows), the CD's display images and information on insect and disease pests of selected southern hardwoods and other hosts. The pest image CD's include **Ash Pests, Oak Wilt, Cottonwood Pests, Oak Pests, and North American Hardwood Borer** image libraries. Two additional CD's, one on **Clavicipitaceous Endophytes** (fungi beneficial to plants, but toxic to pests) and another on the **Indian Paint Fungus** (an important wood decay fungus) provide information on specific economically important fungi.

Wilson and Lester designed the image library CD's as quick references and guides to provide users with diagnostic tools to aid in the rapid identification and diagnosis of forest insect and disease pests of southern hardwood species. Some of the CD's show different life stages of pests, lists of hosts, and are easily searched. The pest image CD's produced by the Center for Bottomland Hardwood Research are the first on forest health to be produced entirely in-house by the USDA Forest Service. Each library contains between 100 and 300 or more full-color and black and white images, arranged by topic, with descriptive text captions or paragraphs describing diagnostic characters. Each image requires less than 1 second to load and display on monitors interfaced to 100 MHz or faster computers. A zoom feature is included for extra detail. Topics include insects, diseases, and abiotic incitants of forest pest problems. Some image libraries, such as the **Oak Wilt Image Library**, provide access to current research activities and results on selected insect and disease problems under investigation at the Southern Hardwoods Laboratory. The CD's operate on 486 or faster IBM-compatible computers with SVGA monitor, Windows 3.x, 95 or 98, mouse or graphics tablet, or faster CD-ROM drive, and run directly off of the CD to conserve hard drive space. They are useful to forest pest managers, teachers, researchers, forest consultants, university and extension entomologists, pathologists, and other hardwood user groups interested in managing forest pest problems.

Image files from the libraries may be imported into other graphics programs for specific applications or used directly from the software for presentations at professional meetings, seminars, demonstrations, workshops, or for teaching. The CD's also may be used on laptop computers as a reference for field diagnoses of forest pests.

Most CD's cost \$12.50, which helps defray the cost of materials and physical reproduction. The North American Hardwood Borer CD costs \$25.00. Based on Dr. Jim Solomon's **book Guide to Insect Borers in North American Broadleaf Trees and Shrubs**, this CD includes 1600 images of 300 pests and damage for 300 hosts, cross referencing, on-line glossary, and detailed text descriptions for each image. You can order any pest image library on CD by any of the following methods:

- On-line order form (at the Internet address listed below)
- E-mail request (dwilson/srs_stoneville@fs.fed.us)
- Written request mailed to Dr. Dan Wilson, USDA Forest Service, Southern Hardwoods Laboratory, P.O. Box 227, Stoneville, MS 38776-0227
- Fax request (662) 686-3195

Please be sure to provide your name, complete address, and a list of CD's you wish to purchase. Please do not send checks when requesting CD's. A bill will be sent to you along with instructions for payment after we receive your order. You may pay by check, money order, or bank draft drawn on a U.S. bank. We cannot accept purchase orders or credit cards. If you need more information before ordering, please contact Dr. Wilson via fax at (601) 686-3195. Please list your questions and

your phone and fax numbers, and he will contact you.

The above information, along with a listing of CD's and prices, is available in .pdf format from the Center for Bottomland Hardwoods Research website (www.srs.fs.fed.us/cbhr/media.htm/).

Recent Publications–September 1999

Berke, B; Tobiasson, F.L.; Hatano, T. [and others]. 1999. **Interactions of flavanoids with bradykinin in aqueous solution.** In: Cheze, C.; Vercauteren, J.; eds. Polyphenols, wine and health communications; polyphenols, wine and health symposium; 1999 April 14-16; Bordeaux, France. Bordeaux Cedex, France: Universite Vicotor Segalen Bordeaux 2, Laboratoire de Pharmacognosie: 55-56. [Ed. Note: **R.W. Hemingway, research forest products technologist with the Southern Research Station, co-authored this publication.**]

Complexation with proteins is central to much of the biological and industrial significance of plant polyphenols. Definition of the interaction of these two classes of biopolymers has, therefore, been studied for decades. The most important mechanism seems to involve hydrophobic interactions and also hydrogen bonding, but to a smaller extent. Study of specific interactions between polyphenols and peptides has been pursued using Nuclear Magnetic Resonance (NMR). Hatano showed that information required for conformation and complexation determination can be obtained from nuclear Overhauser effect spectroscopy. NMR experiments can be guided by Macromodel molecular modeling by applying Monte Carlo methods to the conformational searching on complexes. Results show that the interaction is directed to conformationally accessible hydrophobic regions and emphasize the importance of the shape of both the flavanoid and the peptide.

Epidemiological findings have shown that incidence of cardiovascular and neurologic degenerative diseases appears to be lower for populations with regular but moderate drinking of red wine that contains flavanoids such as catechin and procyanidins. To understand the effects of flavanoids on human health, it is important to obtain an accurate assessment of their interactions with polypeptides involved in the control of blood pressure and cardiovascular functions such as bradykinin. Furthermore, the multiple structural features of bradykinin provide avenues to explore conformational selectivity. In addition to two proline and phenylalanine residues, two arginine residues are present at each end of the peptide, hence the authors' interest in this system. (1)

Bianco, Riccardo.Lo; Rieger, Mark; Sung, She-Jean [Shi-Jean]. 1998. **A simple, rapid extraction and assay procedure for NAD⁺-dependent sorbitol dehydrogenase (SDH) in peach.** Journal of American Society of Horticultural Science. 123(6): 1065-1068.

Sorbitol is the major photosynthetic product in peach (*Prunus persica* (L.) Batsch.). In sink tissues, sorbitol is converted to fructose via NAD⁺-dependent SDH. A new procedure is described that allows rapid, simple quantification of SDH activity in growing tissues. The procedure uses only 0.01 to 5 g of fresh tissue per sample, such that a single shoot tip, a single root tip, or ≈5 g of fruit flesh can be assayed for SDH activity. Storage of samples at 4 or -20°C overnight resulted in significant loss of enzyme activity. Thus, freshly harvested tissues were ground with sand in buffer at 2°C in a mortar and pestle, and the homogenate was centrifuged at 3000 g_n to remove particulate matter and sand. The supernatant was desalted on a Sephadex

G-25 column, and the eluent was assayed for SDH activity immediately. Activity was determined by measuring the production of NADH per minute in the assay mixture using a spectrophotometer (340 nm). Tris buffer at pH 9.0 was the best for extraction of peach SDH. Activity of SDH was strongly inhibited by dithiothreitol (DTT) in the extraction mixture and by DTT, L-cysteine, or SDI-158 in the assay mixture, similar to results reported for SDH from mammalian tissues. Peach SDH has a K_m of 37.7 mM for sorbitol and a pH optimum of 9.5, similar to those reported for apple (*Malus xdomestica* Borkh.) SDH. Unlike older protocols for SDH activity in plant tissues, the new procedure features reduced sample size (1/10 to 1/100 of that which was previously used), smaller volumes of buffer, fewer buffer ingredients, greatly reduced time for sample preparation, yet comparable or higher values of SDH-specific activity. Following the same procedure, SDH activity was also measured in *Prunus fremontii* Wats., *Prunus ilicifolia* (Nutt.) Walp., and Marianna 2624 plum (*P. cerasifera* Ehrh. x *P. munsoniana* Wight & Hedr.). (2)

Bianco, Riccardi Lo; Rieger, Mark; Sung, Shi-Jean. 1999. **Carbohydrate metabolism of vegetative and reproductive sinks in the late-maturing peach cultivar 'Encore.'** Tree Physiology 19(2): 103-109.

Activities of NAD⁺-dependent sorbitol dehydrogenase (SDH), sorbitol oxidase (SOX), sucrose synthase (SS), acid invertase (AI), and neutral invertase (NI) in 'Encore' peach (*Prunus persica* L.) fruits and developing shoot tips were assayed during the growing season to determine whether carbohydrate metabolizing enzymes could serve as indicators of sink strength. In fruit flesh, SS activity was detected during Stage I of growth, when cells were actively dividing, and SDH activity was detected during Stage III, when cells were actively enlarging. Acid invertase activity was detected during Stage I and showed a closer correlation with relative increase in fruit weight during the growing season than SS activity. During seed filling and pit hardening (Stage II), when relative fruit growth rate was slowest, activities of carbohydrate metabolizing enzymes in fruit flesh were not detectable. No SOX activity was detected during Stages I and II. The highest sucrose content occurred near the end of fruit development when the activities of Sucrose metabolizing enzymes were low. In developing shoot tips, the sorbitol:sucrose ratio was 2:1 (w/w) and SDH activity was low at the beginning and end of the season when vegetative growth was slowest. The sorbitol:sucrose ratio changed to 1:1 (w/w) along with an increase in SDH activity in shoot tips during the mid-growing season. In 'Nemaguard' peach, SDH exhibited higher activity in root tips than in other organs. Among the sorbitol- and sucrose-metabolizing enzyme activities, only SDH activity was positively correlated with shoot growth in 'Nemaguard' plants. (3)

Carrie, N. Ross; Conner, Richard N.; Rudolph, D. Craig; Carrie, Dawn K. 1999. **Reintroduction and postrelease movements of red-cockaded woodpecker groups in eastern Texas.** Journal of Wildlife Management. 63(3): 824-832.

The effects of demographic isolation may be particularly severe in small, isolated populations of the endangered red-cockaded woodpecker (*Picoides borealis*). Augmentation of single adult woodpeckers with subadult birds of the opposite sex allows managers to stabilize small, isolated populations but does not provide a means to significantly increase populations. The reintroduction of pairs of subadult red-cockaded woodpeckers into unoccupied habitat provides a technique to bolster small populations. The authors report the results of such efforts to increase a small, isolated red-cockaded woodpecker population in eastern Texas and describe postrelease movements of translocated red-cockaded woodpeckers. Seventeen red-cockaded woodpeckers (9 M, 8 F) were translocated to the Sabine National Forest in eastern Texas between December 1994 and March 1995. Prior to translocation, this forest contained 13 groups of red-cockaded woodpeckers. Five pairs, consisting of a subadult male and female, were released to attempt to establish new breeding

pairs. Seven additional subadult woodpeckers were translocated to provide mates to solitary individuals. Nine previously unoccupied sites were occupied. Of the 17 woodpeckers translocated, 12 (71 percent; 6 M, 6 F) were established in territories following the 1995 and 1996 breeding seasons. The remaining 5 woodpeckers were unaccounted for. Of the 12 woodpeckers resighted, 3 (18 percent) established territories at their release sites. Woodpeckers that dispersed from their release site were relocated in sites an average of 2.8 km (range = 0.5-9.6 km) away. One (20 percent) of the five pairs released remained together into the 1995 breeding season. Eight (89 percent) of the 9 new pairs found during 1995 and 1996 included at least one translocated red-cockaded woodpecker and bred during 1995 and 1996. Results demonstrate that the direct reintroduction of multiple pairs is an effective technique for reestablishing breeding units in formerly vacant habitats. Results also suggest that the reintroduction of pairs in a spatial array dense enough to allow social contact between adjacent pairs and with preexisting clusters substantially increase the formation of new pairs. (4)

Cordell, H. Ken; Herbert, Nancy G.; Pandolfi, Francis. 1999. **The growing popularity of birding in the United States.** *Birding*. 31(2): 168-176.

Every 5 to 10 years, several Federal agencies, professional associations, private organizations, and industries work together to conduct a survey of the recreational interests of the American people--the National Survey on Recreation and the Environment (NSRE). The most recent of these national studies indicated that 94.5 percent of people 16 years old or older participate in some form of outdoor recreation. Walking for pleasure, sightseeing, picnicking, swimming in natural waters, fishing, bicycling, and watching birds are among the most popular of the outdoor activities pursued in the late 1990's. All these activities involve participation by more than 25 percent of the country's population. Based on results from the two most recent surveys, growth of participation in most recreational activities from 1983 to 1995 exceeded growth of population. Of the activities tracked, birding, hiking, backpacking, downhill skiing, and primitive camping were the five fastest-growing activities in the country in terms of percentage change in the number of participants between 1983 and 1995. The authors present an indepth look at the growth of one of these activities, birding. Not only do they look at trends in birding, they also examine where most of the growth is occurring, who birders are, what their outdoor personality tells us, and who is responsible for most of the growth in birding participation. The primary source of data is the 1995 NSRE. (5)

Diner, Alex M.; Zipf, Allan; Ward, Rufina; [and others]. 1999. **Transient expression of GUS in bombarded embryogenic longleaf, loblolly, and eastern white pine.** Res. Note SRS-7. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 4 p.

Embryogenic tissue cultures derived from immature zygotic embryos of longleaf, loblolly, and eastern white pine were maintained in culture for up to 2 years, then bombarded with gold particles coated with a gene construct containing the GUS reporter gene fused to an adenine methyltransferase promoter from an algal virus. Physiological expression of GUS was observed in cultures of all three pine species within 24 hours but not at 7 days. Expression of GUS activity was recorded in somatic embryonal heads of varied stages of development, suspensor cells, and other cells of mixed ontogeny. Collective expression of GUS in small clusters of cells suggested inheritance of the reporter gene through early mitotic events. The presence of multiple discrete sites of GUS expression common in individual somatic embryos was indicative of densely associated multiple transformation events, and was enhanced by reducing the sample distance. This is a first report of transgene expression in longleaf and white pine. (6)

Feng, Z.; Hartel, P.G.; Roncadori, R.W.; Sung, S.-J.S. 1998. **Inhibition of fungal colonization on the rhizoplane of the CS₂ - producing plant, *Mimosa pudica* L.** In: Box, J.E., ed. Root demographics and their efficiencies in sustainable agriculture, grasslands and forest ecosystems. Dordrecht, Netherlands: Kluwer Academic Publishers: 115-126.

Carbon disulfide (CS₂) is a colorless, volatile, foul-smelling, fungicidal liquid that is produced by some plants. The authors determined the ability of a model CS₂-producing plant, *Mimosa pudica*, to affect the rhizoplane colonization of six species of soil fungi. Tomato (*Lycopersicon esculentum*), a plant which does not produce CS₂, was the control. In plate assays, the mycelia of *Fusarium moniliforme*, *Pythium aphanidermatum*, *Phytophthora* sp., *Rhizoctonia solani*, *Sclerotium rolfsii*, and *Trichoderma viride* showed variable responses to CS₂, but all mycelia were inhibited by 4 µg CS₂ ml⁻¹. Inhibition of spore germination of *F. moniliforme*, *P. aphanidermatum*, and *T. viride* was similar to mycelial inhibition. When gnotobiotic tomato or *M. pudica* plants were inoculated with *F. moniliforme* or *T. viride*, spore counts were similar in the nonrhizosphere, but 10- to 100-fold lower on the rhizoplane of *M. pudica* than those of tomato. When the roots of 11-d-old gnotobiotic tomato or *M. pudica* plants were each inoculated separately with one of the six fungal species, abundant hyphae of all six fungal species were observed on the roots of tomato after 7 days. In contrast, roots of *M. pudica* showed many or abundant hyphae of *R. solani* and *S. rolfsii* but no or few hyphae of the remaining species. These observations were confirmed by ergosterol analysis. Plant-generated CS₂ may account for this decreased fungal colonization, although other compounds may also be responsible. (7)

Garbelotto, M.; Cobb, F.W.; Bruns, T.D. [and others]. 1998. **The distribution of genets and their nuclear composition reveal the dynamics of establishment and survival of *Heterobasidion annosum* in white fir stands.** In: INRA, ed. Root and butt rots of forest trees; 9th international conference on root and butt rots; 1997 September 1-7; Carcans-Maubuisson, France. Les Colloques, France: [Publisher unknown]: p. 171-189. [Editor's Note: **William J. Otrosina, research plant pathologist with the Southern Research Station, co-authored this publication.**]

The structure of *Heterobasidiom annosum* populations in white fir was studied in 15 mixed conifer sites of central and northern California. Areas selected for the study displayed mortality of white fir trees in enlarging discrete patches (mortality centers). At each site, fungal genotypes were defined by somatic compatibility tests. In two sites, further genetic and molecular analyses were performed on field genotypes and on homokaryons obtained by dikaryotization of field heterokaryons. Isolates were found to be colonizing mostly the roots and the bole sapwood of white fir trees. No significant infections of other tree species were encountered, and the majority of white firs displayed disease symptoms associated with the presence of the pathogen. Each mortality center was characterized by the presence of several fungal genotypes, all belonging to the S ISG. Both homokaryotic and heterokaryotic strains were present in all sites. Eighty-six percent of fungal genotypes were found only within a single tree or stump, while 14 percent had spread to adjacent trees. The two largest genotypes had diameters of 9-10 m and had colonized 5-9 trees and stumps. The maximum distance between two adjacent trees colonized by the same genotype was 6 m, and a highly significant correlation was found between tree diameter and distance of fungal "vegetative" spread. The largest clones were found in areas characterized by high tree and stump densities. In most cases, original infection courts of existing genotypes could be traced to standing trees and not to stumps that became colonized after felling. The genetic analysis performed in two mortality centers revealed that most local genotypes had different mating alleles, and thus originated from unrelated basidiospores. In a few cases, the same mating allele was shared by different genotypes. Molecular analysis showed that nuclei bearing the same mating allele were identical, providing evidence that the two nuclei forming heterokaryons can act independently in the field and can be

shared among isolates, presumably via di-mon mating or by separate matings of different portions of widespread homokaryons. (8)

Garbelotto, Matteo; Orosina, William J.; Cobb, Fields W.; Bruns, Thomas D. 1998. **The European S and F intersterility groups of *Heterobasidion annosum* may represent sympatric protospecies.** Canadian Journal of Botany. 76: 397-409.

In those regions of Europe where they coexist, the F and S intersterility groups (ISGs) of *Heterobasidion annosum* (Fr.) Bref. are primarily found on *Abies* spp. and *Picea abies* (L.) Karst., respectively. Eighty-three isolates of *H. annosum* were collected from *Abies alba* Mill. from 19 sites in Italy, including 10 *Abies-Picea* mixed conifer stands in the eastern Alps. The ISGs of a subsample of 34 isolates were determined by ISG-diagnostic arbitrary-primed (AP) PCR primers. For a subsample of 16 isolates, including two S isolates from Norway and one S isolate from California, nuclear markers generated by AP-PCR analysis, and mitochondrial markers generated by restriction fragment length polymorphisms and sequencing of the ML5-ML6 region of the mitochondrial large ribosomal RNA gene indicated that, in Europe, (i) the F and S ISGs can be found in the same forest stand but they are two genetically distinct units with restricted gene flow between them; (ii) each of the two ISGs is monophyletic and may lack strong genetic structuring in subpopulations; and (iii) the two ISGs are closely related to each other and their nearest common close relative is the allopatric S ISG from North America. By combining these results with paleobotanical information and results from previous studies, the authors postulate a recent sympatric divergence of these two groups driven by differential host specificity and mating barriers. (9)

Garbelotto, M.; Orosina, W.J.; Cobb, F.W.; Bruns, T.D. 1998. **Habitat preference and the evolution of sympatric intersterility groups in the *Heterobasidion annosum* species complex.** In: INRA, ed. Root and butt rots of forest trees; 9th international conference on root and butt rots; 1997 September 1-7; Carcans-Maubuisson, France. Les Colloques, France: [Publisher unknown]: p. 85-102.

Populations of the basidiomycete *Heterobasidion annosum* display varying degrees, of intersterility and differential host specialization. At least three intersterility groups have been formally described, each characterized by a range of "preferred" hosts. It has been hypothesized that processes of host-pathogen compatibility may have been driving the evolution of sympatric populations of this fungus. Host specialization may also determined a selective disadvantage on inter-ISG hybrids, and keep the gene [gene] pools of these otherwise partially interfertile populations (intersterility in fact is only partial) separate. Molecular data generated in the past five years is indicating that in fact there are more than three genetically distinct groups worldwide. The geographic distribution of these groups suggests that allopatric processes are involved in the evolution of distinct fungal populations.

The authors analyzed the relationships among European and North American populations of *H. annosum* with a range of nuclear and mitochondrial genetic markers. Results indicate that (a) each population (intended here as all the individuals belonging to the same ISG and from the same world region) is genetically well distinct from the others; and (b) the European S and F ISGs as the two closest groups and have probably diverged more recently than the others. Because the European S and F ISGs are found preferentially on different hosts (*Picea* and *Abies* spp. respectively), it is plausible that host specificity may be driving the evolution of this organism. Furthermore, because (1) both ISGs are present (sometimes even on the same stump) in European mixed conifer forests; and (2) paleobotanical data indicate *Picea* and *Abies* spp. shared in the past a largely overlapping geographic range, these results support the hypothesis of sympatric speciation in the

H. annosum complex. To provide evidence for possible mechanisms of sympatric speciation in *H. annosum*, the authors have used North American S, P, and field SP hybrid isolates in greenhouse inoculation experiments. SP isolates were significantly less virulent than P isolates on P-hosts (*Pinus* spp.) and significantly less virulent than S isolates on S-hosts (*Abies*, *Tsuga*), but were as virulent as S or P isolates on the greenhouse “universal” host Sitka spruce. These results support the hypothesis that inter-ISG hybrids may be at a selective disadvantage in nature and provide evidence that mechanisms of host-pathogen interaction act as a driving force or as a reinforcement of the genetic isolation of the two North American ISG, which in the laboratory show moderate levels of infertility. (10)

Garbelotto, M.; Otrrosina, W.J.; Cobb, F.W.; Bruns, T.D. 1998. **Population biology of the forest pathogen *Heterbasidion annosum*: implications for forest management.** In: Proceedings of the 46th annual meeting; California Forest Pest Council; 1997 November 12-13; Sacramento, CA. [Place of publication unknown]: [Publisher unknown]: p. 24-35.

Heterbasidion annosum ranks as one of the most destructive pathogens in North American coniferous forests. Understanding the population biology of this fungus may facilitate understanding not only the basic biology of the organism, but also the general patterns of disease development, modes of host-pathogen interactions, effect of management practices on the dynamics of dispersal, establishment, and evolution of the pathogen and/or the host. In turn, this information allows for a more profound understanding of the general health of an ecosystem, leading to more refined and targeted management practices. In the case of *H. annosum*, previous research has elucidated aspects of the etiology and spread of disease for host species such as European pines and spruces. In these instances, primary stump infection and root-to-root secondary contagion appear to be major avenues of disease development. No information is available on the true fir/*H. annosum* pathosystem for Western North America, although the pathogen is increasingly affecting this tree species. Because of the different hosts involved, of the different biogeographic region, and of the significant genetic divergence among groups of *H. annosum* characterized by different host preferences, it is not possible to extrapolate results from other regions of the world to Western North America, and in particular to California. Two genetically distinct intersterility groups (ISGs) of the fungus are present in California: the S ISG mostly infects true firs, hemlocks, Douglas-firs, and sequoias, while the P ISG is found mostly on pines, incense cedars, and junipers. These two ISGs are known to mate in the laboratory, but evidence of mating in nature has been gathered only recently. Still, there is no understanding of the frequency of mating and gene flow between the two groups. In these last years the authors’ research effort has been to elucidate the dynamics of fungal establishment and spread in California mixed conifer forests with a predominance of true fir. The scale of analyses has ranged from small scale studies designed to understand the genetic structure of pathogen populations in individual mortality centers to larger analysis at the broader regional level; the latter analyses have been designed to shed light on medium to long distance gene flow between demes of one ISG and even potentially between ISGs. One focus of the authors has been to relate the genetic structure of this organism to forest stand characteristics in the attempt to understand the impact of forest to understand the impact of forest management on the population biology of this organism, on the epidemiology of the disease, and on the severity of the mortality associated with this pathogen. (11)

Garbelotto, M.; Cobb, F.W.; Bruns, T.D.; [and others]. 1999. **Genetic structure of *Heterbasidion annosum* in white fir mortality centers in California.** *Phytopathology* 89: 546-554. [Editor’s Note: William J. Otrrosina, research plant pathologist with the Southern Research Station, co-authored this publication.]

The structure of *Heterobasidion annosum* populations was studied in 15 mixed-conifer sites in central and northern California. Study sites displayed mortality of white fir trees in enlarging discrete patches (mortality centers). At each site, fungal genotypes were defined by somatic compatibility tests. In two sites, further genetic and molecular analyses were performed on field genotypes and on homokaryons obtained by dikaryotization of field heterokaryons. Isolates were found to be colonizing mostly the roots and the bole sapwood of white fir trees, and no significant infections of other tree species were observed. Each mortality center was characterized by the presence of several fungal genotypes, all belonging to the S intersterility group. Both homokaryotic and heterokaryotic strains were present in all sites. Multiple genotypes were retrieved in individual trees or stumps. Out of 228 fungal genotypes, 86 percent were found only within a single tree or stump, while 14 percent had spread to adjacent trees. The two largest genotypes had diameters of 9 and 10 in., and had colonized five and nine trees, stumps, or both, respectively. The maximum distance between two adjacent trees colonized by the same genotype was 6 m, and a highly significant correlation was found between tree diameter and distance of fungal "vegetative" spread. The largest clones were found in areas characterized by high tree and stump densities, and secondary spread of the fungus was more significant in denser stands. In most cases, original infection courts of existing genotypes could be traced to standing trees and not to stumps. The genetic analysis performed in two mortality centers revealed that most local genotypes had different mating alleles, and thus originated from unrelated basidiospores. In a few cases, the same mating allele was shared by two heterokaryons (n+n genome) or by a homokaryon (n genome) and a heterokaryon. Molecular analysis showed that nuclei bearing the same mating allele were identical, providing evidence that the two nuclei forming heterokaryons can act independently in the field and can be shared among isolates, presumably via di-mon mating or by separate matings of different portions of widespread homokaryons. (12)

Goheen, D.J.; Ostrosina, W.J. 1998. **Characteristics and consequences of root diseases in forests of Western North America.** In: Frankel, Susan J., tech. coord. User's guide to the western root disease model, version 3.0. Gen. Tech. Rep. PSW-GTR 165. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Station: 3-8.

Root diseases are somewhat mysterious. Operating as they do within the soil, it is difficult to actually view root pathogens or follow their progress in causing disease. The signs and symptoms that they produce can be quite subtle and variable. Just identifying which pathogen occurs in a specific situation is often challenging. Nevertheless, in the past two decades, forest managers have become increasingly aware of the important roles that root disease organisms play in forests and the significant influences that they exert on the ability to attain desired management objectives. Root pathogens usually affect groups of neighboring trees in progressively expanding disease pockets or centers. These centers generally contain dead trees that have died at different times over several years and living but infected trees in various stages of decline. They are commonly characterized by much lower stocking levels than surrounding healthy portions of stands, and they also may contain numerous windthrown or broken trees on the ground. Root disease centers vary in size from those involving only a few trees to those covering hundreds of acres. They may be very discrete or they may involve a scattering of affected trees dispersed over a larger area.

On individual trees, crown symptoms associated with most root diseases are similar and include reduced height growth, loss of needles, chlorotic foliage, death of branches, production of distressed cone crops, and, ultimately, host mortality. Accurate identification of which root pathogen or pathogens occur in an area usually requires digging to expose roots, and removing bark from roots and root collars to reveal the inner wood. Often laboratory culturing or more sophisticated techniques such as isozyme and DNA analyses are necessary to identify the biological species or strain of the causal fungi. Although a number of root diseases are found in the West, three are considered to be the most significant. These are

laminated root rot, caused by the fungus *Phellinus weirii*; Armillaria root disease, caused by *Armillaria ostoyae*; and Annosus root disease, caused by *Heterobasidion annosum*. The impacts of these fungi on forest stands are modelled in the Western Root Disease Model, Version 3.0. A general understanding of their biology is presented to enhance the reader's ability to input data and interpret outputs. (13)

Haag, Wendell R.; Warren, Melvin L., Jr. 1999. **Mantle displays of freshwater mussels elicit attacks from fish.** *Freshwater Biology*. 42: 35-40.

(1) Gravid females of some North American freshwater mussel species (Bivalvia: Unionidae) display highly modified mantle margins and other reproductive structures which mimic small fish, terrestrial insects, or aquatic macro-invertebrates. The authors report the responses of fish to these lures, based on the results of laboratory encounters between the following pairs of displaying mussels and fishes: *Lampsilis cardium* and *Micropterus coosae*; *L. perovalis* and *M. coosae*; and *Villosa nebulosa* and *Percina nigrofasciata*. In all three encounters, the lures elicited attacks from fish. (2) Encounters between *Lampsilis* spp. and *M. coosae* resulted in gill infestations of the fish by larval mussels, which are obligate parasites on fish. An encounter between *V. nebulosa* and *P. nigrofasciata* did not result in infestation. (3) The use of these lures to attract fish may greatly increase the chances of parasite/host encounters and may also reduce the chances of infestation of unsuitable hosts. (14)

Harper, David; Wolcott, Michael; Rials, Timothy. 1999. **Chemical and physical interpretation of MDI cure in saturated steam environments.** In: Hague; Mott; Griffiths; [and others], eds. Proceedings of the second European panel products Symposium; 1998 October 21-22; Llandudno, Wales, UK. Gwynedd, Wales, UK: 193-204.

The cure of polymeric 4-4' diphenylmethane diisocyanate, PMDI, in wood composite manufacturing has been the subject of much research. The exact contribution of polyurethane, polyurea, and polyurete formation to PMDI/wood bonding is still debated. This study foregoes the mechanism controversy and studies the cure from a panel consolidation process. Micro-dielectric analysis, μ DEA, was utilized to monitor the cure of PMDI in a controlled environment of heat, steam, and pressure simulating those encountered during wood composite manufacturing. A small steam-generating chamber was mounted to a universal testing machine that produced saturated steam environments between 110° and 140°C. The degree of conversion calculated from μ DEA provided a basis for further spectroscopic, calorimetric, and lap-shear analysis. Differential scanning calorimetry (DSC) and Fourier transform infrared spectroscopy (FTIR) revealed a large consumption of isocyanate early in cure. However, lap-shear analysis showed that mechanical strength did not develop until late in cure. Low ultimate lap-shear strengths and a plateau in conversion rates were detected for bondlines cured at 110° and 120°C. These characteristics may indicate a transition to diffusion-controlled reaction resulting from a vitrification effect such as crystallization. A phenomenological approach to composite cure kinetics was applied to model isothermal μ DEA and dynamic DSC data. Models successfully predicted cure that followed analytical results. Higher activation energies were obtained for μ DEA than were generated from DSC methods. The observed differences in activation energy are interpreted in terms of differing mechanisms in the progression of chemical and physical cure. (15)

Hemingway, Richard W. 1998. **[Book review:] Practical polyphenolics: from structure to molecular recognition and physiological action,** by Edwin Haslam. *Journal of Natural Products*. 61(11): 1454-1455.

Hemingway's book review brings into focus Edwin Haslam's career, devoted to defining the significance of plant polyphenols. That historical perspective focuses on the progress made in this science over the last 30 years. Most important, this book demonstrates the myriad ways that plant polyphenols influence our lives. Professor Haslam makes a strong argument for continued study of intermolecular association of plant polyphenols with other biopolymers. The very selective treatment of the structure and biosynthesis of condensed and hydrolyzable tannins starts the book out on a slow pace. There is virtually no discussion of the chemistry of commercially important wattle or quebracho tannins and references to chestnut tannins are scarce. Haslam's insights on molecular recognition and the interaction of plant polyphenols with other compounds are keen, and he challenges his readers to take up the task of learning more about how plant polyphenols interact with other biopolymers to express biological activity.

Professor Haslam's book continues to gain strength as he deals with the role of plant polyphenols in taste, bitterness, and astringency, and the chemistry underlying the "maturation" of those properties in foods. He engages the reader in discussions of the chemistry that might be considered the most important commercial and ecological aspects of these compounds. Haslam takes the reader through a series of analyses of the significance of plant polyphenols in foods and beverages. Especially interesting is his treatment of teas, associations between polyphenols and caffeine, and the oxidation and complexation of condensed tannins with proteins to define the properties of chocolate. The discussion of persimmon tannins and their use in Japan for a wide array of applications (including the removal of proteins from sake!) once more highlights the important associations between plant polyphenols and other biopolymers in their commercial use. Haslam includes an interesting analysis of competitive binding of tannins to carbohydrates and proteins as an explanation for the loss of astringency in ripening of fruits. That leads the reader into a valuable summary of the chemistry of carbohydrate gels and mechanisms by which these gels can associate with and "encapsulate" polyphenols. A similar mechanism is proposed for the sequestration of tea polyphenols by casein to explain the loss of astringency resulting from milk in the tea. This chapter concludes with an analysis of the chemistry that occurs in aging of wines and the significance of oak polyphenols on the quality of whiskey.

Professor Haslam then changes focus to the visual rather than taste senses. Inter- and intramolecular recognition once again comes to the fore in providing an explanation of how more than 250 million colors can be produced from such a few basic anthocyanin chromophores. This chapter especially makes one appreciate the great impact molecular associations have on the quality of our lives. Favorite reading for many will lie in Chapters 7 and 8 because of the strong interest of the influence of plant polyphenols on human health. Professor Haslam has done well to stay with the fundamental science that supports the biological impacts of herbal medicines. Chapter 8 deals with perhaps the most important property of plant polyphenols, centering on their antioxidant properties and the chemistry of the oxidation of these extremely reactive compounds. Chapter 9 appropriately closes the book with a valuable analysis of the physical chemistry that explains the vegetable tanning process dating back at least 3000 years. Leather manufacture with vegetable tannins remains the predominant industrial use of these compounds, and they retain their market because of the high-quality heavy leather produced. Perhaps the earliest applications of intermolecular recognition and oxidation of *o*-quinones lie here. A reader cannot avoid the thought that there is so much to do to bring science to reasonable parallel with the art applied to improve our lives. (16)

Hemingway, Richard W.; Steynberg, Petrus J.; Steynberg, Jan P.; Hatano, Tsutomu. 1999. **NMR studies on the conformation of polyflavanoids and their association with proteins.** In: Argyropoulos, Dimitris S., ed. *Advances in lignocellulosics characterization*. Atlanta, GA: TAPPI Press: 157-178.

Polyflavanoids (also named condensed tannins or proanthocyanidins) make up approximately half of the dry weight of most commercial tree barks, are often found in even higher concentrations in nut shells, and are important constituents of the leaves of plants. The polyflavanoids rank second in abundance after lignin as a source of renewable phenolic materials. Most of their commercial and ecological significance centers on either their propensity to form complexes with proteins or on their potent antioxidant properties. Because it is believed that the association of polyflavanoids with proteins is dictated by the shape and flexibility of these molecules, the authors have undertaken an effort to try to define the conformational dynamics of polyflavanoids and to learn more about the interaction of polyflavanoids with proteins. The authors' approach has been centered mainly on NMR experiments to obtain the necessary physical data to evaluate the results of computational chemistry. Both NMR instrumentation and computational chemistry software are advancing at a fast pace and increasingly offer avenues to solution of questions surrounding tannin/protein interactions. (17)

Hemingway, Richard W.; Peng, Weiling; Conner, Anthony H.; [and others]. 1998. **Acid-catalyzed rearrangements of flavans to novel benzofuran derivatives.** In: Charbonnier, Florence; Delacotte, Jean-Michael; Rolando, Christian, eds. Polyphenols Communications 98; XIXth international conference on polyphenols; volume 1; 1998 September 1-4; Lille, France. Bordeaux Cedex, France: Groupe Polyphenols: 191-192.

The objective of this work was to define reactions that occur when proanthocyanidins and their derivatives are reacted in the presence of acid catalysts. Pure compounds (either as the free phenols, the methyl ether, or the methyl ether-acetate derivatives) were isolated by a variety of chromatographic methods. Proof of their structure was based mainly on 2D-NMR, as well as high-resolution MS and CD experiments. This publication summarizes some of the results of these experiments. (18)

Hilderbrand, Robert H.; Lemly, A. Dennis; Dolloff, C. Andrew. 1999. **Habitat sequencing and the importance of discharge in inferences.** North American Journal of Fisheries Management. 19: 198-202.

The authors constructed stream maps for a low-gradient trout stream in southwestern Virginia during autumn (base flow) and spring (elevated flows) to compare spatial and temporal variation in stream habitats. Pool-riffle sequencing and total area occupied by pools and riffles changed substantially depending on the level of discharge: reduced discharge resulted in an increase in total pool surface area with more numerous but smaller pools than during spring. In contrast, total surface area of riffles decreased with decreasing discharge, as did total wetted surface area. These findings suggest caution should be exercised when comparing seasonal or annual surveys, applying habitat guidelines for assessment or management, evaluating fish standing crop potential from predictive habitat models, or predicting availability of habitat or biological information at times other than when stream surveys are conducted. The authors demonstrate the potential dangers by intentionally applying biological sample results taken at one discharge level to the same stream reach at a different discharge level. The results clearly illustrate the importance of acquiring physical and biological information during similar discharges. (19)

Hse, Chung-Yun. 1999. **Overview of the wood adhesives industry in China.** In: Christiansen, Alfred W.; Pilato, Louis A. International contributions to wood adhesion research; Proceedings no. 7267. Madison, WI: Forest Products Society: 48-51.

Adhesives products and demand for them in China are discussed in this paper, with special emphasis on wood adhesives products in this decade. In 1994, the wood industries in China consumed more than 330,000 tons of adhesives. The estimated demand for wood adhesives will be more than 560,000 tons in the year 2000. The main wood adhesive used is urea-formaldehyde resin. Its consumption in 1994 was approximately 90 percent of the total wood adhesives market. The production capacity of formaldehyde will continue to be the main factor affecting the growth of the wood adhesives industry. (20)

Hwang, Chin-Yin; Hse, Chung-Yun; Choong, Elvin T. 1999. **Effect of configuration and some processing variables on the properties of wood fiber-polyethylene composites.** In: Wang, Song-Yung; Yeh, Min-Chyuan, eds.; timber and wood composites for the next century; Proceedings, international conference on effective utilization of plantation timber; 1999 May 21-23; Chi-Tou, Taiwan, R.O.C. Chi-Tou, Taiwan, R.O.C.: Forest Products Association of R.O.C., Bulletin No. 16: 123-130.

Chemical compositions and fiber measurement of virgin and recycled fibers from three sources were determined. Results revealed that virgin southern pine fiber had highest alcohol-benzene extractive and lignin contents and lowest holo- and alpha-cellulose content among the three fiber types. Fiber length distribution of virgin fiber was less sensitive to disintegration. Effects of recycled fiber, panel configuration, and some processing variables on the performance of wood fiber-polyethylene composites were also studied. Investigation showed that replacing virgin fiber with recycled fiber adversely affected mechanical properties of fiberboard. In both homogenous and layered configurations with 20 percent polyethylene content, IB, MOR_b, MOE_b, and dimensional stability were directly related to virgin fiber ratio. However, layered structure with 40 percent polyethylene showed improvement in dimensional stability. Experimental results also indicated that, at given composition, i.e., virgin fiber:recycled fiber: polyethylene=40:40:20, panel IB was affected by both hot press temperature and panel density; bending properties and water absorption were altered by panel density. (21)

Johnson, Tony G; Brown, David R. 1999. **North Carolina's timber industry—an assessment of timber product output and use, 1997.** Resour. Bull. SRS-39. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 34p.

In 1997, industrial roundwood output in North Carolina's forests totaled 870 million cubic feet, 5 percent more than in 1995. Mill byproducts generated from primary manufacturers increased 3 percent to 309 million cubic feet. Almost all plant residues were used primarily for fuel and fiber products. Saw logs were the leading round wood product at 423 million cubic feet; pulpwood ranked second at 355 million cubic feet; veneer logs third at 60 million cubic feet. The number of primary processing plants declined from 320 in 1995 to 280 in 1997. Total receipts increased 4 percent to almost 771 million cubic feet. (22)

Johnson, Tony G.; Wells, John L. 1999. **Georgia's timber industry—an assessment of timber product output and use, 1997**. Resour. Bull. SRS-38. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 36 p.

In 1997, roundwood output from Georgia's forests totaled 1.28 billion cubic feet, 2 percent less than in 1995. Mill byproducts generated from primary manufacturers increased 1 percent to 479 million cubic feet. Almost all plant residues were used primarily for fuel and fiber products. Pulpwood was the leading roundwood product at 617 million cubic feet; saw logs ranked second at 520 million cubic feet; veneer logs were third at 77 million cubic feet. The number of primary processing plants declined from 207 in 1995 to 186 in 1997. Total receipts remained stable at 1.4 billion cubic feet. (23)

Johnston, Carol E. 1999. **The relationship of spawning mode to conservation of North American minnows (Cyprinidae)**. Environmental Biology of Fishes. 55: 21-30.

Approximately 20 percent of North American minnows are considered imperiled. The factors responsible for imperilment in this group are complex, but the relationship of spawning mode to conservation of North American minnows has not been explored. The author provides a summary of the spawning modes of imperiled North American minnows, discuss patterns between these modes and conservation status, and predict the spawning modes for several poorly known imperiled species. Of the 46 species of North American minnows that are imperiled, spawning modes are known for only 13 species. All spawning modes are represented in the imperiled group of minnows except mound-building and egg-clustering, and with the exception of crevice-spawners and pit-ridge-builders, the percentage of imperiled minnows in each category of spawning mode is roughly proportional to the percentage of minnows in that category overall. Species with complex spawning modes, such as mound-building, pit-building, and egg-clustering, are among the most common fishes in North American streams. This pattern suggests that there is a relationship between parental care and success (lack of imperilment) in minnows. Spawning mode is an important consideration in the formulation of recovery plans and proactive conservation efforts. (24)

Kard, Brad. 1999. **Termiticides -- the Gulfport report**. Pest Control. February: [Not paged].

Termiticide treatments to soil are the most widely used and successful method to protect wooden structures from attack by subterranean termites and potentially new termiticides continue to be placed in Forest Service field tests each year. This article presents the latest findings taken from USDA Forest Service field tests in Arizona, Florida, Mississippi, and South Carolina. (25)

Kesen, Ma.; Hutchins, A.; Sung, Shi-Jean S.; Adams, Michael W.W. 1997. **Pyruvate ferredoxin oxidoreductase from the hyperthermophilic archaeon, *Pyrococcus furiosus*, functions as a CoA-dependent pyruvate decarboxylase**. In: Proceedings of the National Academy of Sciences USA. 94: 9608-9613.

Pyruvate ferredoxin oxidoreductase (POR) has been previously purified from the hyperthermophilic archaeon, *Pyrococcus furiosus*, an organism that grows optimally at 100°C by fermenting carbohydrates and peptides. The enzyme contains thiamine pyrophosphate and catalyzes the oxidative decarboxylation of pyruvate to acetyl-CoA and CO₂ and reduces *P. furiosus* ferredoxin. The authors show that this enzyme also catalyzes the formation of acetaldehyde from pyruvate in a

CoA-dependent reaction. Desulfocoenzyme A substituted for CoA showing that the cofactor plays a structural rather than a catalytic role. Ferredoxin was not necessary for the pyruvate decarboxylase activity of POR, nor did it inhibit acetaldehyde production. The apparent K_m values for CoA and pyruvate were 0.11 mM and 1.1 mM, respectively, and the optimal temperature for acetaldehyde formation was above 90°C. These data are comparable to those previously determined for the pyruvate oxidation reaction of POR. At 80°C (pH 8.0), the apparent V_m value for pyruvate decarboxylation was about 40 percent of the apparent V_m value for pyruvate oxidation rate (using *P. furiosus* ferredoxin as the electron acceptor). Tentative catalytic mechanisms for these two reactions are presented. In addition to POR, three other 2-keto acid ferredoxin oxidoreductases are involved in peptide fermentation by hyperthermophilic archaea. It is proposed that the various aldehydes produced by these oxidoreductases *in vivo* are used by two aldehyde-utilizing enzymes, alcohol dehydrogenase and aldehyde ferredoxin oxidoreductase, the physiological roles of which were previously unknown. (26)

Kliejunas, John T.; Otrosina, William J. 1997. **Progress report: effects of subsoiling study, Milford Ranger District, Plumas National Forest.** Forest Pest Management Report Number R97-01. San Francisco, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Region. 10 p.

Subsoiling is becoming a standard practice to alleviate detrimental soil compaction following biomass harvesting in eastside pine and mixed conifer forests in California. Compaction of soil following the harvesting can be detrimental to growth of residuals, to establishment of natural regeneration, and may change long-term soil productivity. The short and long-term effects of this subsoiling practice on forest soil biodiversity and forest ecosystem function as a whole is not known. Because of wounding of tree boles and roots associated with subsoiling, some long-term detrimental effects may occur. Several Forest Pest Management biological evaluations suggested that only through monitoring could the effects be determined. In order to evaluate the impacts of subsoiling on root pathogens, insect vectors of root pathogens, and tree growth, Forest Pest Management, in cooperation with the Pacific Southwest Research Station and the Southern Research Station, initiated a long-term study on the Milford District, Plumas National Forest in 1993 to monitor these effects. (27)

Kormanik, Paul P.; Sung, Shi-Jean S.; Kormanik, T.L.; [and others]. 1997. **Heritability of first-order-lateral roots in five *Quercus* species: effect on 1-0 seedling quality evaluation.** In: Steiner, Kim C., ed. Diversity and adaptation in oak species; Proceedings of the second meeting of working party 2.08.05, Genetics of *Quercus*, of the International Union of Forest Research Organizations; 1997 October 12-17; University Park (State College), PA. University Park, PA: Pennsylvania State University: 194-200.

Heritability estimates (h^2) were calculated for first-order lateral root (FOLR) numbers on a family plot mean basis for 5 *Quercus* species: *Q. alba*, *Q. falcata*, *Q. michauxii*, *Q. pagoda*, and *Q. rubra*. All species were grown with the same nursery soil fertility protocol and the same seedling bed density (54-67/m²). Regardless of *Quercus* species, seedlings with the fewest FOLR (0-3) were not generally competitive in the nursery bed environment and had the smallest root collar diameter and height. In any family, those individuals with the most robust root systems exhibited the fastest growth and occupied the dominant crown position. Based upon root morphology and stem characteristics, less than 50 percent of the seedlings from any species may be competitive and occupy a dominant crown position in the nursery. (28)

Leininger, T. D.; Solomon, J. D.; Wilson, A. D.; Schiff, N. M. 1999. **A guide to major insects, diseases, air pollution injury, and chemical injury of sycamore.** Gen. Tech. Rep. SRS 28. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 44 p.

This booklet will help nurserymen, forest woodland managers, pest control operators, and homeowners to identify and control pest problems on sycamore trees. The major insect and disease pests of sycamores in the Eastern United States are emphasized. Descriptions and illustrations of the pests and the damage they cause are provided to aid in identification. Brief notes are given on biology and control to aid in predicting damage and making control decisions. (29)

Marion, Daniel A.; Weirich, Frank. 1999. **Fine-grained bed patch response to near-bankfull flows in a step-pool channel.** Proceedings, AWRA [American Water Resources Association] specialty conference: wildland hydrology; 1999 June 30-July 2; Bozeman, MT. Herndon, VA: American Water Resources Association: 93-100.

Fine-grained bed patches were monitored in a representative step-pool channel in the Arkansas Ouachita Mountains to assess their response to near-bankfull streamflow events. These patches are small, relatively well-sorted bed areas predominantly composed of gravel-size and smaller grains. They occupy 5.2 and 4.1 percent of the active and bankfull channel areas, respectively, over a 100-m study reach. During each of five simulated flow events with peak discharges ranging in size from 0.25 to 1.34 m³/sec (1.0-to 1.6-yr return periods), 80 percent or more of the patches scoured or filled. Patch response frequency shows no difference between patch types, but does vary between hydraulic unit types. Patches show net aggradation in response to all events with fill volumes being two or more times greater than scour volumes. Patch response magnitude appears to vary somewhat between patch types, but not between hydraulic unit types. Both net volume and net depth change vary directly with peak discharge magnitude. The predominance of fill even at flows somewhat above bankfull stage suggests that bankfull events may not be sufficient for maintaining channel form in Ouachita step-pool channels. (30)

Otrosina, W.J.; Hess, N.J.; Zarnoch, S.J.; [and others]. 1997. **Blue-stain fungi associated with roots of southern pine trees attacked by the southern beetle, *Dendroctonus frontalis*.** Plant Disease. 81: 942-945.

Forty paired plots were established from eastern Texas to Alabama to study root-infecting, blue-stain fungi in southern pine stands undergoing southern pine beetle (SPB) attack. Woody roots were sampled in plots undergoing recent or current attack by the SPB. Comparisons were made between occurrence of *Leptographium* spp. and related fungi and data on various characteristics of natural stands and plantations studied. Three fungal species, *L. terebrantis*, *L. procerum*, and *Ophiostoma ips*, along with unidentified *Leptographium* and *Graphium* species, were isolated from sampled roots. *L. terebrantis* was isolated more frequently from SPB-attacked plots ($P < 0.001$) than was either *L. procerum* or *O. ips*. More blue-stain fungal species and related genera were isolated from SPB-attacked plots than from control plots ($P < 0.001$). This also was true for combined isolation percentages of *L. terebrantis*, *L. procerum*, and *O. ips* ($P = 0.03$). Presence of blue-stain fungi also was associated with higher stand basal area in the control plots ($P = 0.045$). Isolation frequencies of *O. ips* and *L. procerum*, along with the combination of these fungal species with *L. terebrantis*, were logistically related to increasing stand basal area in the control plots ($P = 0.02, 0.02, \text{ and } 0.01$, respectively). No logistic relationship was found for frequency of any of the three blue-stain species with respect to basal area in SPB-attacked plots. These results suggest blue stain fungi are important in the dynamics of susceptibility of southern pines to SPB attack. (31)

Otrosina, W.J.; Garbelotto, M. 1998. **Root disease and exotic ecosystems: implications for long-term site productivity.** In: INRA, ed. Root and butt rots of forest trees; 9th international conference on root and butt rots; 1997 September 1-7; Carcans-Maubuisson, France. Les Colloques, France: [Publisher unknown]: p. 275-283.

Root disease fungi, particularly root-rotting Basidiomycetes, are key drivers of forest ecosystems. These fungi have co-evolved with their hosts in various forest ecosystems and are in various states of equilibrium with them. Management activities and various land uses have taken place in recent times that have dramatically altered edaphic and environmental conditions under which forest tree species and ecosystems have evolved. For example, in *Sequoia giganteum* stands, fire suppression in this fire-dependent ecosystem has resulted in increased mortality due to *Heterobasidion annosum*. One hypothesis is that fire suppression results in increased encroachment of true firs, readily infected by S group *H. annosum*, thereby transferring the disease via root contacts with *S. giganteum*. Also, the existence of a hybrid between the S and P ISG's of *H. annosum* may be evidence for anthropogenic influences on evolutionary pathways in this pathogen. In other ecosystems, such as *Pinus palustris* (longleaf pine) in the Southeastern United States, increased mortality following prescribed fire is being observed. Various *Leptographium* species and *H. annosum* have been associated with this mortality following relatively cool temperature fires, but how these fungi interact with fire and various edaphic factors are not known. Past agricultural practices that resulted in extensive soil erosion may have given rise to an "exotic ecosystem" in which longleaf pine is now maladapted. (32)

Schweitzer, Callie Jo. 1999. **Forest statistics for West Tennessee, 1997.** Resour. Bull. SRS-41. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 60 p.

This report summarizes a 1997 inventory of the forest resources of an 18-county area of Tennessee. Major findings are highlighted in text and graphs; detailed data are presented in 51 tables. (33)

Shupe, Todd F.; Hse, Chung Y.; Choong, Elvin T. 1999. **An overview of silvicultural influences on loblolly pine veneer-based panel properties.** In: Wang, Song-Yung; Yeh, Min-Chyuan, eds.; Timber and wood composites for the next century; Proceedings, international conference on effective utilization of plantation timber; 1999 May 21-23; Chi-Tou, Taiwan, R.O.C. Chi-Tou, Taiwan, R.O.C.: Forest Products Association of R.O.C., Bulletin No. 16: 22-25.

Loblolly pine (*Pinus taeda* L.) harvested from five silviculturally different stands was used to manufacture 13-ply laminated veneer lumber (LVL) and 3-ply plywood. LVL panels were assembled as either all A-grade or all C-grade veneer. Plywood panels were produced according to four different veneer grade layups (AAA, ACA, ACC, and CCC). Many significant differences in modulus of elasticity (MOE) and modulus of rupture (MOR) were found to exist between the stands for both panel products. MOR significantly varied according to stand for both LVL but not plywood, and MOE varied significantly according to stand for plywood but not LVL. (34)

Shupe, Todd F.; Hse, Chung Y.; Choong, Elvin T.; Groom, Leslie H.. 1999. **Effect of silvicultural practice and wood type on loblolly pine particleboard and medium density fiberboard properties.** *Holzforschung.* 53(2): 215-222.

The objective of this study was to determine the effect of five different silvicultural strategies and wood type on mechanical and physical properties of loblolly pine (*Pinus taeda* L.) particleboard and fiberboard. The furnish was prepared in an unconventional manner from innerwood and outerwood veneer for each stand. Modulus of rupture (MOR) differences between the stands were insignificant for particleboard. Some significant modulus of elasticity (MOE) differences existed between the stands for particleboard and fiberboard. Differences between the wood types were minimal for each stand. Innerwood yielded higher mean MOR, MOE, and internal bond (IB) values than outerwood for most of the stands. The differences between the stand and wood types for 2 and 24 h thickness swell and 2 and 24h water adsorption were very minimal. This research has shown that innerwood can produce particleboard and fiberboard panels with very comparable mechanical and physical properties to outerwood. The effect of the silvicultural strategy (i.e., stand) was minimal for most properties. (35)

Shupe, Todd F.; Hse, Chung Y.; Wang, Wan H. 1999. **An investigation of factors affecting wettability of some southern hardwoods.** In: Christiansen, Alfred W.; Pilato, Louis A. International contributions to wood adhesion research; Proceedings no. 7267. Madison, WI: Forest Products Society: 132-136.

Wettability of sanded and nonsanded transverse and tangential sections of 22 southern hardwood species were [was] judged by measurement of contact angles using phenol-formaldehyde resins. As expected, contact angle values on transverse sections were higher than on tangential sections for both sanded and nonsanded surfaces. On sanded surfaces, hackberry had the highest mean contact angle (64.7°), and black oak had the lowest mean contact angle (50.1°). On nonsanded surfaces, winged elm had the highest mean contact angle (59.1°), and sweetgum had the lowest mean contact angle (45.9°). In addition, 4 of the 22 species (southern red oak, sweetgum, white oak, and post oak) were selected to investigate the effect of oven-drying, air-drying, and freeze-drying on wettability. The mean transverse contact angle was 2.1° to 29.0° and 5.1° to 31.5° higher than radial and tangential values, respectively. The contact angle pattern typically displayed for a given species and plane was generally oven-dry > air-dry > freeze-dry. The species pattern for most drying methods and planes was: sweetgum > white oak > post oak > southern red oak. White oak and post oak gave similar contact angle values. (36)

Stratton, Daniel; Lowe, Larry. 1999. **Kentucky's timber industry—an assessment of timber product output and use, 1997.** Resour. Bull. SRS-40. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 40 p.

In 1997, roundwood output from Kentucky's forests totaled more than 195 million cubic feet, 5 percent more than in 1995. Mill byproducts generated from primary manufacturers declined 11 percent to 98 million cubic feet. Almost 95 percent of plant residues were used primarily for fuel and fiber products. Saw logs were the leading roundwood product at 161 million cubic feet; pulpwood ranked at a distant second at 17 million cubic feet. The number of primary processing plants declined from 401 in 1995 to 391 in 1997. Total receipts increased 2 percent to 216 million cubic feet. (37)

Stratton, Daniel; Wright, Robert C. 1999. **Tennessee's timber industry—an assessment of timber products output and use, 1997.** Resour. Bull. SRS-42. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 36 p.

In 1997, roundwood output from Tennessee's forests was 321 million cubic feet. Mill byproducts generated from primary manufacturers was 128 million cubic feet. Ninety-one percent of the plant residues were used primarily for fuel and fiber products. Saw logs were the leading roundwood product at 180 million cubic feet; pulpwood ranked second at 122 million cubic feet; other industrial products were third at 18 million cubic feet. There were 505 primary processing plants operating in Tennessee in 1997. Total receipts amounted to 356 million cubic feet. (38)

Sung, Shi-Jean S.; Xu, Dianpeng; Kormanik, Paul P.; Black, Clanton C. 1997. **Photosynthesis and xanthophyll cycle-mediated photoprotection in leaves of *Quercus rubra* and *Q. alba* seedlings of different light environments.** In: Steiner, Kim C., ed. Diversity and adaptation in oak species; Proceedings of the second meeting of working party 2.08.05, genetics of *Quercus*, of the International Union of Forest Research Organizations; 1997 October 12-17;. University Park (State College), PA. University Park, PA: Pennsylvania State University: 288-297.

Two and three years after the outplanting of 1-0 northern red oak (*Quercus rubra*, NRO) and white oak (*Q. alba*, WO) nursery stocks, the highest net photosynthetic rates (A_{max}) were observed from seedlings growing on a clearcut site, followed by those under a pine stand. Both NRO and WO seedlings under a hardwood stand had A_{max} less than 10 percent of the full sun seedling A_{max} . Oaks grown under hardwoods increased their A_{max} more in response to sunflecks than those under a pine stand. Besides NRO and WO seedlings, leaves of several hardwood seedlings and shrubs grown under different light environments were analyzed for pigments and the operation of the xanthophyll cycle. All species investigated shared the following characteristics: higher contents of chlorophyll a+b, α -carotene, lutein, and neoxanthin; smaller xanthophyll cycle pool (sum of violaxanthin V, antheraxanthin A, and zeaxanthin Z); and lower ratios of Z+A to Z+A+V in leaves of understory plants than leaves of the same species growing in full sun. The diurnal xanthophyll cycle (i.e., high Z+A/Z+A+V ratio in midday and low Z+A/Z+A+V ratio near dawn and dusk) was present in leaves of NRO and WO seedlings on the clearcut site. Almost no xanthophyll cycle was operating in understory leaves except that upon sunflecking NRO and WO under hardwoods increased their Z+A/Z+A+V ratio. For every unit of the xanthophyll cycle pool, twice as many chlorophylls must be protected in shade-grown leaves as in sun-grown leaves. The potential use of leaf α -carotene levels in silviculture is discussed. (39)

Swift, Lloyd W., Jr.; Burns, Richard G. 1999. **The three R's of roads: redesign, reconstruction, and restoration.** Journal of Forestry. 97(8) 41-44.

All too often, unpaved forest access roads in the Southern Appalachian Mountains were located near streams and rivers, thereby contributing storm flow and sediment to the aquatic ecosystem. Landowners may not have the resources to reconstruct and relocate all these roads to protect water quality. However, simple techniques for redesign of storm water drainage structures can provide low-cost alternatives where the forest floor can absorb and filter runoff from roads. These practices could apply not just in the Appalachians but wherever storms and roads are placing sediment in the stream. Land managers and consultants who assist nonindustrial forestland owners can use the principles for maintenance, reconstruction, or restoration of problem roads. (40)

Tobiason, Fred L.; Hemingway, R. W.; Hatano, T. 1998

Conformational dynamics of proanthocyanidins: physical and computational approaches. Phytochemical Society of North America [newsletter]. 38(1). Poster paper 27. [not paged].

The interaction of plant polyphenols with proteins accounts for a good part of their commercial (e.g., leather manufacture) and biological (e.g., antimicrobial activity) significance. The interplay between observations of physical data such as crystal structure, NMR analyses, and time-resolved fluorescence with results of computational chemistry approaches has been essential to any success the authors have had in this effort. Examples of critical steps that demonstrate the importance of combining physical data with computational chemistry are summarized. Both measurement of physical properties and computational studies are required to make progress in understanding the interactions between polyphenols and proteins. (41)

Tohmura, Shin-ichiro; Hse, Chung-Yun; Higuchi, Mitsuo. 1999. **Heat stability of cured urea-formaldehyde resins by measuring formaldehyde emission.** In: Christiansen, Alfred W.; Pilato, Louis A. International contributions to wood adhesion research; Proceedings no. 7267. Madison, WI: Forest Products Society: 93-100.

A test method for measuring formaldehyde from urea-formaldehyde (UF) resins at high temperatures was developed and used to assess the influence of the reaction pH at synthesis on the formaldehyde emission during cure and heat stability of the cured resins without water. Additionally, ¹³C-CP/MAS solid-state nuclear magnetic resonance (NMR) techniques were used to investigate the structure of cured UF resins before and after high-temperature heating. Formaldehyde emissions during cure were related to the UF resins' methylol group content. Heat stability of cured UF resin increased as the reaction pH at resin synthesis increased. Solid-state NMR spectra show formaldehyde emission from cured UF resins after heating is mainly ascribable to decreases of methylol group and dimethylene ether linkage. Significantly, it was revealed that the uron structure characteristically found in the cured UF resin synthesized under strong acid media indicated high heat stability. (42)

Wear, David N. 1999. **Challenges to interdisciplinary discourse.** Ecosystems. 2: 299-301.

Many of the world's critical problems involve human interactions with nature and their long-term implications for environmental quality and the sustainability of resource/ecological systems. These problems are complex-defined by the collective behaviors of people as well as by the structure and function of ecosystems-suggesting that both the social and the natural sciences should focus efforts on dimensions of these problems. The separate efforts of social and natural sciences are unlikely to fully illuminate the fabric of or fashion solutions to environmental problems. Rather, much might be gained by truly interdisciplinary research-endeavors where each constituent discipline informs the investigation of the others and where hypotheses might even be jointly formed. Interdisciplinary research seems the best hope for unraveling the complex interactions between the collective behavior of *Homo sapiens* and their environment and yielding workable solutions to these problems. (43)

Yates, Mark D.; Loeb, Susan C.; Guynn, David C., Jr. 1997. **The effect of habitat patch size on small mammal populations.** In: Proceedings of annual conference; Southeastern Association of Fish and Wildlife Agencies; 1997 October 4-8; Oklahoma City, OK. 51: 501-510.

Habitat fragmentation is one of the greatest threats to the conservation of biodiversity and has 3 components: habitat loss, patch isolation, and patch size. The authors tested the effects of forest-clearing size on small mammal populations in the Upper Coastal Plain of South Carolina. These clearings act as islands for many species of small mammals, particularly old-field mice (*Peromyscus polionotus*) and cotton rats (*Sigmodon hispidus*). The authors live-trapped small mammals in 3 size classes of clearcuts (small <6 ha; medium 10-15 ha; and large > 25 ha) on the Savannah River Site and compared relative density and diversity of small mammal species among the patch size classes. *Peromyscus polionotus* were captured on all grids and were the only species captured on small grids; *P. polionotus* relative density did not vary significantly among patch sizes. In contrast, *S. hispidus* relative density, and relative density of all species combined, tended to increase with increased patch size, although the differences in relative density among size classes were not statistically significant. Species diversity (H') increased with patch size and was significantly greater in large patches than in small patches. Thus, patch size may be an important factor affecting diversity of early successional species, but its influence varies among species. (44)