

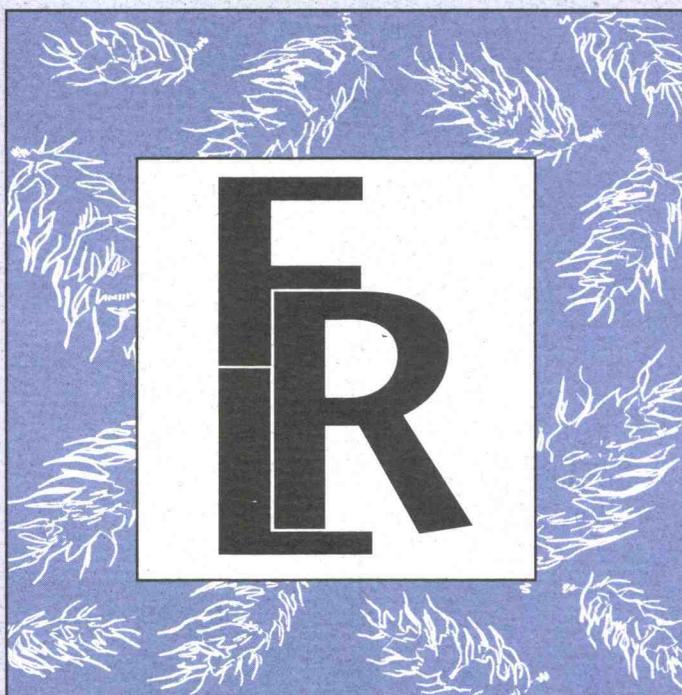
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**Forest Research Laboratory  
Triennial Bibliography 1989-1992**

*compiled by* **Judy D. Starnes**



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# **Forest Research Laboratory Triennial Bibliography 1989-1992**

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**PROGRAM AREAS**

	Page
Forest Regeneration .....	2
Forest Ecology, Culture, and Productivity .....	13
Integrated Protection of Forests and Watersheds .....	30
Evaluation of Forest Uses, Practices, and Policies .....	39
Wood Processing and Product Performance .....	54

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Dear Friend of the Forest Research Laboratory:

The Forest Research Laboratory at Oregon State University is Oregon's only state-supported forestry research organization. Our mission is to conduct research that provides new knowledge about managing forest resources for multiple values and products that help meet society's needs.

The product of our research, new knowledge, is made available to those who wish to use it through a variety of mechanisms. Our research program is closely linked to an outstanding forestry Extension program that delivers problem-solving education to people throughout Oregon. We offer 35-40 workshops each year on a variety of topics through our continuing education program, which helps move research results into application. Scientists at the Forest Research Laboratory also spend a great deal of time answering requests for information by Oregonians who call or write for help.

One of the most important ways we help Oregonians know what we have learned through our research program is to publish our findings in a variety of written media. The following bibliography, whose sections correspond with our five program areas, provides a listing of our published material from July 1, 1989, to June 30, 1992. The list includes publications sponsored by the Forest Research Laboratory, those funded by grants from public and private agencies or other departments of the university, and those representing unsponsored research. Each publication is annotated with a short description of its contents, who the intended audience is, and where copies of the article can be obtained. (Where no University source exists, reprints may be requested directly from the author(s), journal, publisher, or agency stated in the citation.)

There are over 650 citations in this bibliography, a tribute to the productivity and hard work of Forest Research Laboratory scientists. I believe you will be impressed with the quality of the work that has been done, as well. The breadth of subject matter is also significant and reflects the attention the Laboratory gives to all aspects of Oregon's forest resources.

I hope you find this bibliography helpful in obtaining new knowledge about Oregon's forest resources and their utilization. Single copies of reprints available from the Forest Research Laboratory are free; I urge you to take advantage of this opportunity to learn from them.

Sincerely yours,

A handwritten signature in black ink that reads "George W. Brown". The signature is written in a cursive, slightly slanted style.

George W. Brown, Director



## Forestry Publications

Research results find application in many areas as scientists at the Forest Research Laboratory and their cooperators publish their findings. Publications issued between July 1, 1989, and June 30, 1992, are grouped here according to five program areas:

	Page
<b>Forest Regeneration .....</b>	<b>2</b>
<b>Forest Ecology, Culture, and Productivity .....</b>	<b>13</b>
<b>Integrated Protection of Forests and Watersheds .....</b>	<b>30</b>
<b>Evaluation of Forest Uses, Practices, and Policies .....</b>	<b>39</b>
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## Source for Reprints

The appropriate source for reprints is given in parentheses at the end of the citations if they are available from the Forest Research Laboratory or other divisions of Oregon State University. Where no University source exists, reprints may be requested directly from the author(s), journal, publisher, or agency stated in the citation.



## Forest Regeneration

Adams, W.T., R.K. Campbell, and J.H. Kitzmiller. 1992. Genetic considerations in reforestation. P. 284-308 *in* Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For foresters and silviculturists. Natural patterns of genetic variation among and within tree species are described and illustrated by examples from southwestern Oregon and northern California. The consequences of these patterns for silviculture are discussed.

Adams, W.T., G. Johnson, D.L. Copes, J. Daniels, R.G. Quam, J.C. Heaman, and J. Weber. 1990. Is research keeping up with the needs of Douglas-fir tree improvement programs? *Western Journal of Applied Forestry* 5:135-137. (For. Res. Lab.)

For tree improvement specialists, forest geneticists, and managers. This article describes two surveys conducted by a committee of public and private forestry organizations interested in furthering the advancement of tree improvement programs in the Pacific Northwest. The current scope of Douglas-fir tree improvement programs in the region is determined, regional information needs are identified, and the level of existing research is assessed.

Ahrens, G.R., A. Dobkowski, and D.E. Hibbs. 1992. Red alder: guidelines for successful regeneration. Forest Research Laboratory, Oregon State University, Corvallis. Special Publication 24. 11 p. (For. Res. Lab.)

For forest managers, ecologists, and silviculturists. Intentional efforts to regenerate red alder (*Alnus rubra* Bong.) in the Pacific Northwest have been successful in many cases. Natural or artificial regeneration from seed may be adequate under the most favorable site conditions. However, planting is recommended for better control over spacing and for uniform establishment. Consistent success over the range of conditions in the Pacific Northwest requires careful site selection, adequate site preparation, and good quality seedlings.

Amaranthus, M.P., C.Y. Li, and D.A. Perry. 1990. Influence of vegetation type and madrone soil inoculum on associative nitrogen fixation in Douglas-fir rhizospheres. *Canadian Journal of Forest Research* 20:368-371. (For. Res. Lab.)

For forest researchers. Douglas-fir seedlings grown on a cleared manzanita site and an adjacent meadow were

inoculated with small amounts of pasteurized or un-pasteurized soil from a nearby Pacific madrone stand or left uninoculated. Nitrogenase activity in the rhizospheres of the seedlings was compared. Results suggest that early successional ectomycorrhizal shrubs and hardwood trees may be important in maintaining mycorrhizal fungi and associated N<sub>2</sub> fixers after severe disturbance.

Amaranthus, M.P., and D.A. Perry. 1989. Interaction effects of vegetation type and Pacific madrone soil inocula on survival, growth, and mycorrhiza formation of Douglas-fir. *Canadian Journal of Forest Research* 19:550-556. (For. Res. Lab.)

For researchers and managers. Douglas-fir seedlings planted in cleared blocks within three adjacent vegetation types in southwest Oregon were studied to determine the interactive effects of vegetation type and Pacific madrone soil inocula on survival, growth, and mycorrhiza formation. Results suggest that manzanita and madrone impose on soils a biological pattern that stimulates Douglas-fir growth and survival.

Amaranthus, M.P., and D.A. Perry. 1989. Rapid root tip and mycorrhiza formation and increased survival of Douglas-fir seedlings after soil transfer. *New Forests* 3:259-264. (For. Res. Lab.)

For regeneration foresters and forest managers. The influence of soil transfers on the rate root tips and mycorrhizae form on planted Douglas-fir seedlings was studied. Transferring soil from well-stocked plantations into seedling planting holes on old nonreforested clearcuts rapidly stimulated root-tip production, more abundant mycorrhiza formation, and seedling survival.

Andersen, C.P., B.H. Bussler, W.R. Chaney, P.E. Pope, and W.R. Byrnes. 1989. Concurrent establishment of ground cover and hardwood trees on reclaimed mineland and unmined reference sites. *Forest Ecology and Management* 28:81-99.

For foresters and those involved with reclamation ecology. A reclaimed mineland and unmined reference area were planted with hardwood trees to assess the efficacy of current reclamation procedures. Control of competing vegetation was essential for survival and establishment of seedlings on the reclaimed minesite. Disruption of physical characteristics of soil appeared to damage seedling establishment more than did disruption of soil chemical characteristics.

Andersen, C.P., E.I. Sucoff, R.K. Dixon, and A.H. Markhart. 1989. Effects of phosphorus deficiency on root hydraulic conductivity in *Fraxinus pennsylvanica*. *Canadian Journal of Botany* 67:472-476.

For plant physiologists and nursery managers. Phosphorus deficiency of ash (*Fraxinus*) seedlings reduced the ability of root systems to transport water.

Atzet, T., D.L. Wheeler, B. Smith, J. Franklin, G. Riegel, and D. Thornburgh. 1992. Vegetation. P. 92-113 *in* Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from

the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For foresters, silviculturists, ecologists, and wildlife biologists. Plant associations—combinations of plants that are repeated across equivalent environments—are useful indicators of operational environment. This chapter presents the plant series and associations of southwestern Oregon and northern California and discusses management considerations associated with the various operational environments they represent.

**Borchers, S.L., and D.A. Perry. 1990. Growth and ectomycorrhiza formation of Douglas-fir seedlings grown in soils collected at different distances from pioneering hardwoods in southwest Oregon clearcuts. Canadian Journal of Forest Research 20:712-721. (For. Res. Lab.)**

For forest researchers and managers. A greenhouse bioassay was used to compare the growth, ectomycorrhiza formation, and foliar nutrient concentrations of Douglas-fir seedlings grown in soils collected at different distances from hardwood species. Results suggest that pioneering hardwoods strongly influence soil biological activity in clearcuts and impose one or more soil patterns that favor establishment and growth of conifer seedlings.

**Bronson, M.R., and R.K. Dixon. 1991. Cultural factors influencing adventitious shoot and plantlet formation from slash pine cotyledons. New Forests 5:277-288.**

For nursery managers and plant physiologists. A methodology for *in vitro* propagation of slash pine was developed. Approximately 100 slash pine seedlings per embryo can be produced with this 90-day system.

**Brown, D.P., T.K. Pratum, C. Bledsoe, E.D. Ford, J.S. Cothorn, and D. Perry. 1991. Noninvasive studies of conifer roots: nuclear magnetic resonance (NMR) imaging of Douglas-fir seedlings. Canadian Journal of Forest Research 21:1559-1566.**

For forest researchers. Douglas-fir seedlings were grown in an artificial soil mixture and periodically imaged by nuclear magnetic resonance (NMR) for 12 months. Calculated root lengths were in close agreement with measured lengths of excavated roots. Although not all soil materials are suitable for NMR imaging, the great advantage of NMR over conventional techniques is its ability to observe undisturbed roots repeatedly over time.

**Capo-Arteaga, M., and M. Newton. 1991. Survival and growth of five species of *Pinus* seedlings after different approaches to competition control: "bridging" studies between Oregon and Mexico. New Forests 5:219-238. (For. Res. Lab.)**

For reforestation scientists, forest managers, and ecologists. The objectives of this study were (1) to determine if site-preparation treatments and the resulting environments affect juvenile development of five species of pine in Oregon and Mexico, and (2) to determine if seedling responses are related to moisture and temperature modification produced by the treatments. Managers in areas with both dry and wet summer climates can use this data to formulate vegetation-control goals in site preparation.

**Castellano, M.A., and R. Molina. 1990. The biological component: mycorrhizae. P. 103-167 in The Container Tree Nursery Manual. Volume 5. USDA Forest Service, Washington, D.C. Agriculture Handbook 674.**

For nursery managers and foresters. Technical aspects of mycorrhiza management in container nurseries are discussed and illustrated.

**Castellano, M.A., and J.M. Trappe. 1991. *Pisolithus tinctorius* fails to improve plantation performance of inoculated conifers in southwestern Oregon. New Forests 5:349-358.**

For foresters. The results of a large outplanting trial indicate that the ectomycorrhizal fungus *Pisolithus tinctorius* does not stimulate field performance of artificially inoculated bareroot seedlings of *Abies concolor*, *A. grandis*, *Pseudotsuga menziesii*, and *Pinus contorta* on a variety of sites in southwest Oregon.

**Coates, K.D., W.H. Emmingham, and S.R. Radosevich. 1991. Conifer-seedling success and microclimate at different levels of herb and shrub cover in a *Rhododendron-Vaccinium-Menziesia* community of south central British Columbia. Canadian Journal of Forest Research 21:858-866.**

For silviculturists and regeneration specialists. The influence of various amounts of shrub and herb cover on microclimate and on survival and growth of Engelmann spruce and lodgepole pine was examined. Results suggest that soil temperature, air temperature, and light level are the primary factors controlling conifer seedling performance in areas to be regenerated following harvest.

**Dixon, R.K., H.E. Garrett, and G.S. Cox. 1989. Boron fertilization, vesicular-arbuscular mycorrhizal colonization and growth of *Citrus jambhiri* Lush. Journal of Plant Nutrition 12:687-700.**

For horticulturists. Boron deficiency in *Citrus* is common worldwide. Foliar applications of boron stimulate growth and mycorrhizal colonization of *Citrus* seedlings in nursery culture.

**Doescher, P.S., S.D. Tesch, and W.E. Drewien. 1989. Water relations and growth of conifer seedlings during three years of cattle grazing on a southwest Oregon plantation. Northwest Science 63:232-240. (For. Res. Lab.)**

For silviculturists, ecologists, and range conservationists. Cattle grazing, beginning 1 year after planting, was found to enhance water relations and growth of conifer seedlings in a young plantation in southwest Oregon. After 3 years, significantly greater seedling volume was found for both ponderosa pine and Douglas-fir on grazed plots than on those ungrazed or with no competition.

**Emmingham, W.H., M. Bondi, and D.E. Hibbs. 1989. Underplanting western hemlock in a red alder thinning: early survival, growth, and damage. New Forests 3:31-43. (For. Res. Lab.)**

For silviculturists, foresters, and forest researchers. The concept that underplanting conifers beneath a thinned hardwood stand can increase growth and marketable volume of the hardwood and shorten conversion to the

more valuable conifer crop species was tested. In this study, survival and growth of western hemlock underplanted in a thinned red alder stand support this concept.

**Entry, J.A., K. Cromack, Jr., E. Hansen, and R. Waring. 1991. Response of western coniferous seedlings to infection by *Armillaria ostoyae* under limited light and nitrogen. *Phytopathology* 81:89-94. (For. Res. Lab.)**

For forest pathologists. Seedlings of five conifer species were subjected to different levels of light and nitrogen limitation and were inoculated at 4 months with isolates of *Armillaria ostoyae*. After 1 year, disease severity was significantly greater when light or nitrogen was limited than when they were balanced.

**Friedman, J., A. Hutchins, C.Y. Li, and D.A. Perry. 1989. Actinomycetes inducing phytotoxic or fungistatic activity in a Douglas-fir forest and in an adjacent area of repeated regeneration failure in southwestern Oregon. *Biologia Plantarum* 31(6):487-495.**

For researchers in forest regeneration. Data from this study support the idea that, along with other factors, phytotoxic and antifungal actinomycetes may suppress natural regeneration or establishment of planted seedlings through inhibition of seed germination or of mycorrhizal fungi.

**Gleason, J.F., M. Duryea, R. Rose, and M. Atkinson. 1990. Nursery and field fertilization of 2 + 0 ponderosa pine seedlings: the effect on morphology, physiology, and field performance. *Canadian Journal of Forest Research* 20:1766-1772. (For. Res. Lab.)**

For reforestation foresters. Ponderosa pine seedlings were grown in two nurseries where they were subjected to fall application of N, N + K, or no fertilizer. Fall fertilization had only a small effect on seedling N concentration and thus little effect on field performance. Outplanting sites had a larger impact on seedling performance than did any fertilizer treatment.

**Gourley, M., M. Vomocil, and M. Newton. 1990. Forest weeding reduces the effect of deer-browsing on Douglas-fir. *Forest Ecology and Management* 36:177-185.**

For foresters, nurserymen, and forest planners. Three-year-old Douglas-fir transplants were protected against deer browsing by five physical and one chemical treatment, each of which was tested with and without complete weed control. After 5 years, none of the protective treatments provided any growth advantage; in contrast, weed control, with or without protective measures, consistently improved growth.

**Griffiths, R.P., M.A. Castellano, and B.A. Caldwell. 1991. Hyphal mats formed by two ectomycorrhizal fungi and their association with Douglas-fir seedlings: a case study. *Plant and Soil* 134:255-259.**

For ecologists and foresters. Two ectomycorrhizal mat-forming fungi found closely associated with Douglas-fir seedling reproduction under a closed canopy are described.

**Haase, D.L., and R. Rose. 1990. Moisture stress and root volume influence transplant shock: preliminary re-**

**sults. P. 201-206 in Target Seedling Symposium: Proceedings, Combined Meeting of the Western Forest Nursery Associations. R. Rose, S.J. Campbell, and T.D. Landis, eds. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM-200.**

For nursery managers and reforestation specialists. This study was designed to evaluate transplant shock in relation to root volume and soil water content for 2-year-old Douglas-fir seedlings. Preliminary results showed that new growth decreased and days to budbreak increased with higher moisture stress.

**Hamm, P.B., S.J. Campbell, and E.M. Hansen. 1990. Growing healthy seedlings: identification and management of pests in Northwest forest nurseries. USDA Forest Service, Pacific Northwest Region, Portland, Oregon and Forest Research Laboratory, Oregon State University, Corvallis. Special Publication 19. 110 p. (Available from USDA Forest Service, Forest Pest Management Office, P.O. Box 3623, Portland, Oregon 97208.)**

For nursery managers and regeneration specialists. This is an illustrated guide to the identification and management of fungi, insects, and abiotic conditions that cause problems in Northwest bareroot conifer nurseries. Separate chapters address individual pests, with details on recognition, damage cycle, and management practices to reduce losses.

**Hamm, P.B., and E.M. Hansen. 1990. Soil fumigation, cover cropping and organic soil amendments: their effect on soilborne pathogens and the target seedling. P. 174-180 in Target Seedling Symposium: Proceedings, Combined Meeting of the Western Forest Nursery Associations. R. Rose, S.J. Campbell, and T.D. Landis, eds. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM-200.**

For nursery managers. This report summarizes the nursery soil management recommendations derived from a study of the effects of fumigation and cover crops on *Fusarium* and *Pythium* and the diseases they cause.

**Harrington, T.B., and J.C. Tappeiner II. 1991. Competition affects shoot morphology, growth duration, and relative growth rates of Douglas-fir saplings. *Canadian Journal of Forest Research* 21:474-481. (For. Res. Lab.)**

For ecologists and forest managers. Douglas-fir saplings were grown with and without competition from tanoak at two forest sites in southwestern Oregon. Competition reduced Douglas-fir growth by limiting the seasonal duration and daily rates of growth and by constraining development of the following morphological parameters: number and size of buds; length of shoots, internodes, and needles; number of internodes; and biomass of foliage and wood.

**Harrington, T.B., J.C. Tappeiner II, and T.F. Hughes. 1991. Predicting average growth and size distributions of Douglas-fir saplings competing with sprout clumps of tanoak or Pacific madrone. *New Forests* 5:109-130. (For. Res. Lab.)**

For forest managers, weed scientists, and ecologists. The average growth and size distributions of Douglas-fir saplings in three plantations were studied for 7 years after thinning of associated sprout clumps of tanoak or Pacific madrone. Model simulations demonstrated that, for the same initial levels of cover, tanoak grew faster and limited growth of Douglas-fir more than did madrone.

**Helgerson, O.T. 1990. Effects of alternate types of microsite shade on survival of planted Douglas-fir in southwest Oregon. *New Forests* 3:327-332. (For. Res. Lab.)**

For regeneration foresters. Five-year survival of 2 - 0 bareroot Douglas-fir seedlings was increased by three types of shading on two south-facing sites. On the drier site, healthy seedlings growing with minimum competition survived well without shading, but on the wetter site, where seedlings were stressed more by poor planting and greater competition, shading was more beneficial. Shading did not affect growth.

**Helgerson, O.T. 1990. Heat damage in tree seedlings and its prevention. *New Forests* 3:333-358. (For. Res. Lab.)**

For regeneration foresters. Heat damage to natural and planted seedlings can be prevented by recognizing adverse conditions, identifying susceptible seedlings, and taking preventive measures such as shading, planting resistant seedlings, and modifying the soil environment. Shade from live vegetation can prevent heat damage, but the associated competition may kill seedlings.

**Helgerson, O.T. 1990. Response of underplanted Douglas-fir to herbicide injection of sclerophyll hardwoods in southwest Oregon. *Western Journal of Applied Forestry* 5:86-89. (For. Res. Lab.)**

For silviculturists, foresters, and forest managers. Douglas-fir container-grown plug (1 - 0) and nursery-grown bareroot (2 - 0) seedlings were planted in southwest Oregon beneath sclerophyll hardwoods injected with triclopyr amine or left untreated. Herbicide injection of hardwoods was associated with increased height, diameter, and volume growth rates in the underplanted Douglas-fir and seems necessary for establishing Douglas-fir in this environment.

**Helgerson, O.T., D.H. McNabb, and S.D. Hobbs. 1991. Survival and growth of Douglas-fir seedlings after prescribed burning of a brushfield in southwest Oregon. *Western Journal of Applied Forestry* 6:55-59. (For. Res. Lab.)**

For silviculturists and forest managers. The effects of prescribed fire on reforestation were assessed on a brushfield in southwest Oregon where brush had been slashed and either burned or left unburned. Five years after planting, survival of 2 - 0 bareroot Douglas-fir seedlings was high, irrespective of treatment, but seedlings were larger and grew significantly faster in burned than unburned areas.

**Helgerson, O.T., M. Newton, D. deCalesta, T. Schowalter, and E. Hansen. 1992. Protecting young regeneration. P. 384-420 in *Reforestation Practices in Southwestern Oregon and Northern California*. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Or-**

**gon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)**

For foresters, forest managers, natural resource specialists, and others interested in reforestation of hot, droughty sites. Methods of predicting and preventing damage to seedlings from heat, frost, weeds, vertebrate animals, insects, disease, and ravel are described.

**Helgerson, O.T., M. Newton, and D.H. McNabb. 1992. Site preparation. P. 232-256 in *Reforestation Practices in Southwestern Oregon and Northern California*. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)**

For foresters, forest managers, natural resource specialists, and others interested in reforestation of hot, droughty sites. This chapter describes site characteristics, weeds, animals, and diseases that limit reforestation of forests in southwestern Oregon; the use and limitations of site preparation methods in dealing with these problems; safety; and integrating site preparation and vegetation management systems.

**Helgerson, O.T., S.D. Tesch, S.D. Hobbs, and D.H. McNabb. 1989. Survival and growth of ponderosa pine and Douglas-fir stocktypes on a dry low-elevation site in southwest Oregon. *Western Journal of Applied Forestry* 4:124-128. (For. Res. Lab.)**

For professional foresters and managers. Two stocktypes of ponderosa pine and two of Douglas-fir were planted to determine the feasibility of reforesting a dry low-elevation site in southwest Oregon. After five growing seasons, overall survival was high; bare-roots of both species survived significantly better than plugs and had consistently greater height, diameter, and volume.

**Helgerson, O.T., S.D. Tesch, S.D. Hobbs, and D.H. McNabb. 1992. Effects of stocktype, shading, and species on reforestation of a droughty site in southwest Oregon. *Northwest Science* 66:57-61. (For. Res. Lab.)**

For professional foresters and managers. Ponderosa pine seedlings performed slightly better than Douglas-fir for 5 years after clearcutting, but both species have potential to reforest similar harsh sites successfully. Shadecards did not improve seedling performance.

**Hilger, A.B., Y. Tanaka, and D.D. Myrold. 1991. Inoculation of fumigated nursery soil increases nodulation and yield of bare-root red alder (*Alnus rubra* Bong.). *New Forests* 5:35-42.**

For nursery managers, foresters, and microbial ecologists. Evidence from field trials shows that red alder bare-root seedling quality is improved by inoculating with *Frankia*-containing inoculum.

**Hobbs, S.D. 1992. Seedling and site interactions. P. 114-134 in *Reforestation Practices in Southwestern Oregon and Northern California*. S.D. Hobbs, S.D. Tesch,**

P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. *Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)*

For foresters, regeneration specialists, technicians, forestry students, and others interested in forest regeneration. This chapter provides an overview of ecophysiology, which is necessary for understanding seedling response to environmental change and different types of stress.

Hobbs, S.D., S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, editors. 1992. *Reforestation Practices in Southwestern Oregon and Northern California. Forest Research Laboratory, Oregon State University, Corvallis. 465 p. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)*

For foresters and natural resource managers. This book focuses on forest management practices that directly affect conifer establishment and forestry operations in the region. Based on 13 years of research by the FIR Program, it offers silvicultural recommendations designed to achieve reforestation and describes the biological and ecological principles that provide the basis for the recommendations.

Hughes, T.F., J.C. Tappeiner II, and M. Newton. 1990. *Relationship of Pacific madrone sprout growth to productivity of Douglas-fir seedlings and understory vegetation. Western Journal of Applied Forestry 4:20-24. (For. Res. Lab.)*

For foresters and ecologists. This study of the development of Pacific madrone sprout clumps and their effect on Douglas-fir seedlings and understory vegetation indicates that young stands of madrone can quickly occupy a site and affect the growth of planted Douglas-fir. Early measures of madrone density and Douglas-fir seedling diameter can be used as indices of potential crop-tree growth.

Jarmer, C.B., J.W. Mann, and W.A. Atkinson. 1992. *Harvesting timber to achieve reforestation objectives. P. 202-230 in Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)*

For foresters in southwestern Oregon and other regions who are interested in all aspects of forest management. This chapter assists the forester in integrating harvesting activities into the final silvicultural plan. The importance of harvesting as one of the few silvicultural tools available to land managers is stressed.

Knowe, S.A. 1991. *Comparison of expressions for crown size of woody competitors in herbicide efficacy studies. Forest Science 37:1664-1670.*

For forest vegetation management researchers. Estimates of control of woody species made on the basis of one-, two-, and three-dimensional expressions of crown size were evaluated for sensitivity to treatment differences and for correlation with crop tree growth. Sensitivity to treatment differences and correlations with the mean size of crop trees at age 4 years were consistently higher with one- and two-dimensional expressions than with three-dimensional expressions of crown size.

Knowe, S.A. 1991. *Simultaneous prediction of the development of loblolly pine and woody competitors in young plantations. New Forests 5:175-193.*

For forest vegetation management researchers. A system was developed for examining the effects of hardwood density and cover of herbaceous components on mean size of loblolly pine in newly established plantations. The cumulative impacts of associated vegetation on loblolly pine growth and the relative sensitivity of height and diameter to competing vegetation were demonstrated.

Knowe, S.A., B.D. Shiver, and W.N. Kline. 1992. *Fourth-year response of loblolly pine following chemical and mechanical site preparation in the Georgia Piedmont. Southern Journal of Applied Forestry 16:99-105.*

For forest managers and researchers. Fourth-year height, diameter, and volume development of loblolly pine were compared after site treatments with picloram, triclopyr, glyphosate, and hexazinone in various rates, combinations, and timings, and with two- or three-pass mechanical treatments. Predictive models based on species abundance were also developed. The most cost-effective treatments were triclopyr, picloram, and 2,4-D applied in early summer or picloram and triclopyr applied in late summer.

Korpela, E.J., S.D. Tesch, and R. Lewis. 1992. *Plantations vs. advance regeneration: height growth comparisons for southwestern Oregon. Western Journal of Applied Forestry 7:44-47. (For. Res. Lab.)*

For forest managers and silviculturists. This study compared model projections of growth of newly planted Douglas-fir seedlings under three competition regimes across three site classes and growth of three height classes of Douglas-fir and white fir advance regeneration for 20 years following overstory removal. In almost all comparisons, the total height of advance regeneration exceeded that projected for plantation trees.

Lewis, K.J., and E.M. Hansen. 1991. *Survival of *Inonotus tomentosus* in stumps and subsequent infection of young stands in north central British Columbia. Canadian Journal of Forest Research 21:1049-1057.*

For foresters and forest pathologists interested in interior spruce and lodgepole pine forests. The *Inonotus tomentosus* root rot fungus survives at least 30 years in old stumps and infects regenerating trees as they contact old infected roots.

Martin, K.J., Y. Tanaka, and D.D. Myrold. 1991. *Peat-carrier increases inoculation success with *Frankia* on red alder (*Alnus rubra* Bong.) in fumigated nursery beds. New Forests 5:43-50.*

For nursery managers, foresters, and microbial ecologists. Several inoculation methods and rates of inoculum addition are compared. A practical means of using pure-culture *Frankia* inoculum is described.

**McCreary, D.D., D.P. Lavender, and R.K. Hermann. 1990.** Predicted global warming and Douglas-fir chilling requirements. *Annales des Sciences Forestières* 47:325-330.

For tree physiologists and foresters. Potted Douglas-fir seedlings from warm coastal and cool mountainous seed sources in Oregon were chilled at constant temperatures of 5, 7, or 9°C for 9, 11, 13, or 15 weeks and then placed in a growth room. The degree of bud break and the weight of new shoot growth were recorded. Results indicate that relatively small increases in mean winter temperatures could adversely affect Douglas-fir growing in the Northwest.

**McDonald, P.M., and O.T. Helgeson. 1990.** Mulches aid in regenerating California and Oregon forests: past, present, and future. USDA Forest Service, Pacific Southwest Research Station, Berkeley, California. General Technical Report PSW-123. 19 p. (For. Res. Lab.)

For regeneration foresters. This paper brings together information on mulching in Oregon and California and contains recommendations that match the various kinds of mulches to site conditions and vegetation types. Mulch size, longevity, cost, strong points, and limitations, as well as specific weeds controlled, are presented.

**McNabb, D.H. 1991.** Ravel does not affect reforestation of an old clearcut in southwest Oregon. Forest Research Laboratory, Oregon State University, Corvallis. Research Note 82. 4 p. (For. Res. Lab.)

For land managers and regeneration foresters. On a 20-year-old nonforested clearcut in the western Siskiyou Mountains of southwest Oregon, fewer than 3 percent of the unprotected 2 - 0 bareroot Douglas-fir seedlings outplanted were buried by ravel after 2 years.

**McNabb, D.H., and S.D. Hobbs. 1989.** Shallow tillage fails to increase 5-year growth of ponderosa pine seedlings. *Northwest Science* 63:241-245. (For. Res. Lab.)

For regeneration foresters and soil scientists. This study of the effects of soil ripping on the field performance of ponderosa pine seedlings in southwest Oregon showed that tillage did not increase growth of 2 - 0 bareroot seedlings planted in the rip furrows over that of seedlings planted midway between furrows. This result suggests that shallow tillage of soil is ineffective at improving the performance of well-planted seedlings.

**Miller, R.E., D.H. McNabb, and J. Hazard. 1989.** Predicting Douglas-fir growth and response to nitrogen fertilization in western Oregon. *Soil Science Society of America Journal* 53:1552-1560.

For silviculturists and soil scientists. This study examined the efficacy of various stand, climatic, site, and soil-test variables for predicting relative and absolute response to a single application of 224 kg N ha<sup>-1</sup> as urea. Stand

variables remain the most reliable predictors of fertilizer response in this region.

**Minore, D., and R.J. Laacke. 1992.** Natural regeneration. P. 258-283 in *Reforestation Practices in Southwestern Oregon and Northern California*. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For practicing silviculturists and forestry researchers. This chapter is a literature review and discussion that should enable silviculturists to assess the advantages and disadvantages of natural regeneration, relate it to local situations, and realize the potential benefits it can provide.

**Minore, D., J.E. Means, P.G. Cunningham, and H.G. Weatherly. 1991.** Growth patterns of deerbrush and snowbrush as functions of age and shrub vigor. *Forest Science* 37:1140-1149.

For forestry researchers and land managers. Stem analysis techniques were used to develop equations for estimating the growing space that will be occupied by open-grown shrubs of either species. Species growth habits are described and compared.

**Newton, M., and E.C. Cole. 1991.** Root development in planted Douglas-fir under varying competitive stress. *Canadian Journal of Forest Research* 21:25-31. (For. Res. Lab.)

For forest managers. Roots of 5-year-old Douglas-fir on three Oregon sites were excavated with explosives and analyzed for the effects of competition on root biomass and on planting-induced root deformities. Results suggest that competition treatment did not influence shoot:root ratios and that root systems had fully compensated for planting deformities.

**Newton, M., E.C. Cole, R.A. Lautenschlager, D.E. White, and M.L. McCormack, Jr. 1989.** Browse availability after conifer release in Maine's spruce-fir forests. *Journal of Wildlife Management* 53:643-649. (For. Res. Lab.)

For wildlife managers, ecologists, and foresters. Seven years after harvest in a spruce-fir forest in north-central Maine, several herbicides were experimentally applied for conifer release. Vegetation development thereafter was recorded and related to browse availability. Data indicate that intensive management designed to increase forest crop production in northeastern spruce-fir ecosystems substantially improves and prolongs browse availability.

**Omi, S.K., and R. Rose. 1990.** Target root starch concentrations before storage: testing the model. P. 195-200 in *Target Seedling Symposium: Proceedings, Combined Meeting of the Western Forest Nursery Associations*. R. Rose, S.J. Campbell, and T.D. Landis, eds. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM-200.

For nursery managers and reforestation specialists. Because carbohydrate reserves decline with long-term storage, it is important to know whether this depletion will affect subsequent survival and growth after planting. In this study, there was little evidence to support the model of a target concentration of root starch for enhancing survival and growth after planting. However, this lack of evidence does not diminish the importance of maintaining starch reserves.

- Omi, S.K., R. Rose, and T.E. Sabin. 1991. Effectiveness of freezer storage in fulfilling the chilling requirement of fall-lifted ponderosa pine seedlings. *New Forests* 5:307-326. (For. Res. Lab.)

For seedling physiologists, nursery managers, and reforestation specialists. The degree to which freezer storage fulfilled the chilling requirement of ponderosa pine seedlings of two sources was determined by monitoring their development after potting or planting. Storage did not totally replace winter conditions, especially for seedlings lifted in September and October. Patterns of budbreak in seedlings lifted and stored in November were similar to those of seedlings that had overwintered in beds.

- Omi, S.K., B. Yoder, and R. Rose. 1991. Fall lifting and long-term freezer storage of ponderosa pine seedlings: effects on post-storage leaf water potential, stomatal conductance, and root growth potential. *Tree Physiology* 8:315-325. (For. Res. Lab.)

For seedling physiologists, nursery managers, and reforestation specialists. The effects of fall lifting and long-term freezer storage on root-growth potential and physiology of ponderosa pine seedlings were examined. Seedlings lifted in October and stored until March had poor root initiation, low predawn leaf water potential, and low stomatal conductance compared with seedlings lifted in November and stored until March or with March-lifted stock.

- Owston, P.W., G.A. Walters, and R. Molina. 1992. Selection of planting stock, inoculation with mycorrhizal fungi, and use of direct seeding. P. 310-327 in *Reforestation Practices in Southwestern Oregon and Northern California*. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For reforestation specialists and scientists, nursery managers, and forest managers. The types of planting stock, their characteristics, and their uses are described. Literature on direct seeding is reviewed, and terminology for mycorrhizal inoculation is described.

- Pabst, R.J., J.C. Tappeiner II, and M. Newton. 1990. Varying densities of Pacific madrone in a young stand in Oregon alter soil water-potential, moisture stress, and growth of Douglas-fir. *Forest Ecology and Management* 37:267-283. (For. Res. Lab.)

For forest managers and silviculturists. Soil water-potential, moisture stress, and growth in Douglas-fir were studied on a droughty site in southwest Oregon. Pacific

madrone and associated shrub and herbaceous vegetation were thinned to represent a range of site conditions. Conditions for maximum Douglas-fir growth clearly occurred when all madrone and associated vegetation were controlled.

- Palazzi, L.M., R.F. Powers, and D.H. McNabb. 1992. Geology and soils. P. 48-72 in *Reforestation Practices in Southwestern Oregon and Northern California*. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For soil scientists, foresters, regeneration specialists, and forestry students. This chapter provides a broad overview of how soils and geology affect reforestation and how forest operations affect the soil resource.

- Petersen, T.D., Z. Ning, and M. Newton. 1990. Dynamics of size structures in seedling stands of *Fraxinus mandshurica* in northeast China. *Annals of Botany* 66:255-263.

For an international audience interested in forest ecology. A stochastic model describing asymmetric competition in heterogeneous neighborhoods would be appropriate for the size structure of these stands in northeast China.

- Peterson, C.E., K.G. Mattson, and R.J. Mickler. 1989. Seedling response to sulfur, nitrogen, and associated pollutants. USEPA, Environmental Research Laboratory, Corvallis, Oregon. EPA/600/3-89/081. 104 p.

For scientists and developers of regulatory policy. This report reviews preliminary results of seedling exposure studies currently in progress. Projects funded by the Forest Response Program of the National Acid Precipitation Assessment Program are examined.

- Radosevich, S.R. 1988. Methods to study crop and weed interactions. P.121-143 in *Weed Management in Agroecosystems: Ecological Approaches*. CRC Press, Boca Raton, Florida.

For agricultural and forest scientists. This chapter focuses on factors of plant proximity such as density, spatial arrangement of plants, and the proportion of species, which are important considerations when studying plant interference. Several approaches to studying interference in mixed stands are also discussed.

- Redmond, K.T. 1992. Climate. P. 74-90 in *Reforestation Practices in Southwestern Oregon and Northern California*. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For silviculturists, ecologists, forestry specialists, and the general public. This chapter discusses the general climatic influences on southwestern Oregon and northern

California, seasonal and spatial aspects of the primary climate elements, and aspects of regional and local climate with particular relevance to living organisms.

- Rose, R. 1992. Root growth potential and starch differences in seedlings of six families of genetically improved loblolly pine. *Forest Science* 38:448-456. (For. Res. Lab.)

For nursery managers and reforestation supervisors. The relationships among root growth potential, total fresh weight, and starch levels of six genetically improved families of loblolly pine were examined during a test of root growth potential. Measurements showed that, after 30 days, the percentage of starch initially in the roots and the starch in new white lateral roots were not related to root growth potential. Seedlings that produced new roots tended to have more total starch in all plant parts than those that did not.

- Rose, R. 1992. Seedling handling and planting. P. 328-344 in *Reforestation Practices in Southwestern Oregon and Northern California*. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For planters, planting contractors, Boy and Girl Scouts, civic groups that plant trees, and public agencies. Successful establishment of seedlings depends on proper handling and planting. This chapter covers storage and handling of seedlings en route from the nursery, optimum planting site conditions, good planting strategies, and inspection of planted seedlings.

- Rose, R., M. Atkinson, J. Gleason, and T. Sabin. 1991. Root volume as a grading criterion to improve field performance of Douglas-fir seedlings. *New Forests* 5:195-209. (For. Res. Lab.)

For reforestation and nursery professionals. The results of this study show that root volume has promise as an additional parameter for grading seedlings, along with height and diameter. Root volume is simple to measure, and several nurseries in the Pacific Northwest already use it as an index of morphological quality to maximize field performance.

- Rose, R., S.J. Campbell, and T.D. Landis, editors. 1990. *Target Seedling Symposium: Proceedings, Combined Meeting of the Western Forest Nursery Associations*. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM-200. 286 p. (For. Res. Lab.)

For nursery managers and reforestation specialists. This publication is a compilation of 28 technical articles on forest nursery management in western North America. Ten papers of the Target Seedling Symposium discuss the latest methods of describing and measuring the ideal seedling for reforestation purposes. The remaining papers deal with operational aspects of growing forest tree seedlings in bareroot or container nurseries.

- Rose, R., W.C. Carlson, and P. Morgan. 1990. The target seedling concept. P. 1-8 in *Target Seedling Symposium: Proceedings, Combined Meeting of the Western Forest Nursery Associations*. R. Rose, S.J. Campbell, and T.D. Landis, eds. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM-200. (For. Res. Lab.)

For nursery managers and reforestation specialists. Specific physiological and morphological characteristics of seedlings can be quantitatively linked with reforestation success. Nursery technology has advanced to the point where it is possible to predict seedling performance after outplanting more reliably.

- Rose, R., J. Gleason, M. Atkinson, and T. Sabin. 1991. Grading ponderosa pine seedlings for outplanting according to their root volume. *Western Journal of Applied Forestry* 6:11-15. (For. Res. Lab.)

For reforestation and nursery professionals. Three different seed sources of 2 + 0 ponderosa pine seedlings were graded on the basis of three root-volume categories and then outplanted to determine differences in survival and growth over one and two growing seasons. Results suggest that root volume has potential as a criterion for grading seedlings.

- Rose, R., S.K. Omi, B. Court, and K. Yakimchuk. 1992. Dormancy release and growth responses of 3 + 0 bare-root white spruce (*Picea glauca*) seedlings subjected to moisture stress before freezer storage. *Canadian Journal of Forest Research* 22:132-137. (For. Res. Lab.)

For managers and researchers involved with regeneration. Increased moisture stress in white spruce seedlings before freezer storage led to increased moisture stress during storage, delayed budbreak, and reduced height growth, but the effects decreased as the length of freezer storage increased. Seed source had a significant effect on most responses.

- Ross, D.W., C.W. Berisford, and J.F. Godbee, Jr. 1990. Pine tip moth, *Rhyacionia* spp., response to herbaceous vegetation control in an intensively site-prepared loblolly pine plantation. *Forest Science* 36:1105-1118.

For foresters and forest pest management specialists. Pine growth gains resulting from reduced vegetative competition were more than enough to compensate for higher tip moth damage following herbicide treatments.

- St. Clair, J.B., and W.T. Adams. 1991. Effects of seed weight and rate of emergence on early growth of open-pollinated Douglas-fir families. *Forest Science* 37:987-997. (For. Res. Lab.)

For forest geneticists, tree improvement specialists, and nursery managers. Seed weight, time of emergence, and three measures of seedling size were recorded for 39 open-pollinated Douglas-fir families in order to assess family variation in seed weight and emergence and the influence of these seed traits on early growth. Correlations of (a) seed weight to rate of emergence and (b) seed weight and rate of emergence to seedling size were not strong.

Stein, W.I. 1992. Regeneration surveys and evaluation. P. 346-382 *in* Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For forest managers, silviculturists, reforestation specialists and technicians, and all who evaluate reforestation results. The author provides a comprehensive critique of all regeneration survey methods, including design factors, sampling principles, applicable statistics, appropriate applications, and illustrative examples.

Tappeiner, J.C., II, M. Newton, P.M. McDonald, and T.B. Harrington. 1992. Ecology of hardwoods, shrubs, and herbaceous vegetation: effects on conifer regeneration. P. 136-164 *in* Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For forest ecologists, silviculturists, and wildlife biologists. The life cycles and management of shrubs and hardwoods of southwestern Oregon and northern California are discussed. Evaluation and prediction of interactions among shrubs, hardwoods, and conifers are included.

Tesch, S.D., M.S. Crawford, K. Baker-Katz, and J.W. Mann. 1990. Recovery of Douglas-fir seedlings from logging damage in southwestern Oregon: preliminary evidence. *Northwest Science* 64:131-139. (For. Res. Lab.)

For foresters and silviculturists. Two studies of shelterwood overstory removal in southwest Oregon examined Douglas-fir advance regeneration up to 4.5 m tall and found that damaged trees 60 cm or taller recovered well from substantial logging-related injuries. Very small damaged trees (<30 cm), however, recovered poorly.

Tesch, S.D., and J.A. Helms. 1992. Regeneration methods. P. 166-201 *in* Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For silviculturists and reforestation specialists. This chapter provides an overview of concepts related to silvicultural systems and regeneration methods. Results from reforestation tests associated with different methods and in different environments within the region are summarized.

Tesch, S.D., and S.D. Hobbs. 1989. Impact of shrub sprout competition on Douglas-fir seedling develop-

ment. *Western Journal of Applied Forestry* 4:89-92. (For. Res. Lab.)

For foresters and forest scientists. The competitive effects of three initial levels of sclerophyllous shrub sprouts on the development of newly planted Douglas-fir seedlings were studied. After 3 years, Douglas-fir survival did not differ significantly among levels of competition. However, percentage cover of competing shrubs was negatively correlated with conifer root and shoot biomass.

Tesch, S.D., D.H. Lysne, R.A. Lewis, and C.J. Brown. 1992. Reforestation knowledge: perspectives and synthesis for managers. P. 422-434 *in* Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For silviculturists, natural resource managers, and the interested public. This chapter synthesizes available knowledge about reforestation-related issues in the region, written particularly for upper-level decision makers. Much basic knowledge has been developed about forest ecosystems, vegetation ecology, timber harvesting, and operational techniques that can be applied to meet a variety of forest management objectives.

Tesch, S.D., and J.W. Mann. 1991. Clearcut and shelterwood reproduction methods for regenerating southwest Oregon forests. *Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin* 72. 43 p. (For. Res. Lab.)

For regeneration specialists. This report summarizes the available research and experience concerning the clearcut and shelterwood regeneration methods—both important, silviculturally viable reforestation tools in southwest Oregon—and evaluates ecological, operational, and economic trade-offs. It focuses on planted Douglas-fir, although natural regeneration and other species also are discussed.

Tesch, S.D., and J.C. Tappeiner II. 1992. Planning for reforestation success. P. 2-25 *in* Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)

For silviculturists and reforestation specialists. Key elements to consider in writing a reforestation plan are described and a framework for the planning process is offered. Three examples of plans for different types of forest stands and environments are included.

Tung, C.-H., and D.R. DeYoe. 1991. Dormancy induction in container-grown *Abies* seedlings: effects of environmental cues and seedling age. *New Forests* 5:13-22.

- For plant biologists and forest nursery managers. Twelve-week-old container-grown seedlings of noble fir and Shasta red fir, both high-elevation species, were grown under controlled environments in a study of induction of terminal-bud dormancy. Treatments combining different photoperiods, thermoperiods, and moisture regimes were imposed upon seedlings for 12 weeks. The results suggest that seedlings responded dynamically to dormancy cues.
- Valverde, B.E., A.P. Appleby, S.R. Radosevich, and A. Soeldner. 1991. Cellular characteristics of dinitroaniline herbicide-resistant goosegrass (*Eleusine indica*). *Weed Science* 39:6-12.**
- For scientists studying plant competition. Primary root cells from goosegrass biotypes—five resistant and three susceptible to dinitroaniline—were observed by transmission electron microscopy to determine whether resistance was associated with changes in cell-wall formation. Little or no correlation between dinitroaniline resistance and cell-wall malformations appeared.
- Vance, N.C. 1991. Competition between vegetative and reproductive growth of cone-bearing Douglas-fir trees in a clonal seed orchard: nutrient effects. P. 36-37 in Northwest Seed Orchard Managers Association. 1991 Winter Workshop Proceedings, Wilsonville, Oregon. Daniels & Associates, Inc., Centralia, Washington.**
- For seed orchard managers and reforestation specialists. Douglas-fir trees in a clonal seed orchard in western Oregon produced a heavy cone crop in 1989 and 1990. Needles of the same cones from both crop years were analyzed for nutrient content. Differences in levels of potassium, magnesium, and calcium were detected between trees with a heavy cone crop and those with a light crop or no crop. A large crop was related to reduced potassium levels in foliage.
- Vance, N.C., D.O. Copes, and J.B. Zaerr. 1990. Differences in proteins synthesized in needles of unshaded and shaded *Pinus ponderosa* var *scopulorum* seedlings during prolonged drought. *Plant Physiology* 92:1244-1248.**
- For plant physiologists and plant molecular biologists. Protein synthesis induced by water deficit in drought-tolerant seedlings may contribute to resisting the effects of cellular dehydration.
- Vance, N.C., and J.B. Zaerr. 1990. Analysis by high-performance liquid chromatography of free amino acids extracted from needles of drought-stressed and shaded *Pinus ponderosa* seedlings. *Physiologia Plantarum* 79:23-30.**
- For plant physiologists and biochemists. The results of high-performance liquid chromatography analysis showed that drought and shading induced an increase in arginine, proline, and total amino acid concentration in needles; shading had the greater effect.
- Vance, N.C., and J.B. Zaerr. 1991. Influence of drought stress and low irradiance on plant water relations and structural constituents in needles of *Pinus ponderosa* seedlings. *Tree Physiology* 8:175-184.**
- For plant physiologists. The influence of low light on tolerance to prolonged drought was tested on unshaded and shaded seedlings of ponderosa pine. Results suggest that structural changes cause shaded seedlings to be less adaptable to drought than are unshaded seedlings.
- Wagner, R.G., T.D. Petersen, D.W. Ross, and S.R. Radosevich. 1989. Competition thresholds for the survival and growth of ponderosa pine seedlings associated with woody and herbaceous vegetation. *New Forests* 3:151-170. (For. Res. Lab.)**
- For foresters and forest researchers. The results from three previous studies were used to quantify the relation between various levels of woody and herbaceous vegetation and the survival and growth of planted seedlings of ponderosa pine. The maximum- and minimum-response thresholds for pine stem volume occurred at lower levels of vegetation abundance than did those for pine survival.
- Wagner, R.G., and S.R. Radosevich. 1991. Interspecific competition and other factors influencing the performance of Douglas-fir saplings in the Oregon Coast Range. *Canadian Journal of Forest Research* 21:829-835. (For. Res. Lab.)**
- For forest researchers and silviculturists. Results from this study indicated that competing vegetation and animal damage were negatively correlated with tree size. Tree age, initial seedling size, and the use of prescribed burning were positively correlated with tree size. Douglas-fir saplings were larger on steep southeast slopes.
- Wagner, R.G., and S.R. Radosevich. 1991. Neighborhood predictors of interspecific competition in young Douglas-fir plantations. *Canadian Journal of Forest Research* 21:821-828. (For. Res. Lab.)**
- For forest researchers and silviculturists. The objective of this study was to improve techniques for quantifying interspecific competition in young plantations of Douglas-fir. The best interspecific competition index for predicting Douglas-fir height and stem diameter was the total percentage of cover for all woody species within a 2.1-m radius.
- Wagner, R.G., A.A. Robison, P.C. Griessmann, T.B. Harrington, and S.R. Radosevich. 1990. VEGPRO—forest vegetation management prescription optimization and information system: a user manual. Version 1.0. Forest Research Laboratory, Oregon State University, Corvallis. 61 p. (Software package, which includes one user manual, is available for purchase (\$150.00) from the College of Forestry, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331-5704. An extra copy of the user manual is available free from the Forestry Publications Office. VEGPRO requires an MS-DOS compatible computer with a hard disk 512K, RAM, and one 5.25- or 3.5-inch disk drive. Specify disk format (5.25 or 3.5 inch) when ordering software.)**
- For professional foresters. VEGPRO is an interactive computer program that can evaluate site preparation, conifer release, and individual-plant treatments for three forest vegetation types in the Pacific Northwest: (1) coastal and western Cascade deciduous woody vegetation in Oregon, Washington, and northern California, (2) mixed

sclerophyll woody vegetation in southwestern Oregon and northwestern California, and (3) herbaceous vegetation complexes in Oregon and Washington.

**Walstad, J.D. 1991. Feasibility of large-scale reforestation projects for mitigating atmospheric CO<sub>2</sub>—ecological considerations. P. 11-28 in Proceedings, International Workshop on Large-Scale Reforestation. J.K. Winjum and P.E. Schroeder, eds. USEPA, Office of Research and Development, Washington, D.C. EPA/600/9-91/014.**

For environmental scientists and policymakers. Prospects for establishing and tending new forest plantations on a large scale to mitigate CO<sub>2</sub> buildup are discussed with respect to suitable and available land area, technical know-how, operational experience, ecological factors, vulnerability to pests, and socio-economic considerations.

**Walstad, J.D. 1992. History of the development, use, and management of forest resources. P. 26-46 in Reforestation Practices in Southwestern Oregon and Northern California. S.D. Hobbs, S.D. Tesch, P.W. Owston, R.E. Stewart, J.C. Tappeiner II, and G.E. Wells, eds. Forest Research Laboratory, Oregon State University, Corvallis. (Complete book is available from the Forestry Business Office, Oregon State University, Peavy Hall 154, Corvallis, Oregon 97331 at \$27.00 including postage.)**

For foresters, natural resource managers, and others interested in the historical development of southwestern Oregon and northern interior California. This chapter traces the history of resource use in southwestern Oregon and northern interior California from early fur trapping to the present, focusing on the development of timber as the dominant resource. It identifies the obstacles to successful reforestation and discusses their economic implications. Finally, it sketches the development of forestry research in the region, culminating with the FIR Program (Forestry Intensified Research), a major research and technology-transfer program directed at improving reforestation practices.

**White, D.E., and M. Newton. 1990. Herbaceous weed control in young conifer plantations with formula-**

**tions of nitrogen and simazine. Canadian Journal of Forest Research 20:1685-1689. (For. Res. Lab.)**

For silviculturists and forest managers. Weed control and second-year survival and growth of newly planted Douglas-fir and noble fir seedlings were measured after application of herbicide and fertilizer. Results suggest that, although the herbicide simazine may be toxic to first-year conifers, more complete weed control in conjunction with fertilization may substantially benefit young conifer plantations.

**White, D.E., L. Witherspoon-Joos, and M. Newton. 1990. Herbaceous weed control in conifer plantations with hexazinone and nitrogen formulations. New Forests 4:97-105. (For. Res. Lab.)**

For silviculturists and forest managers. The effect of hexazinone applied with different nitrogen fertilizers in three kinds of treatments on the survival and growth of newly planted Douglas-fir and noble fir was evaluated. Survival of noble fir and diameter of both noble fir and Douglas-fir were significantly increased when a co-granular formulation of hexazinone and nitrogen-fertilizer granules was used.

**Zasada, J.C. 1990. Developing silvicultural systems for the boreal forest. Faculty of Agriculture and Forestry, University of Alberta, Alberta. Forest Industry Lecture 25. 43 p.**

For foresters. Boreal forests provide many products and benefits for local residents and visitors. In order to produce a wide variety of products on a sustained basis, an array of silvicultural options must be available. White spruce regeneration can be successfully obtained with a variety of silvicultural practices that include clearcutting and retention in the form of shelterwoods, seed trees, and multiple-aged management.

**Zasada, J.C., T.L. Sharik, and M. Nygren. 1992. The reproductive process in boreal forest trees. P. 85-125 in A Systems Analysis of the Global Boreal Forest. Cambridge University Press, New York.**

For forest ecologists and foresters. The reproductive process in boreal forest trees consists of seed reproduction and regrowth from a vegetative bud bank. The two processes are described for selected boreal forest trees.



## Forest Ecology, Culture, and Productivity

- Adams, P.W., A.L. Flint, and R.L. Fredriksen. 1991. Long-term patterns in soil moisture and revegetation after a clearcut of a Douglas-fir forest in Oregon. *Forest Ecology and Management* 41:249-263. (For. Res. Lab.)
- For soil scientists, ecologists, reforestation specialists, and hydrologists. Soil moisture levels during 1960-80 were compared for a clearcut, broadcast-burned area, and adjacent undisturbed forest. During the summer after logging (1963), the clearcut averaged over 10 cm more moisture than did the forested control, but by 1967 had summer moisture deficits of at least 2 cm compared to the control. Deficits persisted for the rest of the study. These differences in soil moisture, closely related to the rapid revegetation of the clearcut, were large enough to influence forest regeneration and watershed hydrology.
- Adams, W.T., and D.S. Birkes. 1989. Mating patterns in seed orchards. P. 75-86 in *Proceedings, 20th Southern Forest Tree Improvement Conference*, Charleston, South Carolina.
- For tree-improvement foresters, forest geneticists, and seed-orchard managers. Understanding the relative contributions of the pollen sources for production of viable orchard seed is critical to the development of orchard designs and management. This paper describes methods of evaluating mating patterns from the segregation of isozyme genetic markers in the seed of mother trees and reviews empirical results for conifer trees.
- Adams, W.T., and D.S. Birkes. 1991. Estimating mating patterns in forest tree populations. P. 157-172 in *Biochemical Markers in the Population Genetics of Forest Trees*. SPB Academic Publishing bv, The Hague, The Netherlands.
- For forest geneticists and population biologists. A probability-model approach for studying mating patterns within local populations, even those not isolated from external pollen sources, is introduced and then applied to offspring data from a Douglas-fir seed orchard. Derived mating parameters were consistent with previous information on cross-fertilization in seed orchards.
- Adams, W.T., and D.G. Joyce. 1990. Comparison of selection methods for improving volume growth in young coastal Douglas-fir. *Silvae Genetica* 39:5-6.
- For tree breeders and forest geneticists. Data show that indirect selection based on DBH would produce about 90 percent of the gain achievable by direct selection for bole volume (where both height and DBH must be measured). With two-stage selection, up to two-thirds of the trees could be culled on the basis of DBH without significantly lower gains in bole volume than those expected if the height of all trees had been measured.
- Adams, W.T., D.B. Neale, A.H. Doerksen, and D.B. Smith. 1990. Inheritance and linkage of isozyme variants from seed and vegetative bud tissues in coastal Douglas-fir (*Pseudotsuga menziesii* var. *menziesii* (Mirb.) Franco). *Silvae Genetica* 39:153-167.
- For forest geneticists. Isozyme variants of 19 enzyme systems coded by 28 genetic loci from seed and dormant vegetative bud tissues of coastal Douglas-fir were assayed by electrophoresis. Results are reported.
- Adams, W.T., J. Vargas-Hernandez, and D. Joyce. 1990. Selecting for wood density in young Douglas-fir. P. 4.1-4.8 in *Proceedings, Joint Meeting of Western Forest Genetics Association and IUFRO Working Parties S2.02-05,-06,-12,-14 on Douglas-fir, Contorta Pine, Sitka Spruce and Abies Breeding and Genetic Resources*, Olympia, Washington.
- For tree breeders, forest geneticists, and wood technologists. Results of studies comparing various selection criteria for improving wood density in 15-year-old Douglas-fir trees are summarized. Early selection for wood density appears to be quite promising in this species.
- Alaback, P.B., and F.R. Herman. 1988. Long-term response of understory vegetation to stand density in *Picea-Tsuga* forests. *Canadian Journal of Forest Research* 18:1522-1530.
- For plant, forest, and wildlife ecologists. The 17-year response of understory vegetation to forest thinning was studied on two central Oregon coast sites. Results showed that early thinning without subsequent treatments is unlikely to maintain stable herb and shrub populations in forest types where the understory would otherwise be eliminated during intermediate stages of stand development.
- Alaback, P.B., and J.C. Tappeiner II. 1991. Response of western hemlock (*Tsuga heterophylla*) and early huckleberry (*Vaccinium ovalifolium*) seedlings to forest windthrow. *Canadian Journal of Forest Research* 21:534-539.
- For forest ecologists, foresters, and wildlife biologists. Reproductive and growth strategies of western hemlock and early huckleberry seedlings were studied for 5 years following windthrow in a dense 45-year-old forest to better understand these species' response to small natural disturbances. Infrequent opening of dense second-growth conifer canopies—whether by thinning or by small-scale disturbances—is likely to result in dense secondary canopies of shade-tolerant trees and in little understory vegetation or forage for wildlife.
- Amaranthus, M.P., J.M. Trappe, and R.J. Molina. 1989. Long-term forest productivity and the living soil. P. 36-52 in *Maintaining the Long-Term Productivity of Pacific Northwest Forest Ecosystems*. D.A. Perry, R. Meurisse, B. Thomas, R. Miller, J. Boyle, J. Means, C.R. Perry, and R. F. Powers, eds. Timber Press, Portland, Oregon.
- For those with a general interest in forestry. Some forest practices can reduce or eliminate beneficial soil organisms. The long-term impacts on these beneficial organisms can be reduced by (1) minimizing the severity of the disturbance, (2) emphasizing retention of organic mat-

ter, (3) emphasizing rapid revegetation, and (4) recognizing that sites with harsh environments are most susceptible to productivity loss.

- Andersen, C.P., W.E. Hogsett, R. Wessling, and M. Plocher. 1991. Ozone decreases spring root growth and root carbohydrate content in ponderosa pine the year following exposure. Canadian Journal of Forest Research 21:1288-1291.**

For stress physiologists and environmental scientists. Ozone exposure during one growing season was found to significantly reduce root growth and root starch reserves just before and during shoot elongation the following year, without additional ozone exposure.

- Andersen, C.P., and S.B. McLaughlin. 1991. Seasonal changes in shoot water relations of *Picea rubens* at two high elevation sites in the Smoky Mountains. Tree Physiology 8:11-21.**

For tree physiologists. Pressure-volume curves were developed for red spruce saplings growing at two elevations in the southern Appalachian forests. Estimates of relative water content and osmotic potential were made throughout the year.

- Andersen, C.P., S.B. McLaughlin, and W.K. Roy. 1991. A comparison of seasonal patterns of photosynthate production and use in branches of red spruce saplings at two elevations. Canadian Journal of Forest Research 21:455-461.**

For tree physiologists. Branch-level photosynthate allocation patterns in red spruce at two high-elevation sites in the southern Appalachians are compared and contrasted.

- Andersen, C.P., S.B. McLaughlin, and W.K. Roy. 1991. Foliar injury symptoms and pigment concentrations in red spruce saplings in the southern Appalachians. Canadian Journal of Forest Research 21:1119-1123.**

For tree physiologists and foresters. Foliar flecking on red spruce growing at several locations in the southern Appalachians is documented. Levels of chlorophyll and carotenoids are also reported.

- Andersen, C.P., and P.T. Rygielwicz. 1991. Stress interactions and mycorrhizal plant response: understanding carbon allocation priorities. Environmental Pollution 73:217-244.**

For physiologists, ecologists, soil scientists, and environmental engineers working on environmental stresses. This is a theoretical discussion and review of research on effects of natural and anthropogenic stresses on the host and mycobiont. Emphasis is placed on carbon physiology as an integrative measure of stress. One method for distinguishing primary and secondary effects of stresses on the ectomycorrhizal symbiosis is discussed.

- Armstrong, J.L., N.L. Fowles, and P.T. Rygielwicz. 1989. Restriction fragment length polymorphisms distinguish ectomycorrhizal fungi. Plant and Soil 116:1-7.**

For molecular ecologists, soil microbiologists, and mycorrhizae researchers. Restriction fragment length polymorphisms (RFLPs) were produced from DNA isolated from several genera, species, and strains of ectomy-

corrhizal fungi. Results indicate that although distinct hybridized RFLPs can be produced with one or more endonucleases, *a priori* determination of the RFLP for a particular strain is needed before the organism can be tracked in the field. Improved molecular techniques are needed in order to track the mycobiont of individual ectomycorrhizae.

- Bacon, C., A. Hansen, T. McMahon, and A. Skaugset, compilers. 1989. Compendium of current Coast Range research. Forest Research Laboratory, Oregon State University, Corvallis. 128 p. (For. Res. Lab.)**

For managers and researchers in the Oregon Coast Range and similar areas. This compendium lists more than 200 ongoing and recently completed research and administrative studies conducted in the Oregon Coast Range in the areas of fisheries, forestry, soils/hydrology, and wildlife. Each entry gives the location, objective, description, status, contact person, and responsible organization for a different study.

- Barrett, V., R.K. Dixon, and P.A. Lemke. 1990. Genetic transformation of a mycorrhizal fungus. Applied Microbiology and Biotechnology 33:313-316.**

For biotechnologists and soil scientists. A methodology for transformation of the ectomycorrhizal fungus *Laccaria laccata* was developed. The potential to improve ectomycorrhizal symbiosis through transgenic manipulation of the fungal component may now be realized.

- Barrett, V., P.A. Lemke, and R.K. Dixon. 1989. Protoplast formation from selected species of ectomycorrhizal fungi. Applied Microbiology and Biotechnology 30:381-387.**

For biotechnologists. Protoplasts of four ectomycorrhizal fungi were established *in vitro*. Development of protoplast methodology provides an improved mechanism for genetic and physiologic studies of ectomycorrhizal fungi.

- Bildstein, K.L., and M.W. Collopy. 1990. Northern harrier. P. 70-77 in Proceedings of the Southeast Raptor Management Symposium and Workshop. National Wildlife Federation, Washington, D.C.**

For raptor biologists. This paper presents an overview of the life history, population distribution and status, limiting factors, and research and management needs of the northern harrier.

- Binkley, D., and P. Sollins. 1990. Factors determining differences in soil pH in adjacent conifer and alder-conifer stands. Soil Science Society of America Journal 54:1427-1433.**

For biogeochemists, forest ecologists, and soil scientists. Qualitative changes in soil organic matter are factors that drive changes in soil pH and other parameters.

- Bledsoe, C., D. Brown, M. Coleman, W. Littke, P. Rygielwicz, U. Sangwanit, S. Rogers, and J. Ammirati. 1989. Physiology and metabolism of ectomycorrhizae. In Forest Tree Physiology. Annales des Sciences Forestières 46(supplement):697s-705s.**

For mycorrhizae researchers. This article summarizes 10 years of research on ectomycorrhizal fungi and ectomycorrhizae of Pacific Northwest coniferous seed-

- lings. Research topics include kinetic analysis and modeling of mineral nutrient uptake, uptake feedback on rhizosphere chemistry, uptake and storage of organic forms of nitrogen, water relations, phosphorus nutrition, *in situ* analysis of root systems, and use of molecular biology methods to identify and track fungi in the field.
- Borchers, J.G., and D.A. Perry. 1992. The influence of soil texture and aggregation on carbon and nitrogen dynamics in southwest Oregon forests and clearcuts. Canadian Journal of Forest Research 22:298-305. (For. Res. Lab.)**
- For research scientists. Soil texture and aggregation on two old, poorly vegetated clearcuts and adjacent forests in southwest Oregon were investigated for their influence on loss of soil carbon (C) and nitrogen (N) in disturbed ecosystems with different soil parent material and texture. In comparisons of silt loam and sandy loam soils, the coarser soil had lower total C and N concentrations, lower levels of available N in sonically disrupted soil, and significantly greater decreases in available N associated with clearcutting.
- Bousquet, J., L. Simon, and M. Lalonde. 1990. DNA amplification from vegetative and sexual tissues of trees using polymerase chain reaction. Canadian Journal of Forest Research 20:254-257.**
- For forest geneticists and tree physiologists. A simple protocol for the extraction of total DNA from minute amounts of tissue and subsequent amplification of specific sequences by polymerase chain reaction is presented. The method is applicable to a wide variety of vegetative tissues such as leaves, single needles and rootlets, cell suspensions, as well as single sexual embryos and megagametophytes derived from a variety of gymnosperms and perennial angiosperms.
- Caldwell, B.A., M.A. Castellano, and R.P. Griffiths. 1991. Fatty acid esterase production by ectomycorrhizal fungi. Mycologia 83:233-236.**
- For mycologists and physiologists. Forty-eight strains of presumptively ectomycorrhizal fungi were tested for the production of fatty acid esterase in agar plate assay. Twenty-five fungi produced positive reactions to the assay.
- Caldwell, B.A., R.P. Griffiths, R.G. Linderman, and J.E. Loper. 1991. Production of siderophore-like iron chelators by ericoid and ectomycorrhizal fungi. P. 309 in The Rhizosphere and Plant Growth. Kluwer Academic Press, Dordrecht.**
- For microbial ecologists, plant pathologists, and fungal physiologists. Ericoid and ectomycorrhizal fungi produced siderophores, which play a major role in competition between microorganisms and in plant nutrition. These observations have implications for the role of ericoid and ectomycorrhizal fungi in soils.
- Castellano, M.A. 1990. The new genus *Trappea* (Basidiomycotina, Phallales): a segregate from *Hysterangium*. Mycotaxon 38:1-9.**
- For mycologists. This paper discusses a new genus to accommodate two nonmycorrhizal taxa that were formerly placed in the mycorrhizal genus *Hysterangium*, but are more properly aligned in a different family.
- Castellano, M.A., and J.M. Trappe. 1990. Australasian hypogeous fungi. I. Nomenclatural bibliography of type descriptions of Basidiomycotina. Australian Systematic Botany 3:653-670.**
- For mycologists. This is a bibliography of the published type descriptions of the mycorrhizal and nonmycorrhizal truffle-like fungi found in the southern hemisphere or found in the northern hemisphere with southern hemisphere hosts.
- Castellano, M.A., J.M. Trappe, Z. Maser, and C. Maser. 1989. Key to spores of the genera of hypogeous fungi of North Temperate forests with special reference to animal mycophagy. Mad River Press, Arcata, California. 186 p.**
- For mammalogists and mycologists. A synoptic key to spores of all hypogeous fungi found in North Temperate forests is given. Brief introductory comments are made for each fungal genus and additional literature is referenced.
- Chih-Hao, N., K. Cromack, Jr., and C.Y. Li. 1989. Association of nitrogen-fixing bacteria with ectomycorrhizae in Douglas-fir. P. 253-254 in Maintaining the Long-term Productivity of Pacific Northwest Forest Ecosystems. D.A. Perry, R. Meurisse, B. Thomas, R. Miller, J. Boyle, J. Means, C.R. Perry, and R.F. Powers, eds. Timber Press, Portland, Oregon.**
- For forest ecologists, silviculturists, and soil scientists. Mycorrhizae are often essential for plant survival and growth, and are known for their ability to enhance nutrient absorption. This study examined the role of mycorrhizal fungi in rhizosphere nitrogen fixation.
- Ching, K.K. 1991. Temperate deciduous forests in East Asia. P. 539-555 in Ecosystems of the World 7: Temperate Deciduous Forests. Elsevier, Amsterdam. (For. Res. Lab.)**
- For botanists, taxonomists, foresters, ecologists, and climatologists. East Asia escaped the murderous effects of the Ice Age and now possesses extremely varied deciduous broadleaved forests. The floristic composition of the mixed mesophytic forests of China is very similar to that of central Japan. The cold and warm temperate floras of Korea, Japan, and China are closely related; however, the different land forms of these three countries—a peninsula, an island chain, and a huge continental land mass—allow the various forest species to interact differently with their respective environments and to form their own ecological systems.
- Collopy, M.W. 1990. Research and conservation of southeastern raptors. P. 3-9 in Proceedings of the Southeast Raptor Management Symposium and Workshop. National Wildlife Federation, Washington, D.C.**
- For raptor biologists and wildlife managers. This paper presents an overview of past raptor studies and the need for new research programs in the southeastern United States that examine foraging behavior and predator-prey relationships, the adverse effects of upland and wetland habitat loss, and raptor reintroduction programs.

- Collopy, M.W., and T.C. Edwards, Jr. 1989. Territoriality, activity budget, and role of undulating flight in nesting golden eagles. *Journal of Field Ornithology* 60:43-51.
- For raptor biologists and behavioral ecologists. The territory of four golden eagle pairs averaged 3,276 ha and encompassed a variety of habitat types in southwestern Idaho. Time and activity budgets of male and female eagles varied significantly during the breeding season. Undulating flight was exhibited by both sexes, and appeared to serve a territorial function.
- Crawford, R.H., S.E. Carpenter, and M.E. Harmon. 1990. Communities of filamentous fungi and yeast in decomposing logs of *Pseudotsuga menziesii*. *Mycologia* 82:759-765.
- For mycologists. Fungi were isolated from cross sections of Douglas-fir logs in advanced stages of decay. Eighteen genera and 36 species of fungi were recovered. No community differences were found between samples with and without conifer seedlings.
- Cromack, K., Jr., J.A. Entry, and T. Savage. 1991. The effect of disturbance by *Phellinus weirii* on decomposition and nutrient mineralization in a *Tsuga mertensiana* forest. *Biology and Fertility of Soils* 11:245-249.
- For forest ecologists and soil scientists. The effect of disturbance by a root-rot pathogen infection was studied on mountain hemlock in an old-growth forest and a regrowth forest. Microbial biomass was higher in the old-growth forest soil; needle decomposition rates were higher in the regrowth forest. When needle decomposition rates are higher, mineralization of nitrogen, phosphorus, and potassium is increased, which may lead to increased soil fertility and faster rates of tree growth in the regrowth forest.
- Curtis, R.O., and D.D. Marshall. 1989. On the definition of stand diameter growth for remeasured plots. *Western Journal of Applied Forestry* 4:102-103.
- For silviculturists. The lack of standard terminology and analysis for diameter growth may be one of the major reasons that comparisons of diameter growth yield conflicting results. This paper discusses some definitions and briefly illustrates some results of their use.
- Davidson, E.A., D.D. Myrold, and P.M. Groffman. 1990. Denitrification in temperate forest ecosystems. P. 196-220 in *Sustained Productivity of Forest Soils. Proceedings of the Seventh North American Forest Soils Conference. Faculty of Forestry, University of British Columbia, Vancouver, British Columbia.*
- For forest ecologists and soil scientists. This paper reviews the rates of denitrification in forest ecosystems and discusses the factors that regulate the process.
- Davies, T.D., M. Tranter, P.J. Wigington, Jr., and K.N. Eshleman. 1992. Acidic episodes in surface waters in Europe. *Journal of Hydrology* 132:25-69.
- For scientists and managers interested in effects of acidic deposition on surface waters. The occurrence and causes of episodic acidification in Europe are evaluated.
- Dixon, R.K. 1990. Cytokinin activity in *Citrus* seedlings colonized by mycorrhizal fungi. *Annales des Sciences Forestières* 46:734-736.
- For horticulturists and plant physiologists. Cytokinin pools in leaf and root tissue varied, depending on the vesicular-arbuscular mycorrhizal symbiont. Zeatin and zeatin riboside were prominent cytokinins in leaf tissue.
- Dixon, R.K., H.E. Garrett, and G.S. Cox. 1989. Boron fertilization, vesicular-arbuscular mycorrhizal colonization and growth of *Citrus jambhiri* Lush. *Journal of Plant Nutrition* 12:687-700.
- For horticulturists. Boron deficiency in *Citrus* is common worldwide. Foliar applications of boron stimulate growth and mycorrhizal colonization of *Citrus* seedlings in nursery culture.
- Donnelly, P.K., J.A. Entry, D.L. Crawford, and K. Cromack, Jr. 1990. Cellulose and lignin degradation in forest soils: response to moisture, temperature and acidity. *Microbial Ecology* 20:289-295. (For. Res. Lab.)
- For forest ecologists and soil scientists. Microbial biomass and lignin and cellulose decomposition were measured for 6 weeks in forest soil microcosms in order to determine the influence of pH, moisture, and temperature on organic matter and decomposition. Soil temperature was more important in lignin degradation than either soil moisture or soil pH.
- Edelson, N.W., and M.W. Collopy. 1990. Foraging ecology of wading birds using an altered landscape in central Florida. *Florida Institute of Phosphate Research, Bartow, Florida. Publication 04-039-087. 91 p.*
- For avian ecologists and wildlife managers. Results of a 2-year radio-tracking study of the foraging behavior and habitat use of snowy egrets in a highly disturbed landscape in central Florida showed a positive correlation between wading bird presence and water temperature and with secchi depth on a hyper-eutrophic lake. Secchi depth was inversely correlated with amount of dissolved oxygen in the lake.
- Edmonds, R.L., D. Binkley, M. C. Feller, P. Sollins, A. Abee, and D.D. Myrold. 1990. Nutrient cycling: effects on productivity of northwest forests. P. 17-35 in *Maintaining the Long-term Productivity of Pacific Northwest Forest Ecosystems. D.A. Perry, R. Meurisse, B. Thomas, R. Miller, J. Boyle, J. Means, C.R. Perry, and R.F. Powers, eds. Timber Press, Portland, Oregon.*
- For forest ecologists and foresters. This chapter reviews the relationships between nutrient cycling and forest productivity, with special emphasis on Pacific Northwest forest ecosystems.
- Entry, J.A., P.K. Donnelly, and K. Cromack, Jr. 1991. Influence of ectomycorrhizal mat soils on lignin and cellulose degradation. *Biology and Fertility of Soils* 11:75-78. (For. Res. Lab.)
- For soil scientists. The study suggests that the ectomycorrhizal fungus *Hysterangium setchelli*, which forms extensive hyphal mats with the roots of the host tree Douglas-fir, provides a microenvironment that results in faster lignin and cellulose decomposition.

**Entry, J.A., C.L. Rose, and K. Cromack, Jr. 1991. Litter decomposition and nutrient release in ectomycorrhizal mat soils of a Douglas fir ecosystem. *Soil Biology and Biochemistry* 23:285-290. (For. Res. Lab.)**

For soil scientists. The authors examined the role of *Hysterangium setchellii* mats in organic matter decomposition and nutrient mineralization in mat soils and in adjacent non-mat soils in a second-growth Douglas-fir ecosystem. The data suggest that ectomycorrhizal mats provide a microenvironment with faster rates of organic matter decomposition and nutrient mineralization than do non-mat soils.

**Erickson, V.J., and W.T. Adams. 1989. Mating success in a coastal Douglas-fir seed orchard as affected by distance and floral phenology. *Canadian Journal of Forest Research* 19:1248-1255. (For. Res. Lab.)**

For forest geneticists, seed-orchard managers, and population biologists. The effect of distance and stage of phenological development on cross-pollination in a Douglas-fir seed orchard was investigated by estimating the proportion of viable embryos that resulted from fertilization by designated male trees. Data suggest that a lack of complete floral synchrony between near neighbors may reduce preferential mating among them, and thus help promote cross-fertilization.

**Erickson, V.J., and W.T. Adams. 1990. Mating system variation among individual ramets in a Douglas-fir seed orchard. *Canadian Journal of Forest Research* 20:1672-1675. (For. Res. Lab.)**

For forest geneticists, tree-improvement specialists, and seed-orchard managers. This paper documents the extent to which outcrossing rates can vary among individuals within Douglas-fir orchards and examines the extent to which phenological and pollen fecundity characteristics may influence the mating system of individual orchard parents.

**Filip, G.M. 1990. Effects of tree harvesting on *Armillaria* root disease in an old-growth mixed-conifer stand in northeastern Oregon. *Northwest Environmental Journal* 6:412-413.**

For forest pathologists, ecologists, and silviculturists. Fifty permanent plots were established in 1987 in a 25-ha area 10 km from La Grande, Oregon, to examine disease spread and tree mortality over several decades. This study will test the hypothesis that mixed-conifer forests often are more severely damaged by root disease after logging than before logging.

**Filip, G.M., and C.L. Schmitt. 1990. Rx for *Abies*: silvicultural options for diseased firs in Oregon and Washington. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-GTR-252. 34 p.**

For silviculturists, forest pathologists, and ecologists. This paper consolidates research, observations, and management techniques for diseases of true firs, especially the effects of silvicultural activities on root diseases, stem decays, and dwarf mistletoes.

**Franklin, J.F., D.A. Perry, T.D. Schowalter, M.E. Harmon, A. McKee, and T.A. Spies. 1989. Importance of ecological diversity in maintaining long-term site productivity. P. 82-97 in *Maintaining the Long-term Productivity of Pacific Northwest Forest Ecosystems*. D.A. Perry, R. Meurisse, B. Thomas, R. Miller, J. Boyle, J. Means, C.R. Perry, and R.F. Powers, eds. Timber Press, Portland, Oregon.**

For forest ecologists and managers. Long-term site productivity depends on ecosystem resilience conferred by the component species that interact to maintain soil fertility and canopy function and to limit disease epidemics. Insufficient knowledge about the consequences of climate change and management practices on long-term productivity strongly supports an approach that retains maximum diversity in forest ecosystems in order to avoid loss of critical species or components.

**Frederick, P.C., and M.W. Collopy. 1989. Nesting success of five species of wading birds (Ciconiiformes) in relation to water conditions in the Florida Everglades. *Auk* 106:625-634.**

For avian and population ecologists. Nesting success of 1,609 marked nests of 5 species in 18 colonies were studied in the Florida Everglades. Rapid surface-water drying rate was associated most strongly with nesting success of white ibis, and amount of rainfall was directly associated with failure of great egret nests. There was no difference in amount of spring rainfall, autumn/winter drying rate, or water depth.

**Frederick, P.C., and M.W. Collopy. 1989. Researcher distance in colonies of wading birds: effects of frequency of visit and egg-marking on reproductive parameters. *Colonial Waterbirds* 12:152-157.**

For avian ecologists. Two matched colonies of tricolored herons were compared to determine the effects of researcher disturbance on nesting success. Colony visitations beginning after courtship and early egg-laying did not result in large disturbance effects.

**Fried, J.S., J.R. Boyle, J.C. Tappeiner, and K. Cromack, Jr. 1990. Effects of bigleaf maple on soils in Douglas-fir forests. *Canadian Journal of Forest Research* 20:259-266.**

For forest ecologists, soil scientists, and foresters. Soil chemical and physical properties, forest floor weights, nutrient content and turnover rates, and litter fall weights and nutrient content under bigleaf maple and Douglas-fir were compared on five sites on the eastern margin of the Oregon Coast Range. Bigleaf maple trees appear to contribute to increased soil nitrogen and organic carbon content and to increased annual cycling of all macronutrients more than do adjacent Douglas-fir.

**Furrer, G., J. Westall, and P. Sollins. 1989. The study of soil chemistry through quasi-steady-state models: 1. Mathematical definition of model. *Geochimica et Cosmochimica* 53:595-601.**

For soil scientists and geochemists. A mathematical method for studying the composition and speciation of soil solutions is presented. The method is formulated in general algebraic terms, and is adaptable to soil-water systems of virtually any chemical composition.

- Goldfarb, B., G.T. Howe, L.M. Bailey, S.H. Strauss, and J.B. Zaerr. 1991. A liquid cytokinin pulse induces adventitious shoot formation from Douglas-fir cotyledons. *Plant Cell Reports* 10:156-160. (For. Res. Lab.)
- For forest scientists, geneticists, physiologists, and plant tissue culturists. The objective of this study was to develop an improved system for adventitious bud and shoot formation from Douglas-fir cotyledons. There were more cotyledons with buds and more buds per cotyledon when cytokinins were delivered by the liquid-pulse method than when they were incorporated into the growth medium.
- Goldfarb, B., S.H. Strauss, G.T. Howe, and J.B. Zaerr. 1991. Transient gene expression of microprojectile-introduced DNA in Douglas-fir cotyledons. *Plant Cell Reports* 10:517-521. (For. Res. Lab.)
- For plant and forest geneticists and pathologists. This study demonstrated successful delivery and transient expression of DNA in Douglas-fir cells. Because Douglas-fir cotyledons can form multiple adventitious buds, shoots, and ultimately plantlets, this process has the potential for leading to transgenic trees.
- Griffiths, R.P., B.A. Caldwell, K. Cromack, Jr., and R.Y. Morita. 1990. Douglas-fir forest soils colonized by ectomycorrhizal mats. I. Seasonal variation in nitrogen chemistry and nitrogen cycle transformation rates. *Canadian Journal of Forest Research* 20:211-218.
- For forest ecologists, soil scientists, and microbial ecologists. Aspects of nitrogen cycling were studied by comparing microbial activities and chemical characteristics in monthly samples of ectomycorrhizal mat soils and adjacent non-mat soils from a maturing Douglas-fir forest. Seasonal patterns suggested complex interactions among the host tree, ectomycorrhizal fungus, and the mat microbial community that were influenced by seasonal changes in moisture, temperature, and light availability.
- Griffiths, R.P., E.R. Ingham, B.A. Caldwell, M.A. Castellano, and K. Cromack, Jr. 1991. Microbial characteristics of ectomycorrhizal mat communities in Oregon and California. *Biology and Fertility of Soils* 11:196-202.
- For ecologists and foresters. Descriptive characteristics of the ectomycorrhizal mat communities of two Douglas-fir forests in Oregon and a *Eucalyptus globulus* forest in California show many similarities in the potential effects on nutrient cycling.
- Halpern, C.B. 1989. Early successional patterns of forest species: interactions of life history traits and disturbance. *Ecology* 70:704-720.
- For ecologists. Patterns of abundance were examined for vascular plant species during 21 years of succession in two clearcut and burned *Pseudotsuga* forests. Observations suggest that early secondary succession in these forests has a deterministic component that is founded in the life history traits of the available species, and a stochastic component that is reflected in site history and variation in disturbance.
- Halpern, C.B., and J.F. Franklin. 1988. Understory development in *Pseudotsuga* forests: multiple paths of succession. P. 293-297 in *Proceedings, Symposium on Land Classification Based on Vegetation: Applications for Resource Management*. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.
- For plant ecologists and land managers. Successional pathways and rates of recovery are examined among six forest communities exposed to a gradient in soil disturbance resulting from clearcut logging and slash burning in the western Cascades of Oregon.
- Halpern, C.B., and J.F. Franklin. 1990. Physiognomic development of *Pseudotsuga* forests in relation to initial structure and disturbance intensity. *Journal of Vegetation Science* 1:475-482.
- For plant ecologists and foresters. Development of understory structure was observed for 25 years after harvest of *Pseudotsuga* forests on two sites in the western Cascades. The long-term trends suggest that pre-disturbance community structure and disturbance intensity are major determinants of physiognomic succession, but that their effects may be modified by historical or stochastic factors such as limited seed availability or local weather fluctuations.
- Halpern, C.B., P.M. Frenzen, J.E. Means, and J.F. Franklin. 1990. Plant succession in areas of scorched and blown-down forest after the 1980 eruption of Mount St. Helens, Washington. *Journal of Vegetation Science* 1:181-194.
- For plant ecologists. Patterns of plant succession were studied in areas of scorched and blown-down forest that resulted from the 1980 eruption of Mount St. Helens. Total plant cover and species richness increased with time, but because of extreme physical and biological conditions, it may take decades for understory plant cover and community composition to return to pre-eruption levels. Closure of the tree canopy may take a century or more.
- Hansen, A.J., and F. di Castri, editors. 1992. *Landscape Boundaries: Consequences for Biotic Diversity and Ecological Flows*. Springer-Verlag Ecological Studies Series, New York. 452 p.
- For scientists and policymakers. This book examines the theoretical aspects of the effects of landscape patterning on biological diversity and flows of energy, information, and materials. It also considers implications for landscape management under land-use and climate changes.
- Hansen, A.J., J.A. Peterson, and E. Horvath. 1991. Responses of vertebrates to stand and edge type in managed forests of the Oregon Coast Range. *Northwest Environmental Journal* 6:418-419.
- For forest scientists and managers. This paper summarizes the rationale and methods of a vertebrate study that is part of the Coastal Oregon Productivity Enhancement (COPE) program.
- Hansen, A.J., P. Risser, and F. di Castri. 1992. Epilogue: biodiversity and ecological flows across ecotones. P. 423-438 in *Landscape Boundaries: Consequences*

- for **Biotic Diversity and Ecological Flows**. A.J. Hansen and F. di Castri, eds. Springer-Verlag Ecological Studies Series, New York.
- For landscape ecologists. Chapters in this book on landscape boundaries are synthesized and evaluated.
- Hansen, A.J., D.L. Urban, S. Garman, B.R. Noon, and W.C. McComb. 1991. Responses of wildlife habitats to forest management and climate change: a modeling approach. *Northwest Environmental Journal* 6:419-420.
- For forest scientists and managers. The rationale and methods of an approach for projecting vertebrate response to anthropogenic change are summarized.
- Hansen, A.J., D.L. Urban, and B. Marks. 1992. Avian community dynamics: the interplay of landscape trajectories and species life histories. P. 170-195 in *Landscape Boundaries: Consequences for Biotic Diversity and Ecological Flows*. A.J. Hansen and F. di Castri, eds. Springer-Verlag Ecological Studies Series, New York.
- For scientists and policymakers. This chapter uses simulation models to examine how the diversity of bird species is affected by three paths of landscape change: forest fragmentation, forest conversion to plantation, and abandonment of agricultural lands.
- Harcombe, P.A., M.E. Harmon, and S.E. Greene. 1990. Changes in biomass production over 53 years in a coastal *Picea sitchensis* - *Tsuga heterophylla* forest approaching maturity. *Canadian Journal of Forest Research* 20:1602-1610.
- For ecologists. Bolewood biomass, production, and mortality loss were calculated from periodic remeasurements of tagged trees in sample plots established in 1935 in a *Picea sitchensis* - *Tsuga heterophylla* forest. These values were compared with those for 37-year-old plots in the same area. The authors estimate that one-quarter to one-half of the bolewood production is lost by mortality, and that mortality loss may thus be an important factor limiting accumulation of forest biomass.
- Harmon, M.E. 1992. Long-term experiments on log decomposition at the H.J. Andrews Experimental Forest. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-GTR-280. 28 p.
- For ecologists. This report describes the establishment and initial conditions of a 200-year experiment on log decomposition being conducted at the H.J. Andrews Experimental Forest, Oregon.
- Harmon, M.E., G.A. Baker, G. Spycher, and S.E. Greene. 1990. Leaf-litter decomposition in the *Picea/Tsuga* forests of Olympic National Park, Washington, U.S.A. *Forest Ecology and Management* 31:55-66.
- For ecologists and soil scientists. The factors controlling leaf-litter decomposition of 11 species found in *Picea/Tsuga* forests were examined with the litter-bag method. The decay rate-constant decreased more in leached than in unleached litter. Decay of both leached and unleached litter was highly correlated with the lignin:nitrogen ratio, although the regressions differed significantly between leached and unleached litter.
- Harmon, M.E., W.K. Ferrell, and J.F. Franklin. 1990. Effects on carbon storage of conversion of old-growth forests to young forests. *Science* 247:699-702.
- For forest scientists and managers. Simulations of carbon storage suggest that conversion of old-growth forests to young, fast-growing forests will not decrease atmospheric carbon dioxide (CO<sub>2</sub>). On-site carbon storage is reduced considerably and does not approach old-growth storage capacity for at least 200 years. Even when the sequestration of carbon in wooden buildings is included, timber harvest results in a net flux of CO<sub>2</sub> to the atmosphere.
- Harmon, M.E., and C. Hua. 1991. Coarse woody debris dynamics in two old-growth ecosystems. *BioScience* 41:604-610.
- For forest ecologists. Coarse woody debris has the potential to store a large amount of carbon in the forest ecosystem. A comparison of the dynamics of coarse woody debris in a deciduous old-growth forest in China and in a coniferous old-growth forest in the Pacific Northwest indicates that previous amounts of detrital carbon may have been underestimated by 5 to 7 percent.
- Hennon, P.E., C.G. Shaw III, and E.M. Hansen. 1990. Symptoms and fungal associations of declining *Chamaecyparis nootkatensis* in southeast Alaska. *Plant Disease* 74:267-273.
- For pathologists, mycologists, and forest biologists. The decline of Alaska cedar trees is described, and fungi associated with their mortality are reported. None of the observed fungi appears to be causing the decline.
- Hermann, R.K. 1990. Zur Bedeutung der Fichte in Nordamerika (On the importance of spruce in North America). *Forstwissenschaftliches Centralblatt* 109:168-174. [In German with an English summary.] (For. Res. Lab.)
- For European foresters. This paper discusses the seven species of spruce that are indigenous to North America. For each species, the natural range, annual growth increment, average total height, rotation ranges, economic importance, and harvesting methods are discussed.
- Hermann, R.K., and D.P. Lavender. 1990. *Pseudotsuga menziesii* (Mirb.) Franco, Douglas-fir. P. 527-540 in *Silvics of North America. Volume 1. Conifers*. USDA Forest Service, Washington, D.C. Agriculture Handbook 654.
- For foresters. This chapter describes the silvicultural characteristics of Douglas-fir, one of the most important and valuable timber trees in western North America. The habitat, life history, special uses, and genetics of Douglas-fir are discussed.
- Hibbs, D.E., and A.A. Ager. 1989. Red alder: guidelines for seed collection, handling, and storage. Forest Research Laboratory, Oregon State University, Corvallis. Special Publication 18. 6 p. (For. Res. Lab.)

For forestry professionals. This guide provides information on the collection, extraction, and storage of red alder seed. It addresses some genetic considerations; suggests provisional rules for seed zones, seed-transfer, and the selection of trees for seed collection; and describes methods for assessing seed crops, collecting cones, and handling seed.

- Hibbs, D.E., and G.C. Carlton. 1989. A comparison of diameter- and volume-based stocking guides for red alder. *Western Journal of Applied Forestry* 4:113-115. (For. Res. Lab.)**

For forestry researchers and foresters. Stocking guides based on Reineke's stand density index concept (diameter vs. stem density) and on the self-thinning rule (volume vs. stem density) are currently in use in the western United States. The authors developed a Reineke-type guide for red alder and compared the growth of thinned and self-thinned stands in both systems.

- Hibbs, D.E., and K. Cromack, Jr. 1990. Actinorhizal plants in Pacific Northwest forests. P. 343-363 in *Biology of Frankia and Actinorhizal Plants*. Academic Press, Inc., San Diego, California.**

For researchers. Actinorhizal plants play an important role in the nitrogen budgets of Pacific Northwest forests. Where they occur, they improve soil fertility by increasing soil nitrogen, organic matter, and cation-exchange capacity. Planting red alder, currently harvested as a timber crop, and other actinorhizal plants for mixed culture with conifers is discussed.

- Hilger, A.B., and D.D. Myrold. 1991. Method for extraction of *Frankia* DNA from soil. *Agriculture, Ecosystems, & Environment* 34:107-113.**

For soil scientists and microbial ecologists. A new methodology for extracting microbial DNA from soil is described. The method removes most potentially inhibitory humic substances.

- Hipkins, V.D., C.-H. Tsai, and S.H. Strauss. 1990. Sequence of the gene for the large subunit of ribulose, 1,5-bisphosphate carboxylase from a gymnosperm, Douglas fir. *Plant Molecular Biology* 15:505-507. (For. Res. Lab.)**

For forest geneticists. The chloroplast *rbcl* gene encodes the large subunit of ribulose 1,5-bisphosphate carboxylase, the enzyme that catalyzes CO<sub>2</sub> fixation during photosynthesis. Data on *rbcl* nucleotide sequences have been used extensively, and proven to be quite powerful, in studies of plant phylogeny and molecular evolution. The authors report an *rbcl* gene sequence from a Pinaceous gymnosperm, Douglas-fir.

- Ho, I. 1989. Acid phosphatase, alkaline phosphatase and nitrate reductase activity of selected ectomycorrhizal fungi. *Canadian Journal of Botany* 67:750-753.**

For soil microbiologists. Activities of acid phosphatase, alkaline phosphatase, and nitrate reductase were compared in 17 isolates of ectomycorrhizal fungi encompassing five genera and eight species. Isolates within species differed in enzyme activity and isoenzyme patterns by host specificity and site.

- Ingham, E.R., R.P. Griffiths, K. Cromack, and J.A. Entry. 1991. Comparison of direct vs fumigation incubation microbial biomass estimates from ectomycorrhizal mat and non-mat soils. *Soil Biology and Biochemistry* 23:465-472.**

For microbial ecologists and soil scientists. There is a long-standing controversy concerning the effectiveness of the chloroform fumigation-flush method for determining microbial biomass. Based on direct estimates of microbial biomass, it was concluded that the chloroform fumigation method was not a good indicator of microbial biomass, but that it may be a more general measure of readily utilizable carbon in forest soils.

- Jain, R.K., K. Paliwal, R.K. Dixon, and D.H. Gjerstad. 1989. Improving productivity of multipurpose trees growing on substandard soils. *Journal of Forestry* 87:38-40.**

For international foresters and soil scientists. Substandard soils occupy a large proportion of the Indian landscape. Multipurpose trees (e.g., *Leucaena*, *Prosopis*) can be established on sites with unfavorable edaphic and climatic factors and can provide food, fuel, fiber, and fodder to local people.

- Joly, R.J., W.T. Adams, and S.G. Stafford. 1989. Phenological and morphological responses of mesic and dry site sources of coastal Douglas-fir to water deficit. *Forest Science* 35:987-1005.**

For tree physiologists and breeders. Patterns of genetic variation in morphological and phenological responses to water deficit are described for seedling progeny of four populations of coastal Douglas-fir. Progeny from mesic and dry site sources differed for all traits measured; these differences appear to reflect adaptation to the source environment.

- Kaya, Z., R.K. Campbell, and W.T. Adams. 1989. Correlated responses of height increment and components of increment in 2-year-old Douglas-fir. *Canadian Journal of Forest Research* 19:1124-1130. (For. Res. Lab.)**

For forest geneticists and physiologists. The consequences for growth and phenology of early selection for height or its growth components were evaluated in 160 open-pollinated families of Douglas-fir from southwest Oregon. Predicted response to selection suggests that risk of low juvenile-mature correlation and maladaptation with early selection would be less in the inland than in the coastal region.

- Law, B.E., K.H. Riitters, and L.F. Ohmann. 1992. Growth in relation to canopy light interception in a red pine (*Pinus resinosa*) thinning study. *Forest Science* 38:199-202. (For. Res. Lab.)**

For physiological ecologists. Basal area growth data from the most recent 5 years of a 40-year thinning study were compared to the amount of visible light intercepted by the tree canopies over a range of stand densities in a red pine forest. Stand basal area growth was proportional to the amount of light intercepted within the stand and individual tree growth was inversely related to the amount of light intercepted by the canopy. Stand growth efficiency was only weakly correlated with stand density.

Lee, J., D. Lammers, M. Johnson, R. Church, D. Stevens, D. Coffery, R. Turner, L. Blume, L. Liegel, and R. Holdren. 1989. Watershed surveys to support an assessment of the regional effects of acidic deposition on surface water chemistry. *Environmental Management* 13:95-108.

For hydrologists, soil scientists, and land managers. This article provides an overview of the context, rationale, logistics, and implementation of a regional survey to assess relationships between surface water chemistry of lakes and streams and acidic deposition in the eastern United States.

Liegel, L.H. 1990. *Didymopanax morototoni*. P. 288-293 in *Silvics of North America. Volume 2. Hardwoods*. USDA Forest Service, Washington, D.C. Agriculture Handbook 877.

For botanists, foresters, and silviculturists. The distribution, occurrence, silvics, genetics, and growth characteristics of an early successional hardwood species found in Puerto Rico and other areas of the American tropics and subtropics are reviewed.

Liegel, L.H., compiler. 1991. Growth and site relationships of *Pinus caribaea* across the Caribbean Basin. USDA Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana. General Technical Report SO-83. 70 p.

For economists, foresters, land managers, and landowners. This report reviews climatic, soil, and geologic features and managerial practices that influence growth and yield of unthinned Caribbean pine plantations in Costa Rica, Jamaica, Puerto Rico, Trinidad, and Venezuela.

Liegel, L., D. Cassell, R. Church, D. Stevens, and P. Shaffer. 1991. Characteristics of land use in Northeast and Southern Blue Ridge Province: associations with acid rain effects on surface-water chemistry. *Environmental Management* 15:269-279.

For managers and scientists in all natural resource disciplines. This article reviews associations between existing land use and surface water chemistry of lakes and streams for 170 watersheds in the eastern United States affected by acidic deposition.

Liegel, L.H., and J. Stead. 1990. *Cordia alliodora*. P. 270-277 in *Silvics of North America. Volume 2. Hardwoods*. USDA Forest Service, Washington, D.C. Agriculture Handbook 654.

For botanists, foresters, and silviculturists. This chapter reviews information on the distribution, occurrence, silvics, genetics, and growth characteristics of a major hardwood timber species grown in Puerto Rico and other areas of the American tropics and subtropics.

Liegel, L.H., and J.L. Whitmore. 1991. *Cordia alliodora* (Ruiz & Pav.) Oken. In *Useful Trees of Tropical North America*. USDA Forest Service, International Forestry Staff, Washington, D.C. North American Forestry Commission Publication 3.

For tropical botanists, foresters, nursery managers, and silviculturists. This paper discusses the distribution, occurrence, silvics, genetics, and growth characteristics of

a major hardwood timber species grown in Puerto Rico and other areas of the American tropics and subtropics.

Linderman, R.G., T.C. Paulitz, H.J. Mosier, R.P. Griffiths, J.E. Loper, B.A. Caldwell, and M. Henkels. 1991. Evaluation of the effects of biocontrol agents on mycorrhizal fungi. P. 379 in *Beltsville Symposium XIV: The Rhizosphere and Plant Growth*. Kluwer Academic Press, Dordrecht.

For plant pathologists, microbial ecologists, and fungal physiologists. The effects of bacterial and fungal biocontrol agents on sporulation and infectivity of three major groups of mycorrhizal fungi were studied. There were no consistent negative effects seen on the exposure of mycorrhizal fungi to biocontrol organisms.

Loopstra, C.A., and W.T. Adams. 1989. Patterns of variation in first-year seedling traits within and among Douglas-fir breeding zones in southwest Oregon. *Silvae Genetica* 38:235-243.

For forest geneticists and ecologists. To determine the extent of genetic variation within and among Douglas-fir breeding zones in southwest Oregon, the authors studied six seed and seedling traits in families originating from 14 breeding zones. On the average, 53.9 percent of phenotypic variation among families was attributable to variation between zones; the remainder reflected differences among families within zones.

Loucks, D.M., and T.B. Harrington. 1991. *Herbaceous vegetation in forests of the western United States: an annotated bibliography*. Forest Research Laboratory, Oregon State University, Corvallis. 104 p. (For. Res. Lab.)

For forest managers, scientists, and wildlife biologists. Citations and abstracts for 325 articles on herbaceous vegetation in forests of the western United States are included. Literature since 1970 is reviewed; topics include the effects of herbaceous plants on development of forest stands and soil processes, and the management of herbaceous plants to increase production of timber and forage.

Luoma, D.L. 1991. Annual changes in seasonal production of hypogeous sporocarps in Oregon Douglas-fir forests. P. 83-89 in *Wildlife and Vegetation of Unmanaged Douglas-fir Forests*. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-GTR-285.

For mycologists and ecologists. Sporocarps of hypogeous ectomycorrhizal fungi were harvested from 10 Douglas-fir stands in a variety of natural habitats. In contrast to epigeous species, hypogeous sporocarp production was higher in spring than in fall. Individual species showed strong seasonal trends; most had spring production peaks. Year-to-year variation in relative biomass for individual species was greater in spring than in fall.

Luoma, D.L., R.E. Frenkel, and J.M. Trappe. 1991. Fruiting of hypogeous fungi in Oregon Douglas-fir forests: seasonal and habitat variation. *Mycologia* 83:335-353.

For ecologists and mycologists. Hypogeous sporocarps (truffles) were harvested from 10 Douglas-fir stands

representing a variety of natural habitats. Individual species showed strong seasonal trends; most had spring or summer production peaks. Sporocarp production of some species differed by habitat.

- Martin, F., M. Zaiou, F. Le Tacon, and P. Rygielwicz. 1991.** Strain-specific differences in ribosomal DNA from the ectomycorrhizal fungi *Laccaria bicolor* (Marie) Orton and *Laccaria laccata* (Scop. ex Fr.) Br. *Annales des Sciences Forestières* 48:297-305.

For molecular ecologists and ectomycorrhizae researchers. DNA fingerprints of European and North American strains of two *Laccaria* spp. are compared with entire fungal ribosomal DNA genes used as probes. Fingerprints of selected strains produced after isolating DNA with two widely used techniques (sodium dodecyl sulfate (SDS) and cetyltrimethylammonium bromide (CTAB)) are compared.

- Mattson, K.G., and W.T. Swank. 1989.** Soil and detrital carbon dynamics following forest cutting in the southern Appalachians. *Biology and Fertility of Soils* 7:247-253.

For ecologists and foresters. Soil CO<sub>2</sub> efflux to the atmosphere was 33 percent lower on two hardwood watersheds that were clearcut than on an uncut control. Lower CO<sub>2</sub> efflux on the clearcuts was associated with smaller live root masses and slower rates of forest floor decomposition. Cutting these forests was not associated with a large net transfer of carbon to the atmosphere.

- Maxwell, B.D., M.L. Roush, and S.R. Radosevich. 1990.** Predicting the evolution and dynamics of herbicide resistance in weed populations. *Weed Technology* 4:2-13. (For. Res. Lab.)

For agronomists. A model that incorporates plant population demographics with the Hardy-Weinberg concept for gene segregation was developed to predict herbicide resistance dynamics. Gene flow and fitness were identified as important processes influencing the evolution and dynamics of herbicide resistance in weed populations.

- McClellan, M.H., B.T. Bormann, and K. Cromack, Jr. 1990.** Cellulose decomposition in southeast Alaskan forests: effects of pit and mound microrelief and burial depth. *Canadian Journal of Forest Research* 20:1242-1246.

For forest ecologists and soil scientists. Uprooting is the predominant disturbance influencing stand development in Sitka spruce and western hemlock forests in southeast Alaska. In this study, no significant difference was found in the decomposition rates of confined cellulose filter paper placed on both mounds and adjacent pits. The greater organic accumulations observed in pits were largely a result of litter redistribution.

- McComb, W.C., R.G. Anthony, and K. McGarigal. 1991.** Differential vulnerability of small mammals and amphibians to two trap types and two trap baits in Pacific Northwest forests. *Northwest Science* 65:109-115. (For. Res. Lab.)

For vertebrate ecologists. The authors compared capture rates of small mammals and amphibians in six mature forest stands. Results suggest that a combination of

techniques that include pitfall and Museum Special sampling would most effectively estimate presence and abundance of most small mammal species.

- McComb, W.C., and A.J. Hansen. 1992.** An introduction to forest wildlife ecology. P. 93-122 in *Silvicultural Approaches to Animal Damage Management in Pacific Northwest Forests*. H. Black, ed. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-GTR-287.

For land managers and students. This conceptual overview discusses aspects of wildlife ecology that are relevant to the management of animal damage.

- McDade, M.H., F.J. Swanson, W.A. McKee, J.F. Franklin, and J. Van Sickle. 1990.** Source distances for coarse woody debris entering small streams in western Oregon and Washington. *Canadian Journal of Forest Research* 20:326-330.

For forest ecologists and managers. Coarse woody debris from streamside forests is important biologically and physically in stream ecosystems. The distance from stream bank to rooting site was determined for at least 30 fallen trees at each of 39 study sites. Seventy percent of debris pieces originated within 20 m of the stream bank. Stands with old-growth trees contributed coarse woody debris to streams from greater distances than did stands with mature trees.

- McLaughlin, S.B., C.P. Andersen, N.T. Edwards, W.K. Roy, and P.A. Layton. 1990.** Seasonal patterns of photosynthesis and respiration of red spruce saplings from two elevations in declining southern Appalachian stands. *Canadian Journal of Forest Research* 20:485-495.

For tree physiologists. Gas-exchange characteristics were compared at two elevations in declining stands of red spruce in the southern Appalachians.

- McLaughlin, S.B., C.P. Andersen, P.J. Hanson, M.J. Tjoelker, and W.K. Roy. 1991.** Increased dark respiration and calcium deficiency in red spruce in relation to acid deposition at high elevation southern Appalachian stands. *Canadian Journal of Forest Research* 21:1234-1244.

For tree physiologists and environmental scientists. Respiration rates in red spruce foliage increased with elevation in the southern Appalachians. Increased respiration rates were associated with decreased levels of calcium and increased levels of aluminum.

- Miller, S.L., D.M. Durall, and P.T. Rygielwicz. 1989.** Temporal allocation of <sup>14</sup>C to extramatrical hyphae of ectomycorrhizal ponderosa pine seedlings. *Tree Physiology* 5:239-249.

For tree physiologists, mycorrhizae researchers, and researchers interested in flow of carbon in ecosystems. This paper analyzes flow of recently fixed <sup>14</sup>C in all structural components of ectomycorrhizal ponderosa pine seedlings. Extramatrical hyphae (EMH) and growth status of EMH greatly influenced uptake, retention, and release of carbon. Temporal patterns of carbon flow were also greatly altered EMH status.

- Miller, S.L., D.M. Durall, and P.T. Ryglewicz. 1990. Extramatrical hyphae as sinks for carbon in ectomycorrhizal pine seedlings. *Agriculture, Ecosystems, and Environment* 28:101-105.  
For plant physiologists and mycorrhizae researchers. Relative physiological status of host and mycobiont, and the size of extramatrical hyphae network contribute greatly to the flow of recently fixed carbon between host and mycobiont.
- Minore, D., and R.T. Graham. 1990. Regeneration establishment and development in the silvicultural system. A western perspective. P. 219-222 in *Forestry on the Frontier. Proceedings, 1989 Society of American Foresters National Convention, Spokane, Washington. Society of American Foresters, Bethesda, Maryland.*  
For practicing foresters. This paper summarizes western silvicultural practices for those who may or may not be familiar with western conditions. Diversity is emphasized.
- Morris, J.W., P. Doumas, R.O. Morris, and J.B. Zaerr. 1990. Cytokinins in vegetative and reproductive buds of *Pseudotsuga menziesii*. *Plant Physiology* 93:67-71. (For. Res. Lab.)  
For plant physiologists. This article describes the nature of the major cytokinins present in female, male, and vegetative buds from Douglas-fir. Clear differences in cytokinin content between male and female buds are shown. Cytokinins may play a role in at least one phase of the reproductive process in Douglas-fir and perhaps in other conifers as well.
- Myrold, D.D. 1990. Effects of acidic deposition on soil organisms. P.163-187 in *Mechanisms of Forest Response to Acidic Deposition. Springer-Verlag, New York.*  
For forest ecologists. The effects of acid rain on soil organisms and biological processes are reviewed. The implications of these effects are assessed and research recommendations presented.
- Myrold, D.D. 1990. Measuring denitrification in soils using <sup>15</sup>N techniques. P.181-198 in *Denitrification in Soil and Sediment. Plenum Press, New York.*  
For soil scientists and forest ecologists. The use of <sup>15</sup>N stable isotope techniques for measuring denitrification in soils is reviewed. This method is evaluated in comparison with other methods for measuring denitrification rates in soil.
- Myrold, D.D., A.B. Hilger, and S.H. Strauss. 1990. Detecting *Frankia* in soil using PCR. P. 429 in *Nitrogen Fixation: Achievements and Objectives. Chapman and Hall, New York.*  
For soil scientists and microbial ecologists. This is a short summary of improvements in detection methodology.
- Myrold, D.D., P.A. Matson, and D.L. Peterson. 1989. Relationships among soil microbial properties and aboveground stand characteristics of conifer forests in Oregon. *Biogeochemistry* 8:265-281.  
For forest ecologists and soil scientists. Soil microbial properties, such as microbial biomass and respiration rate, were found to correlate with stand characteristics, such as leaf area index, and with remotely sensed variables.
- Myrold, D.D., and G.E. Nason. 1991. Effect of acid rain on soil microbial processes. P. 57-80 in *New Concepts in Environmental Microbiology. Wiley-Liss, Inc., New York.*  
For forest, soil, and microbial ecologists. This is a review article with special emphasis on the potential adaptation of microbes to altered environmental pH.
- Nason, G.E., and D.D. Myrold. 1991. <sup>15</sup>N in soil research: appropriate application of rate estimation procedures. *Agriculture, Ecosystems, & Environment* 34:427-441.  
For soil scientists. Several methods of isotope dilution calculations now in use are evaluated. Recommendations for the most appropriate procedures are given.
- Omi, S.K., and R. Rose. 1991. Amyloglucosidase and  $\alpha$ -amylase enzymes for determining starch concentration in ponderosa pine root tissue. *Forest Science* 37:1479-1483. (For. Res. Lab.)  
For plant and tree physiologists. Purified combinations of  $\alpha$ -amylase and amyloglucosidase were compared with combinations direct from the supplier to determine their relative precision in estimating starch concentration in root tissue of ponderosa pine. The authors concluded that purchased enzymes were sufficiently pure for use in an enzyme digest method.
- Perry, D.A., T. Bell, and M.P. Amaranthus. 1992. Mycorrhizal fungi in mixed-species forests and other tales of positive feedback, redundancy and stability. P. 151-179 in *The Ecology of Mixed-Species Stands of Trees. Oxford, Blackwell Scientific Publications, London. (For. Res. Lab.)*  
For forest researchers and managers. This paper reviews what is known about how mycorrhizal fungi mediate interactions among tree species. Two types of mediation are distinguished: (i) that concerned with gathering and allocation of resources at any one time; and (ii) that having to do with maintaining a continuity of the plant-fungus partnership through time.
- Perry, D.A., and J.G. Borchers. 1990. Climate change and ecosystem responses. *Northwest Environmental Journal* 6:293-313. (For. Res. Lab.)  
For scientists, policymakers, and the public. Current scenarios on climate change and their implications for plant growth and physiology are reviewed. Possible effects on ecosystems include more frequent and severe disturbances such as fire, insect outbreaks, and windstorms; rapid degradation as a result of the breakdown of positive feedback processes between plants and soil; and the inability of plant species to migrate fast enough to keep up with predicted rates of climate change. Some approaches for mitigating possible impacts are discussed.
- Perry, D.A., J.G. Borchers, S.L. Borchers, and M.P. Amaranthus. 1990. Species migrations and ecosys-

**tem stability during climate change: the belowground connection.** *Conservation Biology* 4:266-274. (For. Res. Lab.)

For scientists. Compatibility among plant species with regard to belowground mutualists (mycorrhizae and rhizosphere bacteria) and its influences on species migration during climate change are discussed. Because disruption of plant-soil links can result in rapid site degradation, it is crucial to protect these links by maintaining biodiversity and utilizing management practices that help plants keep a firm grip on the soil.

**Perry, D.A., J.G. Borchers, D.P. Turner, S.V. Gregory, C.R. Perry, R.K. Dixon, S.C. Hart, B. Kauffman, R.P. Neilson, and P. Sollins. 1991. Biological feedbacks to climate change: terrestrial ecosystems as sinks and sources of carbon and nitrogen.** *Northwest Environmental Journal* 7:203-232. (For. Res. Lab.)

For researchers, managers, policymakers, and the public. The concept of feedback is crucial to understanding the potential impacts of climate change. This paper discusses possible atmospheric feedbacks to climate change and how terrestrial ecosystems create biological feedbacks to climate change by acting either as sources or reservoirs of the key elements carbon and nitrogen.

**Perry, D.A., H. Margolis, C. Choquette, R. Molina, and J.M. Trappe. 1989. Ectomycorrhizal mediation of competition between coniferous tree species.** *New Phytologist* 112:501-511. (For. Res. Lab.)

For researchers. This study tested the effect of ectomycorrhizal fungi (EMF) on competitive interactions between seedlings of host plants *Pseudotsuga menziesii* (Mirb.) Franco and *Pinus ponderosa* Dougl. ex Laws. growing in pots of reconstructed field-collected litter and forest soil. Results indicate that EMF can reduce competition between plant species and perhaps increase overall community uptake of phosphorus.

**Peterson, C.E., and L.S. Heath. 1991. The influence of weather variation on regional growth of Douglas-fir stands in the U.S. Pacific Northwest.** *Water, Air, and Soil Pollution* 54:295-305.

For forest managers and ecologists. Increased volume growth rates were highly correlated with increased summer precipitation. While increases in periodic annual growth were correlated with above-normal temperatures during the winter months, above-normal temperatures during the summer months had negative impacts on stand volume growth. If projections of current global circulation models hold, warmer temperatures accompanied by unchanged or decreased soil moisture during the summer months could decrease regional growth rates of forest volume.

**Pothier, D., H.A. Margolis, and R.H. Waring. 1989. Patterns of change of saturated sapwood permeability and sapwood conductance with stand development.** *Canadian Journal of Forest Research* 19:432-439. (For. Res. Lab.)

For forest scientists and researchers in water relations. The saturated sapwood permeability ( $k$ ) of jack pine from stands of different ages and site qualities was measured with a constant water flow apparatus. The ability to

predict changes in  $k$  with stand development has potential for improving leaf area estimates derived from correlations between sapwood area and leaf area.

**Pothier, D., H.A. Margolis, J. Poliquin, and R.H. Waring. 1989. Relation between the permeability and the anatomy of jack pine sapwood with stand development.** *Canadian Journal of Forest Research* 19:1564-1570. (For. Res. Lab.)

For physiologists and physiological ecologists. The anatomical characteristics of jack pine sapwood from stands of different ages and site quality were related to the patterns of change in longitudinal sapwood permeability as previously observed among these stands. Tracheid length and relative water content are the two most important sapwood characteristics that help explain the variation of sapwood permeability with stand development.

**Preston, C.M., P. Sollins, and B.G. Sayer. 1990. Changes in organic components for fallen logs in old-growth Douglas-fir forests monitored by  $^{13}\text{C}$  nuclear magnetic resonance spectroscopy.** *Canadian Journal of Forest Research* 20:1382-1391.

For forest ecologists and biogeochemists.  $^{13}\text{C}$  cross-polarization magic-angle spinning nuclear magnetic resonance (CPMAS NMR) spectroscopy was used to characterize heartwood from decaying fallen boles of Douglas-fir, western hemlock, and western red cedar. The authors conclude that  $^{13}\text{C}$  CPMAS NMR offers a simple and information-rich alternative to wet chemical analyses for monitoring changes in organic components during decomposition of woody litter.

**Radulovich, R., E. Solorzano, and P. Sollins. 1989. Soil macropore size distribution from water breakthrough curves.** *Soil Science Society of America Journal* 53:556-559.

For soil scientists. A new method for characterizing macropore size distribution is presented for a well-aggregated Oxic Dystropept at La Selva, Costa Rica, known to exhibit macropore flow. The method is simple; and, because the results are based on dynamic measurements, they are more applicable to water flow models.

**Reams, G.A., and M.M.P. Huso. 1990. Stand history: an alternative explanation of red spruce radial growth reduction.** *Canadian Journal of Forest Research* 20:250-253. (For. Res. Lab.)

For researchers of pollutant effects on forests. Red spruce sites in northern Maine were classified according to their history of radial growth release. Two major releases were apparent: (1) a reduction and subsequent increase in radial increment in 1920; (2) an increase in radial increment from 1935 to 1955 followed by radial growth reduction in the 1960's. Birch dieback is suggested as a probable contributor to the growth increase from 1935 to 1955 and to the subsequent growth reduction of red spruce in the 1960's.

**Riegel, G.M., B.G. Smith, and J.F. Franklin. 1992. Foothill oak woodlands of the interior valleys of southwestern Oregon.** *Northwest Science* 66:66-76.

- For ecologists, foresters, and forest scientists. The vegetation of the Oregon white oak woodlands found on foothills in the interior valleys of southwestern Oregon is described. Floristic composition and structure of these woodlands have been disturbed by fire suppression, livestock grazing, introduction of alien species, and firewood harvest. Without changes in land management, the oak woodlands characteristic of southwestern Oregon will diminish.
- Rose, R., C.L. Rose, S.K. Omi, K.R. Forry, D.M. Durall, and W.L. Bigg. 1991. Starch determination by perchloric acid vs enzymes: evaluating the accuracy and precision of six colorimetric methods. *Journal of Agricultural and Food Chemistry* 39:2-11. (For. Res. Lab.)
- For researchers in starch analysis. This study compared the accuracy, precision, and convenience of six variations of perchloric acid and enzyme methods for quantifying starch in plant tissues. Detailed protocols for the laboratory procedures are provided. This is valuable as a reference work.
- Rosentreter, R., and R.G. Kelsey. 1991. Xeric big sagebrush, a new subspecies in the *Artemisia tridentata* complex. *Journal of Range Management* 44:330-335.
- For range managers, range ecologists, chemotaxonomists, and plant taxonomists. *Artemisia tridentata* spp. *xericensis*, found primarily in west central Idaho, is given official recognition as a new subspecies in the big sagebrush complex. It grows on basaltic foothill soils and is often associated with bluebunch wheatgrass (*Agropyron spicatum*).
- Roush, M.L., S.R. Radosevich, and B.D. Maxwell. 1990. Future outlook for herbicide-resistance research. *Weed Technology* 4:208-214. (For. Res. Lab.)
- For agronomists. Management of herbicide resistance will require interdisciplinary research so that the mechanisms and dynamics of resistance can be understood. Models that propose hypotheses about biological processes and possible management scenarios can help direct research.
- Ryan, M.G. 1989. Sapwood volume for three subalpine conifers: predictive equations and ecological implications. *Canadian Journal of Forest Research* 19:1397-1401.
- For forest ecologists, ecosystems researchers, and tree physiologists. The author examines how sapwood volume in three subalpine conifers changes with tree size and in relation to tree leaf area, an index of tree productivity. He also presents simple equations for estimating sapwood volume.
- Ryan, M.G. 1990. Growth and maintenance respiration in stems of *Pinus contorta* and *Picea engelmannii*. *Canadian Journal of Forest Research* 20:48-57. (For. Res. Lab.)
- For ecosystems researchers and tree physiologists. Stem maintenance respiration was linearly related to live-cell volume for lodgepole pine and for Engelmann spruce. Sapwood, not bole surface area, should be used to estimate stem maintenance respiration. Stem respiration during the growing season correlated well with annual stemwood growth.
- Rygiewicz, P.T. 1991. Using molecular biology techniques to study the ectomycorrhizal symbiosis. P. 42-77 in IV Renuião Brasileira Sobre Micorrizas. EMBRAPA—Centro Nacional de Pesquisa de Biologia do Solo, Universidade Federal Rural do Rio de Janeiro, Rio de Janeiro, Brazil.
- For mycorrhizae ecologists. The theory and use of molecular biology techniques to study ectomycorrhizae and ectomycorrhizal fungi are discussed. Topics include environmental release of genetically engineered microorganisms, use of probes to track organisms in the field, use of DNA and RNA for analyses, and isolation of nucleic acids.
- Rygiewicz, P.T., and J.L. Armstrong. 1991. Ectomycorrhizal DNA: isolation, RFLPs and probe hybridization. P. 253-280 in *Methods in Microbiology*. Volume 23. Techniques for the Study of Mycorrhiza. Academic Press, London.
- For soil molecular ecologists, especially ectomycorrhizae ecologists. This is a guide to practical applications of selected molecular biology techniques to isolate and analyze the DNA of ectomycorrhizal fungi and ectomycorrhizae. Emphasis is placed on techniques for tracking and identifying the mycobiont in field samples.
- Rygiewicz, P.T., N.L. Fowles, and J.L. Armstrong. 1990. DNA RFLPs distinguish ectomycorrhizal fungi. *Agriculture, Ecosystems, and Environment* 28:431-435.
- For mycorrhizae researchers. Methods for and results of using restriction fragment length polymorphisms to distinguish genera, species, and strains of ectomycorrhizal fungi are briefly described.
- Schowalter, T.D. 1991. Forest ecology. P. 169-172 in *McGraw-Hill Yearbook of Science and Technology*, 1992. McGraw-Hill, New York. (Dep. Entomol.)
- For the general public. Forest canopy processes contribute to forest health, air quality, and regulation of regional climate. These canopy processes are influenced by canopy structure, which is related to resource availability and disturbances that dictate tree species diversity. Canopy resource diversity determines diversity of associated species and their interactions.
- Schowalter, T.D. 1992. Heterogeneity of decomposition and nutrient dynamics of oak (*Quercus*) logs during the first 2 years of decomposition. *Canadian Journal of Forest Research* 22:161-166. (Dep. Entomol.)
- For ecologists. Decomposition of oak logs was studied at replicate sites in Oregon, Minnesota, Kansas, and North Carolina. Decomposition during the first 2 years was consistent among sites, but varied significantly among bark, sapwood, and heartwood components. Nutrients showed variable patterns of loss and accumulation among substrates through time.
- Schowalter, T.D., B.A. Caldwell, S.E. Carpenter, R.P. Griffiths, M.E. Harmon, E.R. Ingham, R.G. Kelsey, J.D. Lattin, and A.R. Moldenke. 1991. Decomposition of fallen trees: effects of initial conditions and heterotroph colonization rates. P. 371-381 in *Tropical*

**Ecosystems: Ecology and Management.** Wiley Eastern, Ltd., Bombay. (Dep. Entomol.)

For ecologists. This paper reports changes in wood chemistry and heterotroph community structure over 2 years in a replicated cohort of conifer logs cut from living undiseased trees. Decomposition processes differed among logs differing in initial conditions and rates of heterotroph colonization.

**Schowalter, T.D., and T.E. Sabin. 1991. Litter microarthropod responses to canopy herbivory, season and decomposition in litterbags in a regenerating conifer ecosystem in western Oregon.** *Biology and Fertility of Soils* 11:93-96. (Dep. Entomol.)

For ecologists. Microarthropods were studied over 2.5 years in litterbags under 10-year-old Douglas-fir subjected to varying levels of canopy herbivory. Of 33 taxa, three were significantly more abundant under defoliated saplings, probably in response to defoliator-induced changes in the litter. Abundance of most taxa fluctuated seasonally; fluctuations were related to temperature, precipitation, and mobilization of nitrogen and calcium from litterbags.

**Shainsky, L.J., M. Newton, and S.R. Radosevich. 1992. Effects of intra- and inter-specific competition on root and shoot biomass of young Douglas-fir and red alder.** *Canadian Journal of Forest Research* 22:101-110.

For foresters and forest scientists. The effects of intra- and inter-specific competition on root and shoot biomass of 5-year-old Douglas-fir and red alder were studied in experimentally manipulated stands. While increasing the density of each species reduced root and shoot biomass per tree, allocation of biomass to roots and shoots was not affected by competition, nor were the allometric equations relating biomass to stem diameter and stem volume index.

**Shainsky, L.J., and S.R. Radosevich. 1991. Analysis of yield-density relationships in experimental stands of Douglas-fir and red alder seedlings.** *Forest Science* 37:574-592.

For ecologists and silviculturists. This study explored a new technique for examining yield-density relationships between competing Douglas-fir and red alder early in stand development. Results show that although responses of young conifers and hardwoods to the systematic manipulation of species densities can be complex, discrete intra- and interspecific interactions can be quantified through the development of mathematical models similar to those developed for annual plants.

**Shainsky, L.J., and S.R. Radosevich. 1992. Mechanisms of competition between Douglas-fir and red alder seedlings.** *Ecology* 73:30-56.

For ecologists and ecological physiologists. Mechanisms of interactions between Douglas-fir and red alder seedlings were assessed in experimentally manipulated stands. Alder was the dominant competitor and overtopped the Douglas-fir. Increasing the densities of both species limited soil moisture, created negative leaf water potential, and reduced the relative growth rate and leaf area per tree.

**Silvester, W.B. 1989. Molybdenum limitation of asymbiotic nitrogen fixation in forests of Pacific Northwest America.** *Soil Biology and Biochemistry* 21:283-289.

For forest scientists. Nitrogenase activity and nitrogen fixation are widespread in forest litter, decaying wood, and the lichen *Lobaria* in Pacific Northwest forests. Stimulation of nitrogenase activity on decaying litter and wood by addition of nutrients is a specific molybdenum effect. The effect is measurable in both the field and the laboratory and is widespread among species and habitats.

**Sollins, P., G.P. Robertson, and G. Uehara. 1988. Nutrient mobility in variable- and permanent-charge soils.** *Biogeochemistry* 6:181-199.

For ecologists, soil scientists, and agronomists. The dynamics of nutrient cycling tends to be more complex in variable-charge than in permanent-charge soils since soil charge and surface chemistry are affected strongly by pH in variable-charge soils. Much of the dynamics can be inferred from soil classification with the Soil Taxonomy.

**Spies, T.A., J. Tappeiner, J. Pojar, and D. Coates. 1991. Trends in ecosystem management at the stand level.** *Transactions of the 56th North American Wildlife & Natural Resources Conference (1991):628-639.*

For forest managers and ecologists. This paper describes management of forest stands to provide various structures and composition. It compares development of managed stands to natural secondary succession.

**St. Clair, J.B., and W.T. Adams. 1991. Relative family performance and variance structure of open-pollinated Douglas-fir seedlings grown in three competitive environments.** *Theoretical and Applied Genetics* 81:541-550.

For tree breeders and forest geneticists. Open-pollinated Douglas-fir families were grown in three contrasting competitive environments to test the hypothesis that relative performance as measured by total seedling dry weight depends on distance or genotype of neighbors. Selection efficiency was greatest where families were grown in mixture at close spacing.

**Strader, R.H., and D. Binkley. 1989. Mineralization and immobilization of soil nitrogen in two Douglas-fir stands 15 and 22 years after nitrogen fertilization.** *Canadian Journal of Forest Research* 19:798-801. (For. Res. Lab.)

For forest scientists. Additions of <sup>15</sup>N-labelled ammonium chloride were used to examine the role of microbial immobilization in long-term growth response of Douglas-fir plantations to nitrogen fertilization. Less than 2 percent of the added N was recovered as mineral N after a 14-day laboratory incubation of soil samples from fertilized and nonfertilized plots.

**Strauss, S.H., and A.H. Doerksen. 1990. Restriction fragment analysis of pine phylogeny.** *Evolution* 44:1081-1096. (For. Res. Lab.)

For evolutionary biologists and forest geneticists. This study assessed the use of restriction fragment analysis of

chloroplast, nuclear, and mitochondrial DNA for understanding pine phylogeny. The results offer a number of major insights into pine evolution—confirming, contradicting, and extending published theories.

**Strauss, S.H., A.H. Doerksen, and J.R. Byrne. 1990. Evolutionary relationships of Douglas-fir and its relatives (genus *Pseudotsuga*) from DNA restriction fragment analysis. *Canadian Journal of Botany* 68:1502-1510. (For. Res. Lab.)**

For forest geneticists, botanists, and evolutionary biologists. Restriction fragment analysis of chloroplast, nuclear, and mitochondrial DNA was used to study phylogeny in the genus *Pseudotsuga*. Both parsimony and distance-matrix analyses indicated that relationships among the species in the genus coincide with their current geographic distribution. Outgroup analysis indicated that *Pseudotsuga* originated in North America and then migrated to Asia.

**Strauss, S.H., and G.T. Howe. 1990. An investigation of somatic variability for ribosomal RNA gene number in old-growth Sitka spruce. *Canadian Journal of Forest Research* 20:853-856. (For. Res. Lab.)**

For forest geneticists. Variability in ribosomal RNA gene number in old-growth trees of Sitka spruce was studied by molecular techniques. Within trees, no indication of gene number differences among branches was found; however, small differences may have gone undetected. This suggests that somatic variability of ribosomal RNA gene number is a minor source of genetic variability.

**Strauss, S.H., G.T. Howe, and B. Goldfarb. 1991. Prospects for genetic engineering of insect resistance in forest trees. *Forest Ecology and Management* 43:181-209. (For. Res. Lab.)**

For forest biologists, silviculturists, and pest managers. Gene transfer and recombinant DNA methods provide opportunities for enhancing insect resistance of forest trees by importing genes from other species and by manipulating native genes to create novel forms of resistance. This paper provides a brief overview of the methodology for engineering insect resistance in forest trees, discusses its opportunities and limitations, reviews current research, and explores areas for future work.

**Strauss, S.H., D.B. Neale, and D.B. Wagner. 1989. Genetics of the chloroplast in conifers. *Journal of Forestry* 87(8):11-17. (For. Res. Lab.)**

For foresters, forest researchers, and geneticists. Genes in chloroplasts play major roles in photosynthesis, but were not accessible to study until the advent of molecular genetic methods. The genetic patterns of conifers deviate significantly from those of the flowering plants; both the structure of the chloroplast genome and its inheritance are distinct. The experience with chloroplast genetics reinforces the concept that basic research on tree genes is needed if genetic engineering is to be successful in enhancing forest productivity.

**Tappeiner, J., J. Zasada, P. Ryan, and M. Newton. 1991. Salmonberry clonal and population structure: the basis for a persistent cover. *Ecology* 72:609-618. (For. Res. Lab.)**

For plant ecologists and foresters. Salmonberry clones in alder stands and clearcuts were larger and produced more ramets and aerial stems than those in conifer stands and on riparian sites. Salmonberry apparently are able to replace their aerial stems as they die and thus can likely maintain a persistent cover.

**Tilak, K.V.B.R., C. Li, and I. Ho. 1989. Occurrence of nitrogen-fixing *Azospirillum* in vesicular-arbuscular mycorrhizal fungi. *Plant and Soil* 116:286-288.**

For soil microbiologists. Nitrogenase activity measured by acetylene reduction was detected when surface-sterilized spores of vesicular-arbuscular mycorrhizal fungi were inoculated into nitrogen-free liquid medium containing malic acid and incubated under microaerophilic conditions.

**Tingey, D.T., and C.P. Andersen. 1991. The physiological basis of differential plant sensitivity to changes in atmospheric quality. P. 209-234 in *Ecological Genetics, Terrestrial Vegetation and Anthropogenic Changes in the Atmosphere*. Springer-Verlag, New York.**

For plant, environmental, and stress physiologists. This chapter addresses the physiological basis of differential plant sensitivity to pollutants. Plant responses to multiple pollutants, including the nonadditive nature of stress response, are addressed.

**Tingey, D.T., D.P. Turner, and J.A. Weber. 1991. Factors controlling the emissions of monoterpenes and other volatile organic compounds. P. 93-120 in *Trace Gas Emissions by Plants*. Academic Press, Inc., San Diego, California.**

For ecophysicologists and those interested in atmospheric chemistry. The variation among plant species in the quantity and type of volatile organic compounds (VOC) emitted is described and environmental controls on emission rates are discussed. A whole-leaf model for VOC emissions is presented.

**Tsai, C.-H., and S.H. Strauss. 1989. Dispersed repetitive sequences in the chloroplast genome of Douglas-fir. *Current Genetics* 16:211-218. (For. Res. Lab.)**

For forest geneticists. Restriction mapping and DNA sequencing were used to characterize dispersed repetitive DNA in the chloroplast genome of Douglas-fir. Dispersion of repetitive DNA by transposition, coupled with loss of the large inverted repeat, appears to have predisposed conifer chloroplast DNA to a large number of inversions during its evolution.

**Turner, D.P., J.V. Baglio, A.G. Wones, D. Pross, R. Vong, B. McVeety, and D.L. Phillips. 1991. Climate change and isoprene emissions from vegetation. *Chemosphere* 23:37-56.**

For atmospheric chemists and researchers interested in global climate change. Emissions of volatile organic carbon compounds (VOCs) from plants influence atmospheric chemistry and the concentrations of several important greenhouse gases. A global model for isoprene emissions under current and projected climates indicates increased biogenic VOC emissions and a possible biospheric feedback to climate change.

- Turner, D.P., D.D. Myrold, and J.D. Bailey. 1990. Climate change and patterns of denitrification in the Willamette basin of western Oregon, USA. P. 511-517 *In* Soils and the Greenhouse Effect. John Wiley & Sons, Chichester.
- For forest ecologists. Modelled climate change scenarios are combined with empirical relationships between environmental variables and denitrification rates in order to assess the potential impact of future climate change on nitrogen losses in western Oregon.
- Turner, D.P., and D.T. Tingey. 1990. Foliar leaching and root uptake of Ca, Mg and K in relation to acid fog effects on conifers. *Water, Air, and Soil Pollution* 49:205-214.
- For ecophysiologicalists and researchers interested in air pollution effects on plants. Chamber studies of acid fog effects on conifers revealed that foliar leaching of nutrient cations was increased by increasing fog acidity. However, the amounts leached were not large relative to potential root uptake rates, and concentrations of nutrients were not reduced in foliar tissue over the 3 months of exposure.
- Turner, D.P., and H. van Broekhuizen. 1992. Nutrient leaching from conifer needles in relation to foliar apoplast cation exchange capacity. *Environmental Pollution* 75:259-263.
- For ecophysiologicalists and those interested in air pollution effects on plants. Immersion of detached conifer needles in acidic solutions indicated increased leaching of nutrient cations with decreasing solution pH. The apoplast cation-exchange capacity was large relative to the quantity of nutrients leached; thus, leached ions may have originated in the apoplast, rather than in the symplast.
- Vance, N.C., and M.V. Wilson. 1990. Introduction to the symposium: environmental disasters: the nature of recovery. *Northwest Science* 64:237-238.
- For ecologists, biologists, and the general public. Prefatory discussion of massive environmental disruptions that have occurred in the Pacific Northwest over the past 30 years.
- Vargas-Hernandez, J., and W.T. Adams. 1991. Genetic variation of wood density components in young coastal Douglas-fir: implications for tree breeding. *Canadian Journal of Forest Research* 21:1801-1807.
- For tree breeders, forest geneticists, and wood technologists. The genetic control of earlywood density, latewood density, and latewood proportion, and their relationships with overall density were examined in a 15-year-old progeny test of Douglas-fir to assess the usefulness of this information in breeding for wood density. Density components were found to be of limited value in improving the efficiency of selection for overall density, but overall density was positively correlated with intra-ring density variation and negatively correlated with bole volume.
- Vargas-Hernandez, J., and W.T. Adams. 1992. Age-age correlations and early selection for wood density in young coastal Douglas-fir. *Forest Science* 38:467-478. (For. Res. Lab.)
- For tree breeders, forest geneticists, and wood technologists. Age-age correlations and age-associated changes in the genetic control of wood density and its components (earlywood density, latewood density, and latewood proportion) were investigated in 15-year-old trees of 60 open-pollinated families of Douglas-fir. Early selection to improve overall density at age 15 appears quite efficient (relative efficiency above 79 percent), even when selection is based on core density at age 7; but using wood density components as secondary traits produced only a slight increase in early selection efficiency.
- Waring, R.H. 1989. Ecosystems: fluxes of matter and energy. P. 17-41 *In* Ecological Concepts. The Contribution of Ecology to an Understanding of the Natural World. Blackwell Scientific Publications, Oxford, London, Edinburgh.
- For ecologists. Four areas in which fundamental insights now provide a basis for predicting ecosystem fluxes and for recognizing stability and instability are reviewed. These areas are (i) hydrology, with emphasis on evapotranspiration; (ii) the carbon cycle, with emphasis on photosynthesis and net primary production; (iii) biogeochemistry, with emphasis on changing chemical equilibria; and (iv) ecosystem disturbance, with emphasis on resistance and resilience.
- Waring, R.H. 1991. Searching for specific measures of physiological stress in forest ecosystems. P. 222-238 *In* Comparative Analyses of Ecosystems: Patterns, Mechanisms, and Theories. Springer-Verlag, New York, Berlin.
- For ecologists and the general scientific community. Subtle changes in climate, atmospheric chemistry, or management policies may eventually lead to shifts in ecosystem structure. Stresses may occur before shifts in structure are evident. Probable sources of stress can be identified by monitoring decreases in photosynthetic or growth efficiency and changes in carbon partitioning, nutrient balance, biochemical indices, and stable isotope composition.
- Waring, R.H., T. Savage, K. Cromack, Jr., and C. Rose. 1992. Thinning and nitrogen fertilization in a grand fir stand infested with western spruce budworm. Part IV: An ecosystem management perspective. *Forest Science* 38:275-286. (For. Res. Lab.)
- For forest ecologists, managers, silviculturists, and entomologists. A stand of grand fir was either (1) thinned, (2) fertilized with 350 kg/ha of nitrogen, or (3) both thinned and fertilized during an outbreak of the western spruce budworm. Fertilizing with one application of nitrogen at the time of an insect outbreak may reduce mortality and associated fire hazard for up to 5 years.
- Webb, W.L. 1991. Atmospheric CO<sub>2</sub>, climate change, tree growth: a process model. I. Model structure. *Ecological Modelling* 56:81-107. (For. Res. Lab.)
- For forest scientists and resource managers. This paper presents the structure of a model to be used for predicting changes in tree seedling growth associated with predicted increases in atmospheric carbon dioxide and predicted climate changes. The model is a compartment

representation of carbon flow that incorporates gross photosynthesis, stomatal conductance, growth and maintenance respiration, photosynthate allocation, and photosynthate conversion to biomass.

**Webb, W.L. 1991. Dynamics of photoassimilated  $^{14}\text{C}$  and  $^{12}\text{C}$  in *Pseudotsuga menziesii* seedlings: photosynthesis, respiration, and biomass. *Photosynthetica* 25:323-331. (For. Res. Lab.)**

For forest scientists. The rate at which photosynthate is converted to tree biomass is the fundamental link between atmospherically controlled photosynthetic rates and tree growth. Quantification of these linkages is important for predicting growth since continued increase in atmospheric  $\text{CO}_2$  is expected to produce climatic shifts in the future.

**Wigington, P.J., Jr., T.D. Davies, M. Tranter, and K.N. Eshleman. 1990. Episodic acidification of surface water due to acidic deposition. NAPAP SOS/T Report 12. In *Acidic Deposition: State of Science and Technology. Volume II. National Acid Precipitation Assessment Program*, Washington, D.C.**

For scientists, federal policymakers, and Congress. The occurrence and causes of episodic acidification in the United States are evaluated.

**Wilson, M.V., D.E. Hibbs, and E.R. Alverson. 1991. Native plants, native ecosystems, and native landscapes. *Kalmiopsis* 1:13-17. (For. Res. Lab.)**

For scientists and lay people interested in native plants of Oregon. Much of the worldwide conservation effort seeks to protect and sustain plants and animals in their native habitats. This paper discusses some of the ecological characteristics of native species and landscapes, and explores implications for conservation and ecological restoration.

**Wyant, J.G., R.J. Alig, and W.A. Bechtold. 1991. Physiographic position, disturbance, and species composition in North Carolina coastal plain forests. *Forest Ecology and Management* 41:1-19.**

For resource analysts and forest ecologists. Harvest disturbances and prescribed fires dominate other disturbance patterns in this area in regard to effects on species composition. Initial vegetation, physiographic class, and disturbances interact to determine the species compositional dynamics of individual stands.

**Yin, X., J.A. Perry, and R.K. Dixon. 1989. Fine-root dynamics and biomass distribution in a *Quercus* ecosys-**

**tem following harvesting. *Forest Ecology and Management* 27:159-177.**

For forest ecologists and soil scientists. Fine-root dynamics of a Wisconsin *Quercus* forest varied significantly with harvest practice and edaphic factors. Clearcutting significantly reduced fine-root production and belowground biomass of post-harvest stands relative to adjacent undisturbed stands.

**Yin, X., J.A. Perry, and R.K. Dixon. 1989. Influence of canopy removal on oak forest floor decomposition. *Canadian Journal of Forest Research* 19:204-214.**

For forest ecologists and soil scientists. Decomposition of *Quercus* litter on a clearcut site in Wisconsin was slower relative to rates observed on adjacent undisturbed sites. Canopy removal apparently changes microclimatic conditions and alters litter decomposition processes.

**Yin, X., J.A. Perry, and R.K. Dixon. 1991. Temporal changes in nutrient concentrations of fine roots in a *Quercus* forest. *Forest Ecology and Management* 44:174-184.**

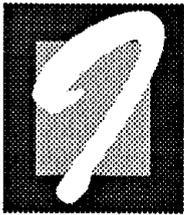
For forest ecologists and soil scientists. Fine-root content in a Wisconsin *Quercus* varied with edaphic and climatic factors. Temporal patterns of phosphorus and potassium concentration varied with root biomass.

**Yoder, B.J., and L.S. Daley. 1990. Development of a visible spectroscopic method for determining chlorophyll *a* and *b* in vivo in leaf samples. *Spectroscopy* 5(8):44-50. (For. Res. Lab.)**

For those interested in spectroscopy and remote sensing. Chlorophyll *a* (Chl *a*), Chl *b*, total chlorophyll, and the ratio of Chl *a* to Chl *b* can be determined from intact leaves with visible spectroscopy. Statistical analysis of red alder leaf attenuation (approximately adsorbance) data determined the highest correlated bands. This general method was retested and verified with barley, hazelnut, petunia, radish, and salvia leaves.

**Zasada, J.C., J.C. Tappeiner II, and T.A. Max. 1990. Viability of bigleaf maple seeds after storage. *Western Journal of Applied Forestry* 5:52-55.**

For forest ecologists and horticulturists. Stored seeds from bigleaf maple are generally believed to lose viability within a few weeks. In this study, seeds with a low moisture content at the time of collection were viable after 1 year of storage, but further study is needed to define optimal collection time and storage conditions.



## Integrated Protection of Forests and Watersheds

**Adams, P.W., and C.W. Andrus. 1990. Planning secondary roads to reduce erosion and sedimentation in humid tropic steeplands. P. 318-327 in Research Needs and Applications to Reduce Erosion and Sedimentation in Tropical Steeplands. Proceedings of the Fiji Symposium. International Association of Hydrological Sciences, Wallingford, Oxfordshire, U.K. Publication 192. (For. Res. Lab.)**

For resource managers, planners, and engineers. The applications and limitations of available information for reducing erosion and sedimentation from secondary roads in the humid tropics are reviewed. Key concerns are rainfall intensities and peak streamflows as well as the need for economical road design alternatives. However, most of the principles discussed are applicable to both tropical and temperate areas.

**Adams, P.W., and C.W. Andrus. 1991. Planning timber harvesting operations to reduce soil and water problems in humid tropic steeplands. P. 24-31 in Proceedings of a Symposium on Forest Harvesting in Southeast Asia. Forest Engineering, Inc., Corvallis, Oregon, and Forest Engineering Department, Oregon State University, Corvallis. (For. Res. Lab.)**

For resource managers, planners, and engineers. Greater use and management of forest resources present a vital opportunity for many countries but can also increase the risk of adverse impacts on soil and water. Harvest systems, equipment, scheduling, training, supervision, and other factors affecting the tropical environment are discussed. Most of the principles and references cited are also applicable to the Pacific Northwest.

**Amaranthus, M.P., D.S. Parrish, and D.A. Perry. 1989. Decaying logs as moisture reservoirs after drought and wildfire. P. 191-194 in Stewardship of Soil, Air, and Water Resources: Proceedings, WATERSHED '89. USDA Forest Service, Alaska Region, Juneau, Alaska. No. R10-MB-77.**

For forest managers and scientists. Decaying wood on the forest floor retains large reservoirs of moisture and thus provides long-lasting, high-moisture microsites that aid in forest recovery after prolonged drought or fire. Examination of logs after the Galice complex fires in southwest Oregon revealed considerable root and mycorrhizal activity. Mean log moisture was 25 times greater than mean soil moisture.

**Bentson, K.P. 1990. Fate of xenobiotics in foliar pesticide deposits. P. 125-161 in Reviews of Environmental Contamination and Toxicology. Springer-Verlag, New York.**

For scientists. The major processes affecting residues in pesticide deposits on foliage (besides washoff by rain) are

foliar penetration, volatilization, and photodegradation. The traditional approaches for studying these processes are evaluated.

**Bentson, K.P., and L.A. Norris. 1991. Foliar penetration and dissipation of triclopyr butoxyethyl ester herbicide on leaves and glass slides in the light and dark. Journal of Agricultural and Food Chemistry 39:622-630.**

For scientists. This study demonstrated the importance of temperature in the environmental disposition of triclopyr butoxyethyl ester (BEE) herbicide from deposits. A rise in temperature caused an exponential increase in triclopyr BEE loss regardless of surface and a greater increase in foliar penetration in chinkapin than in madrone.

**Beschta, R.L. 1990. Effects of fire on water quantity and quality. P. 219-232 in Natural and Prescribed Fire in Pacific Northwest Forests. J.D. Walstad, S.R. Radosevich, and D.V. Sandberg, eds. Oregon State University Press, Corvallis.**

For foresters, hydrologists, and aquatic ecologists. This paper summarizes current literature and research results related to the hydrologic effects of fire, with emphasis on Pacific Northwest conditions. Whereas hot wildfires or slash burns may alter the short-term production of sediment and nutrients, little or no increase in nutrients or sediment generally occurs after low-severity burns. Water yield increases are directly associated with the proportion of overstory vegetation removed by fire.

**Beschta, R.L. 1990. Peakflow estimation using an antecedent precipitation index (API) model in tropical environments. P. 128-137 in Research Needs and Applications to Reduce Erosion and Sedimentation in Tropical Steeplands. Proceedings of the Fiji Symposium. International Association of Hydrological Sciences, Wallingford, Oxfordshire, U.K. Publication 192. (For. Res. Lab.)**

For hydrologists and geomorphologists. An antecedent precipitation index (API) model is presented that utilizes a hydrograph recession coefficient in conjunction with precipitation amounts and timing to simulate streamflow during large storms. The potential usefulness of API in tropical environments is illustrated by showing how it can estimate peakflows on a watershed in Hawaii and simulate stream levels of a river in India.

**Beschta, R.L. 1991. Stream habitat management for fish in the northwestern United States: the role of riparian vegetation. American Fisheries Society Symposium 10:53-58. (For. Res. Lab.)**

For foresters and fisheries biologists. Historical development and land-use patterns along streams draining forest and range watersheds have had major effects on riparian vegetation, channel characteristics, and fish habitat. A high priority for long-term improvement of fish habitat is the implementation of management practices that allow and encourage continued functioning and succession of riparian vegetation.

**Brasier, C.M., P.B. Hamm, and E.M. Hansen. 1989. Phytophthora diseases: status of *P. gonapodyrides*, *P. drechsleri*, and *P. cryptogea*. P. 45-46 in British Forestry**

**Commission Report on Forest Research. Her Majesty's Stationery Office, London.**

For mycologists. This report clarifies the taxonomic status and world-wide distribution of *Phytophthora* fungi. *P. gonapodyrides* is frequently recovered from stumps in the Northwest, but does not cause disease on conifers; the other species are important pathogens of agricultural crops, including conifer seedlings in nurseries.

**Bray, R.O., C.L. Wambolt, and R.G. Kelsey. 1991. Influence of sagebrush terpenoids on mule deer preference. Journal of Chemical Ecology 17:2053-2062.**

For chemical ecologists, wildlife researchers, and animal ecologists. Volatile and nonvolatile compounds, primarily terpenoids, in the foliage of four sagebrush species were applied to alfalfa hay and presented to mule deer in a two-choice preference test. All compounds tested significantly deterred ingestion. The deterrent activity of foliage extracts containing nonvolatile sesquiterpene lactones related closely to mule deer preference for the sagebrush species extracted.

**Cherry, J., and R.L. Beschta. 1989. Coarse woody debris and channel morphology: a flume study. Water Resources Bulletin 25:1031-1036. (For. Res. Lab.)**

For fisheries biologists and forest hydrologists. The effects of coarse woody debris on local channel morphology were evaluated. Wooden dowels were used to simulate the effects of individual logs in a stream. The results, in combination with field studies, show that the orientation of coarse woody debris affects channel scour and stability and can be important in shaping the morphology of alluvial channels.

**Commandeur, P.R., and M.R. Pyles. 1991. Modulus of elasticity and tensile strength of Douglas-fir roots. Canadian Journal of Forest Research 21:48-52.**

For geotechnical specialists. The average form and material moduli of elasticity were, respectively, 185 and 503 MPa, whereas the average tensile strength was 17 MPa.

**Connelly, A.E., and T.D. Schowalter. 1991. Seed losses to feeding by *Leptoglossus occidentalis* (Heteroptera: Coreidae) during two periods of second-year cone development in western white pine. Journal of Economic Entomology 84:215-217. (Dep. Entomol.)**

For forest entomologists. Seed bugs were caged on western white pine cones during early and late stages of cone development. Cone abortion and reduced seed yield per cone were associated with feeding during early stages of cone development. Feeding during late stages of cone development resulted in damage to the endosperm. Seed bug feeding at either stage resulted in 70-80 percent reduction in viable seed.

**Craig, R.E.R., J.A. Campbell, A.C. Craig, C.F. Campana, and R.G. Kelsey. 1990. Tatrudin A from *Artemisia arbuscula* ssp. *arbuscula*: crystal structure of tatrudin A diacetate and the identification of deacetyltulirinol. Journal of Natural Products 53:1585-1586.**

For natural products chemists, chemical ecologists, and chemotaxonomists. Tatrudin A, a sesquiterpene lactone isolated from *Artemisia arbuscula* Nutt. ssp. *arbuscula* (low sagebrush), has been identified as deacetyltulirinol

on the basis of the crystal structure determination of the derivative, tatrudin A diacetate.

**Daniels, S.E., and C.M. Kelly. 1990. Deciding between an EA and an EIS may be a question of mitigation. Western Journal of Applied Forestry 5:111-116. (For. Res. Lab.)**

For federal agency resource managers. The authors present the legal issues and some important legal decisions linking an environmental assessment (EA), a finding of no significant impact, mitigation, and an environmental impact statement. They also develop a system designed to help managers decide whether to include mitigation in EAs.

**Daniels, S.E., and R.A. Riggs. 1988. Improving economic analysis of habitat management. Wildlife Society Bulletin 16:452-457. (For. Res. Lab.)**

For wildlife-management professionals. This paper examines a recent analysis of the cost effectiveness of creating forest openings to increase populations of white-tailed deer. It suggests procedural changes that could improve the general relevance of the analysis for habitat modification and recommends conducting similar analyses for most habitat modifications.

**Entry, J.A., K. Cromack, Jr., R.G. Kelsey, and N.E. Martin. 1991. Response of Douglas-fir to infection by *Armillaria ostoyae* after thinning or thinning plus fertilization. Phytopathology 81:682-689. (For. Res. Lab.)**

For forest pathologists and silviculturists. Thinning combined with fertilization may predispose Douglas-fir trees to infection by *Armillaria ostoyae* by lowering concentrations of defensive compounds in root bark and increasing the energy available to the fungus to degrade them.

**Entry, J.A., S.K. Hagle, and K. Cromack, Jr. 1990. The effect of *Armillaria* attack on the nutrient status of Inland Douglas-fir. European Journal of Forest Pathology 20:269-274. (For. Res. Lab.)**

For forest pathologists. Nutrient status, sapwood basal area, and the ratio of sapwood to heartwood basal area were measured on second-growth Douglas-fir trees in western Montana. Results indicate a general influence of *Armillaria* infection on nutrient content and physiological status of Douglas-fir trees. However, these measurements are not a reliable method for determining the extent of infection.

**Entry, J.A., N.E. Martin, R.G. Kelsey, and K. Cromack, Jr. 1992. Chemical constituents in root bark of five species of western conifer saplings and infection by *Armillaria ostoyae*. Phytopathology 82:393-397. (For. Res. Lab.)**

For forest pathologists and managers. Ten years after being planted, five species of western conifer saplings were inoculated with two isolates of *Armillaria ostoyae*. Infection ratings assigned to *A. ostoyae* were highest in saplings of *Abies grandis* and *Pseudotsuga menziesii* and lowest in those of *Larix occidentalis*. Ratios of the energetic costs of phenolic and lignin degradation relative to the energy available from sugars were correlated with infection rate.

- Fedora, M.A., and R.L. Beschta. 1989. Storm runoff simulation using an antecedent precipitation index (API) model. *Journal of Hydrology* 112:121-133. (For. Res. Lab.)
- For hydrologists and forest engineers. An Antecedent Precipitation Index (API) model for predicting storm runoff was developed for use in the Oregon Coast Range. Results from one test and five "calibration" watersheds indicate that despite gross hydrologic simplifications, the API model provides a relatively simple, objective method of predicting peak flows and storm flow volumes.
- Filip, G.M., C.L. Schmitt, and K.P. Hosman. 1992. Effects of harvesting season and stump size on incidence of annosus root disease of true fir. *Western Journal of Applied Forestry* 7:54-56.
- For forest silviculturists and pathologists. A high frequency of annosus root disease caused by *Heterobasidion annosum* was found in true fir stumps cut 5 to 10 years earlier in northeastern Oregon. Neither season of harvesting nor stump size significantly affected the amount of stump decay, which averaged 51 percent.
- Filip, C.M., B.E. Wickman, R.R. Mason, C.A. Parks, and K.P. Hosman. 1992. Thinning and nitrogen fertilization in a grand fir stand infested with western spruce budworm. Part III: tree wound dynamics. *Forest Science* 38:265-274.
- For forest silviculturists and pathologists. The authors tested the effects of thinning and urea fertilization on stem-wound closure and associated wood decay as affected by tree growth and vigor. Although wound closure and cross-sectional area of decay were not significantly affected by their treatments, the percentage of stem cross-sectional area with decay was significantly less in trees that had been both thinned and fertilized.
- Frederick, P.C., and M.W. Collopy. 1989. The role of predation in determining reproductive success of colonially-nesting wading birds in the Florida Everglades. *Condor* 91:860-867.
- For avian and population ecologists. In a sample of 1,609 marked nests of five species of Ciconiiformes in 21 colonial nesting aggregations in the Florida Everglades, evidence of abandonment without destruction of nest contents accounted for 31 percent of failures. Failures at the remaining nests resulted from predation or post-abandonment scavenging of nest contents. Snakes and mammals were the most frequently identified predators at nests.
- Ghersa, C.M., and M.A. Martinez-Ghersa. 1991. A field method for predicting yield losses in maize caused by johnsongrass (*Sorghum halepense*). *Weed Technology* 5:279-285.
- For farmers, weed scientists, and agronomists. This paper presents a simple and accurate way of predicting maize/johnsongrass interactions with the use of a thermal calendar to decide the sampling date for relative biomass estimation. With further information, this method could be used in other situations involving different crop species and more complex crop/weed associations.
- Hansen, A.J., T.A. Spies, F.J. Swanson, and J.L. Ohmann. 1991. Conserving biodiversity in managed forests. *BioScience* 41:382-392. (For. Res. Lab.)
- For foresters, ecologists, and concerned citizens. Knowledge of ecological patterns in the natural forests of the coastal Northwest can help guide strategies for maintaining biodiversity in commodity forests.
- Hansen, E.M., P.B. Hamm, and L.F. Roth. 1989. Testing Port-Orford-cedar for resistance to *Phytophthora*. *Plant Disease* 73:791-794.
- For foresters interested in the survival of Port-Orford-cedar. Methods to test trees for resistance to *P. lateralis* are described, and the first resistant trees are reported.
- Hansen, E.M., and D.P. Maxwell. 1991. Species of the *Phytophthora megasperma* complex. *Mycologia* 83:376-381.
- For mycologists. This species complex is shown to be comprised of at least four distinct species, including two that attack Douglas-fir seedlings. New species are described.
- Hansen, E.M., D.D. Myrold, and P.B. Hamm. 1990. Effects of soil fumigation and cover crops on potential pathogens, microbial activity, nitrogen availability, and seedling quality in conifer nurseries. *Phytopathology* 80:698-704.
- For plant pathologists and nursery managers. The interacting effects of cover crops and fumigation on populations of *Fusarium* and *Pythium* and seedling quality of Douglas-fir are described. Not growing a cover crop gives benefits nearly equal to fumigating the soil.
- Happe, P.J., K.J. Jenkins, E.E. Starkey, and S.H. Sharrow. 1990. Nutritional quality and tannin astringency of browse in clear-cuts and old-growth forests. *Journal of Wildlife Management* 54:557-566. (For. Res. Lab.)
- For resource managers and researchers. Most indices of forage quality for four shrubs were greater in old growth than in clearcuts. However, relative availability of shrubs and herbaceous forage was not studied. Retention of old growth within the habitat mosaic of managed forests will provide optimum year-round foraging habitat.
- Harvey, S.D., J.A. Campbell, R.G. Kelsey, and N.C. Vance. 1991. Separation of taxol from related taxanes in *Taxus brevifolia* extracts by isocratic elution reversed-phase microcolumn high-performance liquid chromatography. *Journal of Chromatography* 587:300-305.
- For chromatographers, natural products chemists, and mass spectroscopists. Taxol and cephalomannine, two important taxanes in the tissues of Pacific yew, were separated by reversed-phase high-performance liquid chromatography in microcolumns packed with octadecyl silica under isocratic elution conditions.
- Hennon, P.E., C.G. Shaw III, and E.M. Hansen. 1990. Dating decline and mortality of *Chamaecyparis nootkatensis* in southeast Alaska. *Forest Science* 36:502-515.

- For forest biologists. Aerial photographs, the rope tree method of dating cedar death, and historical references all support the suggestion that the onset of extensive mortality of Alaska yellow-cedar began about 1880, perhaps too early for some forms of human involvement, particularly anthropogenic pollutants, to be considered directly causal.
- Hicks, B.J., R.L. Beschta, and R.D. Harr. 1991. Long-term changes in streamflow following logging in western Oregon and associated fisheries implications. *Water Resources Bulletin* 27:217-226. (For. Res. Lab.)
- For hydrologists, fisheries biologists, and foresters. This study examined the long-term effect of timber harvest on low summer streamflow, taking into account the period of vegetative regrowth following logging. Increases in water yield for August were relatively large after clearcut logging for about 8 years, compared with yield in an unlogged control watershed. Thereafter, August water yields were less than normal for 18 of 19 years. Potential effects on salmonid survival are discussed.
- Holtby, L.B., T.E. McMahon, and J.C. Scrivener. 1989. Stream temperatures and inter-annual variability in the emigration timing of coho salmon (*Oncorhynchus kisutch*) smolts and fry and chum salmon (*O. keta*) fry from Carnation Creek, British Columbia. *Canadian Journal of Fisheries and Aquatic Sciences* 46:1396-1405.
- For fisheries biologists. Stream temperatures were shown to strongly influence the timing of emergence and downstream migration of coho and chum salmon fry and of seaward migration of coho salmon smolts over a 9- to 10-year period. Changes in the timing of migration of fry and smolts relative to temperature changes may be significant since these movements are synchronized with advantageous conditions in the stream and the ocean.
- Ice, G.G., R.L. Beschta, R.S. Craig, and J.R. Sedell. 1989. Riparian protection rules for Oregon forests. P. 533-536 in *Proceedings of the California Riparian Systems Conference: Protection, Management, and Restoration for the 1990's*. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, California. General Technical Report PSW-110. (For. Res. Lab.)
- For foresters, fisheries biologists, and forest managers. Forest Practice Rules under the Oregon Forest Practices Act were modified in 1987 to increase protection of riparian areas adjacent to timber harvesting operations. This paper chronicles the development and implementation of rules specifically designed to improve protection of riparian habitat for fish and wildlife.
- Joseph, G., J.C. Miller, R.E. Berry, J. Wernz, A.F. Moldenke, and R.G. Kelsey. 1991. White alder and Douglas-fir foliage quality and interegg-mass influences on larval development of gypsy moth, *Lymantria dispar*. *Journal of Chemical Ecology* 17:1783-1799.
- For chemical ecologists, entomologists, and insect ecologists. Foliar nutritional quality, including nitrogen and allelochemical composition (terpenes and phenols), was determined to be a key factor influencing the performance of gypsy moth families fed diets of white alder, a suitable broadleaf host, and Douglas-fir, an unsuitable conifer host. The influence of a family's genetic resources on larval survival was most notable when larvae were under the greatest nutritional stress.
- Krantz, G.W., L.A. Royce, R.R. Lowry, and R. Kelsey. 1991. Mechanisms of phoretic specificity in *Macrocheles* (Acari:Macrochelidae). P. 561-569 in *Modern Acarology. Volume 2*. Academia, Prague and SPB Academic Publishing bv, The Hague.
- For chemical ecologists, acarologists, entomologists, and insect ecologists. The attraction of phoretic *Macrocheles* mites to their specific beetle carriers was found to be mediated by a kairomone consisting of a dihydroxy wax or class of waxes located on the surface of the beetle cuticle. The specificity of a mite species to a particular beetle species is based on the fidelity of the mite to the ecological niche of its beetle carrier, and secondarily on the beetle kairomonal cue.
- Larsen, G.L. 1989. Geographical distribution, morphology and water quality of caldera lakes: a review. *Hydrobiologia* 171:23-32. (For. Res. Lab.)
- For limnologists. Eighty-eight caldera lakes located in 31 volcanic subregions were evaluated through a review of literature and maps. The lakes varied greatly in elevation, surface area, maximum depth, and shoreline development. Water quality ranged from ultraoligotrophic (very deficient in nutrients) to highly eutrophic (rich in nutrients).
- Lewis, K.J., and E.M. Hansen. 1991. Vegetative compatibility groups and protein electrophoresis indicate a role for basidiospores in spread of *Inonotus tomentosus* in spruce forests of British Columbia. *Canadian Journal of Botany* 69:1756-1763.
- For forest pathologists and population biologists. This important root rot pathogen spreads both by vegetative growth along roots and by basidiospores.
- Lewis, K.J., D.J. Morrison, and E.M. Hansen. 1992. Spread of *Inonotus tomentosus* from infection centres in spruce forests in British Columbia. *Canadian Journal of Forest Research* 22:68-72.
- For foresters and forest pathologists. The path of infection in spruce by *Inonotus tomentosus* and disease development were studied by excavating roots of trees in five plots situated at the edge of disease centres in 60- to 80-year-old stands. Root contacts resulted in infection only when ectotrophic or intrabark mycelium was present. Roots less than 4 cm in diameter were infected by direct penetration through the bark; larger roots were infected through feeder roots or at root junctions.
- Loucks, D.M., H.C. Black, M.L. Roush, and S.R. Radosevich. 1990. Assessment and management of animal damage in Pacific Northwest forests: an annotated bibliography. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-GTR-262. 371 p.
- For forest land managers. This annotated bibliography of published literature provides a comprehensive source of information on animal damage assessment and management in the Pacific Northwest. It complements and

supplements "A Silvicultural Approach to Animal Damage Management in Pacific Northwest Forests," a compendium focusing on interactions between silvicultural and animal-damage management.

**Matter, W.J., R.W. Mannan, E.W. Bianchi, T.E. McMahon, J.H. Menke, and J.C. Tash. 1989. A laboratory approach for studying emigration. *Ecology* 70:1543-1546.**

For behavioral and population ecologists. The authors describe the development and testing of an experimental method for identifying the specific habitat features and social conditions that trigger animals to emigrate or become residents in an area. The use of such open-laboratory systems is demonstrated for a fish and a crayfish.

**Mattson, K.G., L.Y. Arnaut, G.A. Reams, S.P. Cline, C.E. Peterson, and R.J. Vong. 1990. Response of forest trees to sulfur, nitrogen, and associated pollutants. USEPA, Environmental Research Laboratory, Corvallis, Oregon. EPA/600/3-90/074. 134 p.**

For scientists and developers of regulatory policy. This is a synthesis of research on the effects of acidic precipitation and ozone on forests. Projects of the Forest Response Program of the National Acid Precipitation Assessment Program are reviewed. The review includes several observations on mechanisms behind pollutant effects and conclusions regarding the consistent relationship between forest conditions and pollutant levels in several regions of the United States.

**McComb, W.C., P.L. Groetsch, G.E. Jacoby, and G.A. McPeck. 1989. Response of forest birds to an improvement cut in Kentucky. *Proceedings, Annual Conference, Southeastern Association of Fish and Wildlife Agencies* 43:313-325. (For. Res. Lab.)**

For ornithologists, wildlife biologists, and forest managers. An improvement cut that removed trees of commercially low quality from an unmanaged, 60-year-old, mixed mesophytic forest reduced stand basal area and the availability of cavities, snags, and small seeds. The abundance of primary and secondary cavity-using birds, as well as of neotropical, migrant songbirds, was not affected severely by the cut.

**McComb, W.C., A.J. Hansen, and K. McGarigal. 1990. Cope-ing with fragmented landscapes in western Oregon: forests by design or default? P.155-158 in *Forestry on the Frontier. Proceedings, 1989 Society of American Foresters National Convention, Spokane, Washington. Society of American Foresters, Bethesda, Maryland.***

For forest managers. This paper discusses two ongoing projects and one future project of the Coastal Oregon Productivity Enhancement (COPE) Program that should provide information on landscape design to meet both wildlife and timber objectives. These projects will investigate the influence of forest fragmentation on wildlife abundance and habitat and the role of riparian areas as habitats and movement corridors.

**McComb, W.C., K. McGarigal, J.D. Fraser, and W.H. Davis. 1989. Planning for basin-level cumulative ef-**

**fects in the Appalachian coal field. *Transactions, 54th North American Wildlife and Natural Resources Conference* 54:102-112. (For. Res. Lab.)**

For land managers and administrators. The authors describe current and expected land-use patterns in the Appalachian coal field, discuss the potential cumulative effects of anticipated land-use changes, and suggest research needs and approaches to minimize those impacts on wildlife.

**McComb, W.C., J.E. Sedell, and T.D. Buchholz. 1990. Dam-site selection by beavers in an eastern Oregon basin. *Great Basin Naturalist* 50:273-281. (For. Res. Lab.)**

For riparian area managers. Physical and vegetative habitat characteristics at 14 dam sites occupied by beavers were compared with those at 41 randomly selected unoccupied sites to identify features important to dam-site selection. Occupied sites were found to have no rock substrates, shallower stream reaches with lower gradients, more gently sloping banks, and greater tree canopy cover. Models for classifying dam sites also were tested.

**McGarigal, K., and W.C. McComb. 1989. Riparian wildlife information needs in western Oregon: land manager concerns. *Transactions, 54th North American Wildlife and Natural Resources Conference* 54:32-42. (For. Res. Lab.)**

For land managers and research scientists. A 9-year study within the Coastal Oregon Productivity Enhancement (COPE) research and education program was initiated to provide objective information on riparian-wildlife relationships in western Oregon. This paper identifies and prioritizes needs for information on riparian management by foresters and biologists in state and federal agencies and by land managers in private industry.

**McGarigal, K., and W.C. McComb. 1992. Streamside versus upslope breeding bird communities in the central Oregon Coast Range. *Journal of Wildlife Management* 56(1):10-23. (For. Res. Lab.)**

For forest and wildlife managers. Contrary to a common belief, streamside areas were dramatically less important than adjacent upslope areas in contributing to the avifauna of mature, unmanaged forest stands in this study. A landscape-level approach that considers both upslope and riparian habitat may meet the needs of the entire breeding community most effectively.

**McMahon, T.E., and G.F. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences* 46:1551-1557. (For. Res. Lab.)**

For fisheries biologists, hydrologists, and forest managers. Experiments were conducted in outdoor stream channels to determine winter-habitat use by juvenile coho salmon. Cover utilization and the number of fish remaining in stream channels increased significantly as cover complexity (current velocity, shade, and wood debris) increased.

**Miles, D.W.R., and H.A. Froehlich. 1988. Objectives and evaluation of forest tillage. P. 204 in *Degradation of***

- Forested Land: Forest Soils at Risk. Proceedings, 10th British Columbia Soil Science Workshop. British Columbia Ministry of Forests, Victoria, British Columbia. Land Management Report 56.**
- For soil scientists and land managers. The objective of forest tillage in most operations is to modify the soil on degraded sites and thus increase tree establishment, survival, and growth. Immediate evaluation of tillage involves ensuring that the desired changes in soil physical properties are produced and that as much of the compacted soil is tilled as is economically justifiable.
- Murphy, G., and M.R. Pyles. 1989. Cost-effective selection of culverts for small forest streams. Journal of Forestry 87(10):45-50. (For. Res. Lab.)**
- For practicing foresters and forest engineers. Minimizing total discounted cost (TDC) is suggested as an economic design criterion for culvert selection. TDC is the sum of the original installation cost, the discounted annual maintenance costs, and the discounted expected costs of culvert failures that could be caused by peak flows. Evaluating these costs combines hydraulic probability, culvert hydraulics, and cost estimating and discounting.
- Newton, M., F. Roberts, A. Allen, B. Kelpas, D. White, and P. Boyd. 1990. Deposition and dissipation of three herbicides in foliage, litter, and soil of brushfields of southwest Oregon. Journal of Agricultural and Food Chemistry 38:574-583. (For. Res. Lab.)**
- For foresters, soil scientists, environmental chemists, water-quality and regulatory personnel. The herbicides 2,4-D, triclopyr, and picloram were applied by helicopter to test grids on shallow, rocky, clay loam soils. All three herbicides leave low but detectable traces in evergreen brushfield ecosystems for nearly 1 year. Residues disappear most rapidly in soil and litter. Residues are apparently immobile and pose no hazard to forest fauna.
- Niwa, C.G., and G.E. Daterman. 1989. Pheromone mating disruption of *Rhyacionia zozana* (Lepidoptera: Tortricidae): influence on the associated parasite complex. Environmental Entomology 18:570-574.**
- For entomologists, pest managers, and foresters. Total percentage of parasitism of the tip moth was the same in check plots and in areas treated with mating disruption. However, the species composition of larval and pupal parasites varied between treatments.
- Norris, L.A. 1990. Behavior of chemicals in the forest environment. P. 59-70 in Chemistry, Biochemistry, and Toxicology of Pesticides. J.M. Witt, ed. Oregon State University Extension Service, Corvallis, Oregon.**
- For forest managers and pesticide applicators. This paper, one of 18 papers that are part of an Oregon State University Extension short course on pest control, discusses chemicals used in forestry: their properties, behavior in the environment, toxicity, effects, initial distribution, movement, persistence, and fate.
- Norris, L.A. 1990. An overview and synthesis of knowledge concerning natural and prescribed fire in Pacific Northwest forests. P. 7-22 in Natural and Prescribed Fire in Pacific Northwest Forests. J.D. Walstad, S.R. Radosevich, and D.V. Sandberg, eds. Oregon State University Press, Corvallis.**
- For forest managers and policymakers. This chapter summarizes and synthesizes information from 22 papers in this volume, a state-of-the-art analysis of fire in natural resource management in the Pacific Northwest.
- Pickering, J., D.W. Ross, and C.W. Berisford. 1989. An automated system for timing the insecticidal sprays for Nantucket pine tip moth control. Southern Journal of Applied Forestry 13:184-187.**
- For forest pest-management specialists, Christmas-tree growers, nursery managers, and horticulturalists. A computer system was used to implement degree-day models so that insecticide applications could be effectively timed to control Nantucket pine tip moth.
- Reams, G.A., W.G. Warren, R.J. Vong, M. Bohm, K.G. Mattson, and L.Y. Arnaut. 1990. Extent and magnitude of recent changes in forest condition and the role of air pollution and non-air pollution factors. USEPA, Environmental Research Laboratory, Corvallis, Oregon. EPA/600/3-90/042. 152 p.**
- For scientists and developers of regulatory policy. This report provides a synthesis of research on forest condition and reviews projects of the Forest Response Program of the National Acid Precipitation Assessment Program. It examines changes in the forests that may be related to levels of air pollution.
- Ripple, W.J., G.A. Bradshaw, and T.A. Spies. 1991. Measuring forest landscape patterns in the Cascade Range of Oregon, USA. Biological Conservation 57:73-88.**
- For foresters, wildlife biologists, and Geographic Information System specialists. Five groups of statistics were used to describe forest fragmentation caused by the patchwork of clearcuts made over a 15-year period. By comparing two sets of data representing two dates, the authors found that patch abundance, patch spacing measures, and matrix characteristics were most useful in capturing the amount of forest fragmentation over time.
- Ripple, W.J., D.H. Johnson, K.T. Hershey, and E.C. Meslow. 1991. Old-growth and mature forests near spotted owl nests in western Oregon. Journal of Wildlife Management 55:316-318. (For. Res. Lab.)**
- For wildlife biologists, foresters, and resource managers. The authors investigated how the amount of old-growth and mature forest influences the selection of nest sites by northern spotted owls in the central Cascade Mountains of Oregon. The proportion of old-growth and mature forest was significantly greater at nest sites than at random sites for all plot sizes.
- Robison, E.G., and R.L. Beschta. 1989. Coarse woody debris and channel morphology of low-gradient streams in southeast Alaska, U.S.A. P. 371-380 in Headwaters Hydrology: Proceedings of the 1989 Symposium of the American Water Resources Association. American Water Resources Association, Bethesda, Maryland. (For. Res. Lab.)**
- For fisheries biologists and land managers. Characteristics of coarse woody debris (CWD) and channel morphology were measured in five undisturbed low-gradient

streams ranging in size from first to fourth order. The results show that to preserve diversity in stream morphology and fish habitat, input sources of CWD must also be preserved.

**Robison, E.G., and R.L. Beschta. 1989. Estimating stream cross-sectional area from wetted width and thalweg depth. *Physical Geography* 10(2):190-198. (For. Res. Lab.)**

For hydrologists and geomorphologists. Cross-sectional areas calculated from stream width and thalweg depth by the formula for a triangle were compared to those determined by conventional survey measurements. Statistical comparisons indicated no significant difference in cross-sectional areas determined by the two methods. The triangle method provides a quick and accurate estimate of mean cross-sectional area for a wide range of channel conditions.

**Robison, E.G., and R.L. Beschta. 1990. Characteristics of coarse woody debris for several coastal streams of southeast Alaska, USA. *Canadian Journal of Fisheries and Aquatic Sciences* 47:1684-1693. (For. Res. Lab.)**

For fisheries biologists, stream ecologists, and hydrologists. Coarse woody debris was measured along five undisturbed low-gradient stream reaches; volume, decay class, and horizontal orientation in relation to channel flow of first- through fourth-order coastal streams were determined. The results, illustrating how the loadings and characteristics of coarse woody debris change with stream size, provide a useful comparison for streams affected by land-management activities.

**Robison, E.G., and R.L. Beschta. 1990. Coarse woody debris and channel morphology interactions for undisturbed streams in southeast Alaska, U.S.A. *Earth Surface Processes and Landforms* 15:149-156. (For. Res. Lab.)**

For fisheries biologists and land managers. Coarse woody debris and channel morphology were evaluated for five low-gradient, undisturbed streams in southeast Alaska. The study shows that woody debris is active in the formation of pools and in producing variability in bankfull width—important factors influencing fisheries habitat.

**Robison, E.G., and R.L. Beschta. 1990. Identifying trees in riparian areas that can provide coarse woody debris to streams. *Forest Science* 36:790-801. (For. Res. Lab.)**

For foresters and resource managers. Geometric and empirical equations, based on tree size and distance from the stream, were used to determine the conditional probability of a tree's adding coarse woody debris to a stream. After selecting a probability and determining the basal area factor by these equations, resource managers can use prisms or wedge devices before timber harvesting in riparian areas to identify specific trees that have a high probability of providing woody debris to streams.

**Ross, D.W. 1990. Sampling for pine shoot moths (Lepidoptera: Tortricidae): biological principles and procedures. *Journal of Agricultural Entomology* 7(1):51-59.**

For foresters, forest pest-management specialists, and entomologists. Sampling methods for insects in the

genera *Rhyacionia* and *Eucosma* (Lepidoptera: Tortricidae) are reviewed, and the biological bases for their development are discussed.

**Ross, D.W., and C.W. Berisford. 1990. Nantucket pine tip moth (Lepidoptera: Tortricidae) response to water and nutrient status of loblolly pine. *Forest Science* 36:714-728.**

For foresters and forest pest management specialists. Larger numbers of heavy pupae developed on vigorous seedlings than on stressed seedlings. Pupal weights were directly related to total nitrogen concentration and inversely related to total phenolic and condensed tannin concentrations of pine shoots.

**Ross, D.W., J. Pickering, J.D. Berg, and C.W. Berisford. 1989. Mapping Nantucket pine tip moth (Lepidoptera: Tortricidae) phenology in Georgia. *Journal of Entomological Science* 24:405-412.**

For forest pest management specialists and entomologists. With an estimated mean thermal requirement of 754 degree-days, the Nantucket pine tip moth will complete two to four generations per year in Georgia. This study demonstrates a technique that could be used to map the phenology of any multivoltine insect for which there are data on thermal requirements for development.

**Ryan, R.B. 1990. Evaluation of biological control: introduced parasites of larch casebearer (Lepidoptera: Coleophoridae) in Oregon. *Environmental Entomology* 19:1873-1881. (For. Res. Lab.)**

For entomologists, especially those interested in biological control. Two species of European parasites, *Agathis pumila* and *Chrysocharis laricinellae*, have become established in a classical biological control project against the larch casebearer, *Coleophora laricella*, in Oregon. The casebearer's density was reduced as the introduced parasites increased, although the long-term density that will be achieved will be known only after more years of study.

**Schwalter, T.D. 1989. Canopy arthropod community structure and herbivory in old-growth and regenerating forests in western Oregon. *Canadian Journal of Forest Research* 19:318-322. (Dep. Entomol.)**

For entomologists, ecologists, and forest managers. Arthropod abundances and foliage losses were compared among Douglas-fir and western hemlock in replicated old-growth stands and Douglas-fir in regenerating stands at the H.J. Andrews Experimental Forest. Species diversity and functional diversity were much higher and herbivory much lower in old-growth canopies than in regenerating canopies.

**Schwalter, T.D. 1990. Differences and consequences for insects. P. 91-106 in *Forests—Wild and Managed: Differences and Consequences*. Students for Forestry Awareness, University of British Columbia, Vancouver, British Columbia. (Dep. Entomol.)**

For forest managers. Forest insects and pathogens do not threaten forest resources unless changes in forest conditions promote population growth. Natural forests often are highly diverse, in part because of interactions among

trees, insects, and pathogens. Managed forests often induce pest outbreaks because of dense planting of the most commercially valuable tree species and reduction of nonhost vegetation and successional stages.

**Schowalter, T.D. 1990. Invertebrate diversity in old-growth versus regenerating forest canopies. *Northwest Environmental Journal* 6:403-404. (Dep. Entomol.)**

For the general public. Differences in species diversity between old-growth and regenerating forest canopies suggest that many species require the diverse resources, the moderate environmental conditions, or both that are provided by old-growth forests but not by regenerating forests. Loss of predator species in regenerating canopies was particularly notable and may indicate serious consequences for biological control of pests in landscapes without old-growth refuges.

**Schowalter, T.D., and J.E. Means. 1989. Pests link site productivity to the landscape. P. 248-250 in *Maintaining the Long-Term Productivity of Pacific Northwest Forest Ecosystems*. D.A. Perry, R. Meurisse, B. Thomas, R. Miller, J. Boyle, J. Means, C.R. Perry, and R.F. Powers, eds. Timber Press, Portland, Oregon.**

For forest managers. Changes in forest landscape patterns influence pest epidemiology. Old-growth forests, with their complex array of tree species and insect predator species, their large stand size, and their diversity of age classes, are less conducive to pest outbreaks than are the simplified forests created through current harvest and regeneration practices.

**Schowalter, T.D., T.E. Sabin, S.G. Stafford, and J.M. Sexton. 1991. Phytophage effects on primary production, nutrient turnover, and litter decomposition of young Douglas-fir in western Oregon. *Forest Ecology and Management* 42:229-243. (Dep. Entomol.)**

For ecologists. Ten-year-old Douglas-fir saplings were subjected to manipulated abundances of sap-sucking insects and defoliating insects. Herbivores had no significant effect on tree growth, nutrient content, or litter decomposition rate over 3 years.

**Schowalter, T.D., and J.M. Sexton. 1990. Effect of *Leptoglossus occidentalis* (Heteroptera: Coreidae) on seed development of Douglas-fir at different times during the growing season in western Oregon. *Journal of Economic Entomology* 83:1485-1486. (Dep. Entomol.)**

For forest entomologists. The authors tested the hypothesis that feeding by the western conifer seed bug, *Leptoglossus occidentalis* Heidemann, has different effects on Douglas-fir seed development at different times during the growing season. Total number of aborted seeds was significantly related to seed bug feeding, especially during early and mid-season treatments.

**Sessions, J. 1992. Solving for habitat connections as a Steiner network problem. *Forest Science* 38:203-207.**

For forest planners and wildlife biologists. One concern in forest planning is how to provide connections between critical wildlife habitats in separated forest locations. A network modeling procedure for habitat connections is

discussed, and a heuristic algorithm is presented that is suitable for solving large-scale Steiner networks.

**Sexton, J.M., and T.D. Schowalter. 1991. Physical barriers to reduce damage by *Lepesoma lecontei* (Coleoptera: Curculionidae) to conelets in a Douglas-fir seed orchard in western Oregon. *Journal of Economic Entomology* 84:212-214. (Dep. Entomol.)**

For forest entomologists and managers. This weevil causes seed losses of 10-30 percent in Douglas-fir seed orchards. Because the weevil is flightless, barriers on trunks of trees should be adequate to prevent cone injury. Sticky barriers are a low-cost, pest-specific control that need be applied only to cone-producing trees.

**Stack, W.R., and R.L. Beschta. 1989. Factors influencing pool morphology in Oregon coastal streams. P. 401-411 in *Headwaters Hydrology: Proceedings of the 1989 Symposium of the American Water Resources Association*. American Water Resources Association, Bethesda, Maryland. (For. Res. Lab.)**

For fisheries biologists and land managers. The authors surveyed pool morphology and related stream characteristics along 14 stream sections in the central Oregon Coast Range. Results identify a variety of factors that influence the occurrence and magnitude of pools and that may be useful for designing and evaluating stream rehabilitation projects.

**Tesch, S.D., and E.J. Korpela. 1990. Forest grazing in southern Oregon: a forester's perspective. P. 17-22 in *Integrated Management of Southwestern Oregon's Rangeland Resources*. Agricultural Experiment Station, Oregon State University, Corvallis. Special Report 866.**

For range conservationists and foresters. Current information shows that controlled grazing programs can meet a variety of vegetation management objectives. But it has been difficult to document improvements in conifer survival and particularly growth; such improvements may appear only after 5 to 10 years of annual grazing. Prescriptive forest grazing should not be viewed as a panacea that will replace all existing vegetation management tools, but rather as a technique that should be considered with others on a site-specific basis.

**Triquet, A.M., G.A. McPeck, and W.C. McComb. 1990. Songbird diversity in clearcuts with and without a riparian buffer strip. *Journal of Soil and Water Conservation* 45:500-503. (For. Res. Lab.)**

For forestry and wildlife managers. Equitability, richness, and diversity of breeding bird communities were monitored on four Appalachian watersheds in 1983 and 1986. Bird species richness and bird diversity were highest on an uncut control area of mature forest and a best-management-practices harvest unit with a riparian buffer strip. Bird diversity and species equitability were lowest on a logger's choice unit without a buffer strip.

**Wagner, R.G., and J.C. Zasada. 1991. Integrating plant autecology and silvicultural activities to prevent forest vegetation management problems. *Forestry Chronicle* 67(5):506-513.**

For forest ecologists and foresters. Forest managers are under increasing pressure to decrease herbicide use. Intensity, timing, and frequency of silvicultural activities interact with autecological characteristics of forest plants to affect survival and colonization. Forest managers are often forced into a "removal loop" in the vegetation management cycle when such factors are ignored. Modifying activities to take site conditions into account can move management into a "prevention loop," thus reducing dependency on herbicides.

**Walstad, J.D., and L.A. Norris. 1992. Animal damage management in the context of integrated forest protection. P. 57-66 in *Silvicultural Approaches to Animal Damage Management in Pacific Northwest Forests*. H.C. Black, tech. ed. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-GTR-287.**

For forest-land managers, wildlife specialists, and others concerned with animal-damage management in the Pacific Northwest and other regions. This chapter describes the elements of an approach to forest protection that integrates basic ecological knowledge with technical advances to prevent, minimize, or eliminate adverse effects of animal damage to forest trees.

**Webber, J., and E.M. Hansen. 1989. Species susceptibility to black stain root disease. P. 44-45 in *British Forestry Commission Report on Forest Research*. Her Majesty's Stationery Office, London.**

For forest pathologists. This report describes the susceptibility of conifers grown in Europe to the black-stain root disease fungus native to the Northwest. Lodgepole pine and Scots pine are particularly susceptible.

**Webber, J.F., and E.M. Hansen. 1990. Susceptibility of European and north-west American conifers to the North American vascular pathogen *Leptographium wagneri*. *European Journal of Forest Pathology* 20:347-354.**

For forest pathologists and those concerned about the dangers of pest introductions to foreign lands. The black-stain root disease fungus colonizes and kills seedlings of Scots pine, as well as seedlings of native host trees.

**Wood, P.B., T.C. Edwards, Jr., and M.W. Collopy. 1989. Characteristics of bald eagle nesting habitat in Florida. *Journal of Wildlife Management* 53:441-449.**

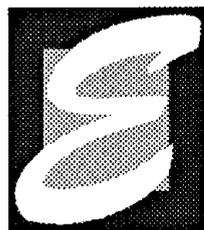
For raptor biologists and wildlife managers. The authors identified land use and ownership associated with 116 active bald eagle nests, measured physical characteristics of the nest trees, and quantified the habitat surrounding nests in four major nesting areas in Florida. Major threats to eagle nesting areas are identified for each region studied, and recommendations are made.

**Zaerr, J.B., and H. Schill. 1991. Early detection of effects of acid deposition and automobile exhaust on young spruce [*Picea abies* (L.) Karst.] trees. *European Journal of Forest Pathology* 21:301-307. (For. Res. Lab.)**

For forest and environmental scientists. Rooted spruce cuttings from three clones were sprayed daily with sulfuric acid at pH 2.5 for 1 month or treated with automobile exhaust for 1 hour. Foliage samples were extracted and analyzed by high-performance liquid chromatography. Results demonstrated that unidentified plant constituents can be used to detect damage to plants even before symptoms are visible.

**Zhong, H., and T.D. Schowalter. 1989. Conifer bole utilization by wood-boring beetles in western Oregon. *Canadian Journal of Forest Research* 19:943-947. (Dep. Entomol.)**

For pest managers, forest ecologists, and entomologists. Wood excavation by scolytid and cerambycid beetles was studied in decomposing boles of four conifers during the first 2 years on the ground. Tree species determined the early patterns of wood utilization. The losses resulting from channelization were quantitatively small.



## valuation of Forest Uses, Practices, and Policies

**Adams, P.W. 1992.** Do water resources curricula and program options of educational programs in our universities meet the needs of today?—An educator's perspective. P. 153-156 in *Pacific Rim Forestry—Bridging the World*. Proceedings, 1991 Society of American Foresters National Convention, San Francisco, California. Society of American Foresters, Bethesda, Maryland.

For educators, policymakers, and other professionals involved with water resources. This paper discusses the need for stronger extension, continuing-education, and degree programs in order to meet the complex and wide-ranging challenges in water resource management today and tomorrow.

**Alexander, S., and B. Greber. 1991.** Environmental ramifications of various materials used in construction and manufacture in the United States. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon. General Technical Report PNW-GTR-277. 21 p.

For government officials, public and private forest landowners, legislators, and interested citizens. The purpose of this study was to estimate a relation among construction materials as they are used as substitutes or complements of each other and to qualitatively assess the environmental consequences of the extraction, manufacture, use, and disposal of wood products, steel, cement, aluminum, and plastics.

**Alig, R.J. 1989.** Projecting area changes for forest resource supply analysis: applications in the 1989 assessment of the forest and range land situation in the United States. P. 15-25 in *Proceedings, Conference on Forest Sector Analysis*, Soderfors, Sweden.

For forest economists and resource analysts. This paper describes methods of the 1989 Resources Planning Act Assessment for projecting changes in area for the U.S. forest and rangeland base, by region and decade. It discusses a network of models linked in a forest-sector modeling framework, including use of area projections in models of timber supply and non-timber resources.

**Alig, R.J. 1989.** Projecting land cover and use changes. P. 57-74 in *An Analysis of the Land Base Situation in the United States: 1989-2040*. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM-181.

For forest resource analysts, economists, and policy analysts. Changes in the area of the U.S. forest and rangeland base are projected by region and decade. Forest-land changes are given by forest types. The projection methods are briefly described as well.

**Alig, R.J. 1989.** Strategic research planning to support natural resource management: a Southeast example. P. 314-318 in *Forestry on the Frontier*. Proceedings, 1989 Society of American Foresters National Convention, Spokane, Washington. Society of American Foresters, Bethesda, Maryland.

For forest researchers and research managers. The strategic planning process by a regional experiment station involved with research pertaining to natural resources is described. Major steps in the planning process include mission statement and goals, analysis of comparative strengths and weaknesses, demand for research products, evaluation of alternatives, and monitoring and feedback plan.

**Alig, R.J. 1990.** Methods for projecting timberland area. In *Proceedings of the 19th IUFRO World Congress session on "Applied Forest Sector Modelling,"* Montreal, Canada.

For forest economists and resource analysts. This paper describes methods used in the periodic 1989 Resources Planning Act Assessments by the USDA Forest Service for projecting changes in timberland, by owner and forest type. It summarizes results from regional studies of land-use changes and forest-type dynamics that were used in constructing models that project area change for use in timber supply projections.

**Alig, R.J. 1990.** Nonindustrial private forests: timber supply for an uncertain future. *Western Wildlands (Fall)*:11-14.

For resource economists, resource analysts, and policy analysts. While the potential for increased production on nonindustrial private forest (NIPF) lands is enormous, especially in the South, the primary land-management objective for such owners often is not timber production. Government programs have encouraged NIPF owners to grow and harvest trees, though the diversity of this owner group complicates projections of likely timber management and supply levels.

**Alig, R.J., K.J. Lee, and R.J. Moulton. 1990.** Likelihood of timber management on nonindustrial private forests: evidence from research studies. USDA Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina. General Technical Report SE-60. 17 p.

For resource economists, resource analysts, and policy analysts. This report synthesizes information from numerous research studies of determinants of timber management by nonindustrial private forests. Future timber management is likely to depend on a complex of market and policy factors, as stumpage prices alone will not necessarily lead to increased timber supplies.

**Alig, R.J., B.C. Murray, W.G. Hohenstein, and R.G. Haight. 1990.** Changes in area of timberland in the United States, 1952-2040, by ownership, forest type, region, and state. USDA Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina. General Technical Report SE-64. 34 p.

For resource economists, resource analysts, and policy analysts. Timberland area in the United States is projected to decline by 21 million acres or 4 percent by the year 2040, with the largest reduction on nonindustrial private forest lands. This study, which supported the

1989 Resources Planning Act Assessment by the USDA Forest Service, also projected the largest area changes for forest types to occur in the South.

**Allig, R.J., J. M. Vaslevich, and K.J. Lee. 1990. Economic opportunities to increase timber growth on timberland in the United States. In Proceedings of the North American Conference on Forestry Responses to Climate Change. Climate Institute and American Forestry Association, Washington, D.C.**

For foresters, resource economists, and resource and policy analysts. Estimates of timber treatment opportunities on private lands are presented along with estimates of financial returns for different classes of opportunities to increase net timber growth. Possible use of such information in climate-change analyses is discussed in the context of carbon sequestration.

**Allig, R.J., and D.N. Wear. 1992. U.S. Private Timberlands, 1952-2040. Journal of Forestry 90(5):31-37.**

For foresters, resource economists, and resource and policy analysts. This article discusses projections of area changes for timberland and forest investment on private lands, in support of the 1989 Resources Planning Act Assessment. Projected rates of area changes are similar to those of the recent decade, as population and personal income levels continue to grow. More than 60,000,000 acres of timber investment opportunities on private lands, primarily in the South, are identified.

**Anderson, J., and J. Sessions. 1991. Managing low volume road systems for intermittent use. P. 224-230 in Fifth International Conference on Low Volume Roads. Transportation Research Board, National Research Council, Washington, D.C. TRR 1291. Volume 1.**

For forest engineers and managers. A mixed-integer mathematical programming approach for determining the schedule of road openings and closings to manage a low volume road system efficiently is presented.

**Anderson, P., and J. Sessions. 1991. Factors affecting the maximum grade a truck can climb around a curve. P. 15-19 in Fifth International Conference on Low Volume Roads. Transportation Research Board, National Research Council, Washington, D.C. TRR 1291. Volume 2.**

For forest engineers and managers. Various factors affect the maximum grade a truck can climb around a curve: truck geometry, curve radius, surface type, truck loading, superelevation, and truck speed. The sensitivity of gradeability to these factors is discussed.

**Anderson, P., and J. Sessions. 1991. Gradeability on forest roads—field observations compared to an analytical model. P. 17-21 in Forestry Operations in the 1990's; Challenges and Solutions. Proceedings of the 14th Annual Meeting of the Council of Forest Engineering, Nanaimo, British Columbia. Forest Engineering Research Institute of Canada, Vancouver, British Columbia and Faculty of Forestry, University of British Columbia, Vancouver, British Columbia.**

For forest engineers and road managers. Forest engineers were surveyed about truck operations on steep roads on

the western national forests. The survey results are compared to the calculations provided by an analytical model.

**Aulerich, D.E. 1989. Harvest planning prior to plantation establishment. P. 308-320 in Proceedings, Regional Symposium on Recent Development in Tree Plantations of Humid/Subhumid Tropics of Asia. Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia.**

For plantation planners, engineers, and managers. This article stresses the importance of considering harvesting in the early stages of plantation development. It is especially important for fast-growing, low-value plantations.

**Aulerich, D.E., M. Piedrahita, and S.P. Aulerich. 1990. Applying steep terrain harvesting technology to the forests of Quebec. P. 187-197 in Proceedings, XIX IUFRO World Congress, Montreal, Quebec.**

For forest engineers and planners. This article presents the necessary steps for planning harvesting operations in the difficult terrain encountered in several Latin American countries.

**Barber, R.L., and J.D. Brodie. 1989. A sequential approach to derivation of stand treatment and forest-wide harvest prescription or supply. Natural Resource Modeling 3(2):217-239. (For. Res. Lab.)**

For resource analysis researchers. The harvest-schedule planning model presented here assumes that stand-level planning and harvest scheduling proceed sequentially rather than simultaneously over all planning periods. It uses best current data with allowance for future updating.

**Bettinger, P., H.L. Haney, Jr., and W.C. Siegel. 1991. The impact of federal and state income taxes on timber income in the West following the 1986 Tax Reform Act. Western Journal of Applied Forestry 6:15-20.**

For foresters and tax practitioners. The provisions of state income taxes are listed for the West. Federal-state income tax impacts are compared for hypothetical taxpayers, both active and passive, at medium and high income tax levels for timber sales.

**Beuter, J.H., and K.N. Johnson. 1989. Economic perspectives on maintaining the long-term productivity of forest ecosystems. P. 221-229 in Maintaining the Long-Term Productivity of Pacific Northwest Forest Ecosystems. D.A. Perry, R. Meurisse, B. Thomas, R. Miller, J. Boyle, J. Means, C.R. Perry, and R.F. Powers, eds. Timber Press, Portland, Oregon.**

For forestry professionals and researchers. Conventional benefit-cost analysis does not favor constraints on timber management to preserve long-term ecosystem productivity. The challenge is to show that constraints can increase net public benefit. Decision models for considering the costs of long-term ecosystem deterioration were conceptualized.

**Bierlmaier, F.A., and A. McKee. 1989. Climatic summaries and documentation for the primary meteorological station, H.J. Andrews Experimental Forest, 1972 to 1984. USDA Forest Service, Pacific Northwest Re-**

- search Station, Portland, Oregon. General Technical Report PNW-GTR-242. 56 p.
- For forest researchers. This report describes the climate at the H.J. Andrews Experimental Forest, as well as some data from the thermograph and rain-gauge networks, on the basis of 13 years of study. A condensed climatic description and details of climatic variation are given.
- Boyle, J.R., compiler. [1991]. Sustainable forestry: perspectives for the Pacific Northwest. The 1990 Starker Lectures. College of Forestry, Oregon State University, Corvallis. 53 p. (For. Res. Lab.)**
- For concerned citizens. This year's Starker lecturers provide a variety of insights into what sustainable forestry might be for the Pacific Northwest. Ross Squire presents a comprehensive program of forestry research and development in Australia that addresses issues of native forests, wood supply, wildlife, and aesthetics. Robert Lee discusses the social upheavals involved in the current forestry debates. Norman E. Johnson presents a view of the world-scale demands for and stresses on natural resources. Niels Elers Koch suggests consideration of integrated, socially based uses of forest land, rather than exclusive, single-use approaches.
- Brodie, J.D., and J. Sessions. 1991. The evolution of analytic approaches to spatial harvest scheduling. P. 187-191 in Proceedings of the 1991 Symposium on Systems Analysis in Forest Resources. USDA Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina. General Technical Report SE-74.**
- For forest planners and analysts. After nearly three decades of attention to problems of strata-based allocation and scheduling, research and practical attention recently have focused on plans that can be implemented on a harvest-unit basis. In addition to traditional concerns for stability and sustainability, problems of transportation, habitat maintenance, corridors, and landscape adjacency are addressed.
- Brunson, M., and B. Shelby. 1990. A hierarchy of campsite attributes in dispersed recreation settings. Leisure Sciences 12:197-209. (For. Res. Lab.)**
- For researchers, resource managers, and students. The authors re-examined literature on campsite choice for common elements. A tentative model of campsite choice is developed in which sites are evaluated for their ability to provide, first, necessities, then, experiences, and finally, if more than one potential site remains, amenities. Data from the Deschutes River in Oregon support the model.
- Brunson, M., and B. Shelby. 1991. Activity-related differences in campsite preference: potential causes and implications for management. Western Journal of Applied Forestry 6:78-81. (For. Res. Lab.)**
- For public land managers and researchers. This study showed that preferences for attributes of wilderness campsites differ for participants in different recreational activities. Management actions that limit use of campsites having certain attributes may therefore have disproportionate impacts on some groups.
- Brunson, M., and B. Shelby. 1992. Effects of alternative silvicultural methods on scenic and recreational quality. P. 169-172 in Proceedings, 1991 Northeastern Recreation Research Symposium. USDA Forest Service, Northeastern Research Station, Broomall, Pennsylvania. General Technical Report. NE-160.**
- For public land managers and researchers. Judgments of the acceptability of traditionally managed and "New Forestry" stands as places for scenic viewing, hiking, and camping were compared. Nontraditional treatments such as retention of green tree and patch cutting generally were judged more acceptable than clearcutting, but acceptability varied depending on the amenity use for which the judgment was obtained.
- Buckman, R. 1990. Global forestry research: closing of the first century, preparing for the second. P. 53-54 in XIX IUFRO World Congress, Montreal, Canada.**
- For a general forestry audience. This report calls attention to the accomplishments of the first 100 years of IUFRO and outlines the challenges facing the union and forestry research in the second 100 years.
- Buckman, R.E., compiler. [1990.] Oregon's forestry outlook: an uncertain future. The 1989 Starker Lectures. College of Forestry, Oregon State University, Corvallis. 35 p. (For. Res. Lab.)**
- For concerned citizens. The four 1989 Starker Lectures address the uncertainties in the future of Oregon's forests. Richard Plochmann describes the evolution of forestry in central Europe with inferences for the future of forestry in the Northwest. Don Flora examines questions surrounding timber trade. John Mitchell discusses overall economic growth for Oregon. The fourth lecture is a panel report of the major study by the College of Forestry titled "Timber for Oregon's Tomorrow, The 1989 Update."
- Buckman, R.E. 1991. Conclusions and results of the XIX IUFRO World Congress in Montreal, 1990. P. 175-179 in Proceedings, 10th World Forestry Congress, Paris. Volume 8.**
- For a general forestry audience. R. E. Buckman, past president (1986-1990) of IUFRO outlines two major problems facing world forestry: global climate change and tropical deforestation. Other concerns are the need to recognize small science, to build forestry institutions in the developing world, and to recognize the growing interdependence of forestry with other sciences.
- Carlson, J.Y., C.W. Andrus, and H.A. Froehlich. 1990. Woody debris, channel features, and macroinvertebrates of streams with logged and undisturbed riparian timber in northeastern Oregon, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences 47:1103-1111. (For. Res. Lab.)**
- For fisheries biologists and land managers. Channel features and macroinvertebrate populations in stream segments with undisturbed riparian timber were compared with those in segments with partially logged riparian stands. Timber harvesting activities do not appear to have damaged aquatic insect habitat or altered pool abundance, a pattern suggesting the habitat's carrying capacity for fish was not affected.

- Church, M.R., K.W. Thornton, P.W. Shaffer, D.L. Stevens, B.P. Rochelle, G.R. Holdren, M.G. Johnson, J.J. Lee, R.S. Turner, D.L. Cassell, D.A. Lammers, W.G. Campbell, C.I. Liff, C.C. Brandt, L.H. Liegel, G.D. Bishop, D.C. Mortenson, S.M. Pierson, and D.D. Schmoyer. 1989. Direct/delayed response project: future effects of long-term sulfur deposition on surface water chemistry in the Northeast and Southern Blue Ridge Province. Environmental Protection Agency, Washington, D.C. EPA/600/3-89/061a-d. 887 p.
- For managers and scientists in all natural resource disciplines. Results of a large interdisciplinary study to assess associations between surface water chemistry, acidic deposition, and many watershed characteristics for 170 lake and stream watersheds in the eastern United States are presented.
- Clark, R.N., and P.J. Brown. 1990. The emerging web of integrated resource management. P. 24-33 in Volume 6, Proceedings of the IUFRO World Congress, Montreal, Quebec.
- For forestry scientists and managers. The authors discuss the need to shift from a paradigm that emphasizes dominant resource uses such as timber harvesting to an ecosystem approach that features landscape and stand-level integration of social values (such as recreation, aesthetics, and subsistence) with extractive resource uses such as timber harvesting and mining.
- Clark, R.N., and G.H. Stankey. 1991. New forestry or new perspectives: the importance of asking the right questions. *Forest Perspectives* 1(2):9-13
- For educators, researchers, managers, and policymakers. This article reviews the growth of interest in and concern with new forestry. It reports on a Delphi survey that identifies the distinguishing features of new forestry and the New Perspectives in Forestry program of the USDA Forest Service. The survey found at least six dimensions to these programs. Implications for research, management, education, and the public are discussed.
- Cleaves, D.A., and K. Birch. 1991. Decision analysis and sensitivity testing of reforestation strategies. *Western Journal of Applied Forestry* 6:73-78.
- For silviculturists and economists working with silviculturists. A reforestation project in western Oregon that involved four alternatives was structured as a decision analysis problem. The optimal solution ranked the alternatives based on their probabilistically weighted soil expectation value. Relative rankings were most sensitive to cost components with wide natural ranges (such as prescribed burning) and to variation in 15-year survival and growth predictions.
- Cortner, H.J., J.G. Taylor, E.H. Carpenter, and D.A. Cleaves. 1990. Factors influencing Forest Service fire managers' risk behavior. *Forest Science* 36:531-548.
- For economics researchers and fire managers. Fire managers from five western regions of the USDA Forest Service were surveyed to determine which decision factors most strongly influenced their risk-taking behavior during fire management. Results show that safety, the resources at risk, public opinion, and the reliability of information were important influences on manager decisions.
- Cullen, J., and J. Sessions. 1989. Does network analysis pay? P. 92-94 in Proceedings, Implementing Techniques for Successful Forest Operations. Council of Forest Engineering, Coeur D'Alene, Idaho.
- For forest engineers and managers. The experiences of the Washington Department of Natural Resources with network analysis in several harvest planning projects are described. Costs and benefits of using and not using network analysis on six case studies are presented and compared.
- Czaplewski, R.L., P.W. Snook, and R.J. Allig. 1989. Combining past inventories of land/forest cover with forecasting models and remotely sensed data. In Proceedings of the International Conference on Global Natural Resource Monitoring and Assessments: Preparing for the 21st Century, Venice, Italy.
- For forest inventory specialists, foresters, and forest resource analysts. A Kalman filter approach to projecting area changes in land cover is described. The use of remotely sensed data and field data from forest surveys by the USDA Forest Service is discussed in a modeling context.
- Daniels, S.E. 1990. Private management of public recreation: is it cost-effective. P. 105-112 in *Outdoor Recreation Policy: Pleasure and Preservation*. Greenwood Press, New York.
- For researchers and managers interested in publicly supplied recreation. Private management of public campgrounds as a way to reduce costs is examined. Analysis is based on a case study in the Seeley-Swan valley of western Montana. Results show that concessionaire management was neither more nor less cost-effective than traditional management. Private management has some reasonable advantages, but problems can potentially outweigh benefits.
- Daniels, S.E., W.F. Hyde, and D.N. Wear. 1991. Distributive effects of Forest Service attempts to maintain community stability. *Forest Science* 37:245-260. (For. Res. Lab.)
- For researchers and policy analysts. This paper examines community stability, and the success the Forest Service can have in fostering it by maintaining a constant-volume schedule of timber harvest. Departure from a market-responsive timber policy can have positive impacts on the wood products sector, but the net effects on the local community are very small.
- Daniels, S.E., R. Johnson, and D.C. Markstrom. 1991. Estimating and comparing demand functions for personal use Christmas tree cutting at seven Utah sites. *Western Journal of Applied Forestry* 6:42-46. (For. Res. Lab.)
- For recreation researchers and managers. Travel-cost modeling of recreational demand for gathering Christmas trees for personal use revealed that the demand functions from any one of seven Utah sites cannot be readily applied to any other. Therefore, recreation managers should probably do their own travel-cost analysis.

Daniels, S., and M. Reed. 1992. Enhancing forestry education through writing. *Journal of Forestry* 90(3):27-32. (For. Res. Lab.)

For forestry students, educators, and practicing foresters. This article on teaching writing to forestry students in classrooms emphasizes writing improvement as an ongoing process. Techniques are provided to improve writing assignments. Practicing foresters who want to polish their own writing skills, or new employees who need to learn to communicate more effectively, can benefit from writing workshops and short courses offered by universities and private and government agencies.

Dixon, R.K., T.C. Niblock, and D.A. Taylor. 1989. Forestry/Fuelwood Research Development Project: research networking in Asia. *Journal of Forestry* 87(4):41.

For international foresters. The Tropical Forest Action Plan requests additional support for forestry research within tropical latitudes. An information and technical-cooperation network linking forestry research institutions in Asia was established.

Dixon, R.K., and D.P. Turner. 1991. The global carbon cycle and climate change: responses and feedbacks from below-ground systems. *Environmental Pollution* 73:245-262.

For forest ecologists, soil scientists, and policy analysts. Soil systems play a significant role in the global carbon cycle, accounting for approximately 2000 Pg of carbon. Below-ground processes will strongly influence the response and feedbacks of terrestrial ecosystems to climate change.

Driver, B.L., P.J. Brown, and G.L. Peterson, editors. 1991. *Benefits of Leisure*. Venture Publishing, Inc., State College, Pennsylvania. 483 p.

For students, researchers of recreation and leisure, and recreation managers, and policymakers. The book is an anthology of state-of-the-art papers prepared by international experts on what is known about the benefits derived from leisure activities. The authors represent many academic disciplines from anthropology to human physiology. Recommendations for future research are included. Information in the book has become the basis for a benefits-based approach to recreation and leisure management.

Elmore, W., and R.L. Beschta. 1989. The fallacy of structures and the fortitude of vegetation. P. 116-119 in *Proceedings of the California Riparian Systems Conference*. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, California. General Technical Report PSW-110.

For fisheries biologists, riparian ecologists, and hydrologists. Structural additions to stream channels provide limited opportunities to improve aquatic habitat and riparian functions. Improved management of vegetation along streams offers the most promise for developing valuable and productive riparian ecosystems.

Elwood, N.E. 1992. Forestry cooperatives in Japan. *Journal of Forestry* 90(6):25-28. (For. Res. Lab.)

For professional foresters. Cooperatives are important forestry businesses in Japan, receiving active support from all levels of government and having their own prefectural and national management and support groups. This article focuses on nonindustrial private forest ownerships—the user-owned, democratically controlled businesses from which members receive benefits in proportion to their use of services.

Elwood, N.E., and P.W. Adams. 1989. Achieving group project success in Oregon: the *Woodland Workbook*. *Journal of Agronomic Education* 18:119-121. (For. Res. Lab.)

For natural resource educators and others involved with group projects. This article describes the development at Oregon State University of the *Woodland Workbook*, a comprehensive and widely used forest management guidebook. Its production unified and improved the performance of a diverse and geographically scattered staff. Guidelines for achieving successful group projects of this kind are suggested.

Elwood, N.E., and D.W. Rose. 1990. Heuristic simulation: an alternative to linear programming in developing forest management schedules. *Forest Ecology and Management* 35:303-310. (For. Res. Lab.)

For professional foresters. Heuristic simulations can overcome many of the limitations of mathematical programming techniques in solving problems with scheduling forest treatments. Heuristic-simulation approaches have an advantage for large scheduling problems that cannot be solved via linear programming, or that are solved only after data aggregation and its associated problems.

Erkert, T., and J. Sessions. 1989. A method for determining offtracking of multiple unit vehicle combinations. *Journal of Forest Engineering* 1(1):9-16.

For forest engineers and managers. The authors present a method for determining the offtracking for common multiple unit vehicles travelling over forest roads. The method is shown to have good agreement with experimental data. A computer program OFFTRACK has been developed to implement the technique.

Erkert, T., and J. Sessions. 1989. Offtracking of truck and truck combinations using forest roads. P. 51-55 in *Proceedings, Implementing Techniques for Successful Forest Operations*. Council of Forest Engineering, Coeur D'Alene, Idaho.

For forest engineers and managers. This paper discusses the factors affecting offtracking of multiple unit vehicles on forest roads and presents an overview of the OFFTRACK program developed for microcomputers.

Fisher, G.J., L.P. Queen, and A.S. Reed. 1991. User requirements analysis for Geographic Information Systems: a case study of the Cloquet Forestry Center. *The Compiler* 9(4):11-19.

For natural resource professionals and managers of spatial data. A systematic approach to the design, selection, and implementation of a Geographic Information System based upon conduct of a user requirements analysis is described. A case study describes a model approach at the Cloquet Forestry Center near Cloquet, Minnesota.

- Franklin, J.F., F.J. Swanson, M.E. Harmon, D.A. Perry, T.A. Spies, V.H. Dale, A. McKee, W.K. Ferrell, J.E. Means, S.V. Gregory, J.D. Lattin, T.D. Schowalter, and D. Larsen. 1991. Effects of global climatic change on forests in northwestern North America. *Northwest Environmental Journal* 7:233-254. (Dep. Entomol.)  
For ecologists and land managers. The changes in forest cover that may accompany climate change in the Pacific Northwest are examined. Major shifts in forest zones are anticipated if the projected climate change occurs. Increases in disturbance frequency and intensity may largely mediate these changes.
- Garland, J.J. 1990. Assessing gains from woodworker training. *International Journal of Industrial Ergonomics* 5:227-242. (For. Res. Lab.)  
For forest engineers, logging managers, and ergonomists. This paper describes the environment for woodworker training in the United States and presents a decision model for evaluating training gains. Results show logging firms could recover training costs with productivity gains before workers change jobs in chokersetting.
- Garland, J.J., and P.W. Adams. 1992. Coordinated tactical program planning among specialists and agents: the Oregon Extension Forestry experience. *Journal of Natural Resources and Life Sciences Education* 21(1):64-69. (For. Res. Lab.)  
For groups that plan and conduct team projects. This article describes an annual group planning and decision process that effectively focuses human resources through a system of priority setting, time allocation, and accountability.
- Gottko, J., and R. McMahon. 1989. Oregon lumber products: evaluating exporting in the 1980s. *Forest Products Journal* 39(11/12):29-32. (For. Res. Lab.)  
For academics and public and private agency managers. This article, the last of three exploring how small manufacturers of lumber in Oregon perceive and practice exporting, examines the export sales of such firms in the 1980s. Results indicate that a marketing strategy that employs aggressive selection of target countries and use of an appropriate mix of marketing elements (decisions regarding product, promotion, price, and place) is the most likely way to increase exports.
- Greber, B.J., and K.N. Johnson. 1991. What's all this debate about overcutting? *Journal of Forestry* 89(11):25-30. (For. Res. Lab.)  
For a general forestry audience. This article presents eight possible definitions of overcutting in order to promote more rational consideration of prudent forest management. All definitions have been employed—often implicitly—in discussions about appropriate forest management.
- Greber, B.J., K.N. Johnson, and G. Lettman. 1990. Conservation plans for the northern spotted owl and other forest management proposals in Oregon: the economics of changing timber availability. *Forest Research Laboratory, Oregon State University, Corvallis. Papers in Forest Policy* 1. 50 p. (For. Res. Lab.)  
For government officials, public and private forest landowners, legislators, and interested citizens. Recently released national forest plans and conservation plans for the protection of the northern spotted owl all call for a change in management direction on public forest lands in Oregon. This report summarizes how the conservation plans will influence Oregon's timber availability and economy in the context of overall changes in public land management.
- Haney, H.L., Jr. 1991. Should I buy timberland, or tax-free bonds? *Forest Farmer* 51(2):8-10.  
For foresters and forest landowners. A framework is provided for investors to use in comparing timber with alternative uses of capita.
- Haney, H.L., Jr. 1991. Taxing Questions. *Virginia Forests* 47(2):39-40.
- Haney, H.L., Jr. 1991. Taxing Questions. *Virginia Forests* 47(3):41-42.
- Haney, H.L., Jr. 1991. Taxing Questions. *Virginia Forests* 47(4):34-35.
- Haney, H.L., Jr. 1991. Taxing Questions. *Virginia Forests* 48(1):33.  
For forest landowners. This quarterly column gives Virginia Forestry Association members the opportunity to have income, estate and gift tax questions about their tree farm answered.
- Haney, H.L., Jr. 1991. What will become of your timberland? *Northwest Woodlands* 7(4):14-15, 30.  
For timberland owners. The high cost of dying unprepared is examined for timberland owners. Some basic plans illustrate how estate planning can save death taxes and achieve other goals for timberland.
- Haney, H.L., Jr. 1991. What will become of your tree farm? *Virginia Polytechnic Institute and State University, Blacksburg, Virginia. Extension Forestry Notes* 6(2):3-4.  
For foresters and timberland owners. The basic provisions of federal estate and gift taxes and special forestry provisions are explained. Emphasis on estate planning to achieve continuity of management is stressed.
- Haney, H.L., Jr. 1992. The Forest Practices Act—regulation, Oregon style. *Virginia Forests* 47(4):12-16.  
For foresters and forest landowners. The provisions of the Oregon Forest Practices Act are reviewed to help Virginia timberland owners appreciate the flexibility for managing timber under a voluntary strategy for maintaining water quality.
- Haney, H.L., Jr., and D.A. Cleaves. 1992. Potential cost of forestry regulation in the South. *Forest Farmer* 51(6):11-21.  
For foresters and natural resource policymakers interested in forest management. The authors compare costs of a voluntary and a regulatory strategy of timber management, using the Oregon Forest Act regulations for a hypothetical southern timberland example.

Haney, H.L., Jr., and W.C. Siegel. 1991. Planning your tree farm's future. *Tree Farmer (Winter)*:12-14.

For timberland owners. Some basic provisions of the federal estate and gift-tax laws are reviewed and the importance of timely planning to save taxes is stressed.

Haney, H.L., Jr., and W.C. Siegel. 1991. Timber and the Federal Income Tax. A Workshop for Tax Practitioners. The Georgia Center for Continuing Education, University of Georgia, Athens, Georgia. 129 p.

For certified public accountants and other tax practitioners. Annotations on federal income-tax provisions that affect timber owners are compiled.

Haney, H.L., Jr., and W.C. Siegel. 1992. Estate Planning for Forest Landowners, "What Will Become of your Timberland?" The Georgia Center for Continuing Education, University of Georgia, Athens, Georgia. 261 p.

For timberland owners, foresters, and estate planners. Annotations on federal estate and gift tax provisions that affect timber owners are compiled. The estate-planning process is explained, and alternative strategies for achieving the goals of timber owners are illustrated with case examples.

Haney, H.L., Jr., and W.C. Siegel. 1992. Timber Income Tax—A Workshop for Timber Owners, Foresters, and Tax Practitioners. The Georgia Center for Continuing Education, University of Georgia, Athens, Georgia. 187 p.

For timberland owners, foresters, and tax practitioners. These annotations on federal income-tax provisions that affect timber owners cover basic strategies for record keeping, accounting for capital expenditures, deducting forestry expenses in the context of passive loss rules, and reporting of timber income.

Hann, D.W., and D.R. Larsen. 1991. Diameter growth equations for fourteen tree species in southwest Oregon. Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin 69. 18 p. (For. Res. Lab.)

For forest biometricians, modelers, and ORGANON users. The individual-tree, 5-year diameter growth rate equations produced in this study are the first reported for the mixed-conifer zone of southwest Oregon. These equations express diameter growth as a function of diameter at breast height, crown ratio, site index, total stand basal area, and stand basal area in trees with diameters larger than the subject tree's diameter.

Hann, D.W., and C.-H. Wang. 1990. Mortality equations for individual trees in the mixed-conifer zone of southwest Oregon. Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin 67. 17 p. (For. Res. Lab.)

For forest modelers. For individual-tree/distance-independent growth-and-yield models, it is necessary (1) to predict the probability of death of individual trees and (2) to keep stand projections within reasonable biological limits. In this study, the probability of death of an individual tree is predicted by a logistic equation with

coefficients estimated for tree species growing in the mixed-conifer zone of southwest Oregon.

Hann, D.W., and A.A. Zumrawi. 1991. Growth model predictions as affected by alternative sampling-unit designs. *Forest Science* 37:1641-1655. (For. Res. Lab.)

For forest biometricians. In order to study the effect on growth-model predictions of introducing differential design error to predictor variables influenced by sampling-unit design, computer simulations of five forest stands were generated from random spatial distributions and field data covering a range of stand conditions. Different sampling-unit designs may produce large differences in individual predictions. Such differences may affect decisions about stand treatment and could complicate validation of a growth-and-yield model.

Harmon, M.E. 1992. Fire influences on coarse woody debris. P. 13-14 in *Fire in Pacific Northwest Ecosystems: Exploring Emerging Issues*. College of Forestry, Oregon State University, Corvallis. (Available at \$15.00 including postage and handling from the Conference Office, College of Forestry, Oregon State University, Peavy Hall 202, Corvallis, OR 97331.)

For ecologists and foresters. The way in which fire creates and removes coarse woody debris in Pacific Northwest ecosystems is examined.

Harrington, T.B., J.C. Tappeiner II, T.F. Hughes, and A.S. Hester. 1991. Planning with PSME: a growth model for young Douglas-fir and hardwood stands in southwestern Oregon. Forest Research Laboratory, Oregon State University, Corvallis. Special Publication 21. 14 p. (For. Res. Lab.)

For forest land managers, foresters, and vegetation management specialists. PSME (Plantation Simulator - Mixed Evergreen) is a computerized growth model for predicting development of Douglas-fir plantations under specific initial levels of competition from tanoak, Pacific madrone, or chinquapin and from herb + shrub vegetation in southwestern Oregon. This user's manual provides software for PSME, information on model installation and application, and techniques for collecting input data.

Hendee, J.C., G.H. Stankey, and R.C. Lucas. 1990. Wilderness Management. International Wilderness Leadership Foundation, Golden, Colorado. 546 p.

For educators, students, managers, researchers, and interested citizens. This is the second edition of the basic reference text on wilderness management. It covers philosophy, history, legislation and policy, and management approaches.

Hennon, P.E., E.M. Hansen, and C.G. Shaw III. 1990. Causes of basal scars on *Chamaecyparis nootkatensis* in southeast Alaska. *Northwest Science* 64:45-54.

For foresters, ecologists, and those interested in Alaskan forests. Scars that are common on the lower boles of Alaska yellow-cedar trees on two southeast Alaskan islands appear to be caused primarily by brown bears. However, these scars were not consistently associated with dying Alaska yellow-cedar and, thus, are not a significant factor in the decline and mortality of this species.

Hester, A.S., D.W. Hann, and D.R. Larsen. 1989. **ORGANON: southwest Oregon growth and yield model user manual. Version 2.0.** Forest Research Laboratory, Oregon State University, Corvallis. 59 p. (For. Res. Lab.)

For forest managers and silviculturists. The "Southwest" version of ORGANON, the OREGON Growth ANALYSIS and projection model, is designed to project changes in young-growth, mixed conifers stands in southwest Oregon. ORGANON is a user-friendly interactive program that will run on any IBM or compatible computer under the PC-DOS or MS-DOS operating system.

Heywood, J.L., J.E. Christensen, and G.H. Stankey. 1991. **The relationship between biophysical and social setting factors in the recreation opportunity spectrum.** *Leisure Sciences* 13:239-246.

For researchers and park planners. Data on biophysical and social setting preferences of campers are used to test whether campers' preferences reflect linear arrangements of components or whether these relationships are more complex. Results indicate that there are multiple linear and nonlinear relationships between biophysical and social conditions.

Hill, M.T., W.S. Platts, and R.L. Beschta. 1991. **Ecological and geomorphological concepts for instream and out-of-channel flow requirements.** *Rivers* 2(3):198-210.

For fisheries biologists, river planners, stream ecologists, and hydrologists. Because fluvial-geomorphic processes form and control channel morphology, multiple in-channel and out-of-channel flows are needed to maintain these processes and to sustain high-quality fisheries habitat. Four types of streamflow regimes are identified and discussed: instream, channel maintenance, riparian maintenance, and valley maintenance.

Isaacson, D.L., and W.J. Ripple. 1990. **Comparison of 7.5-minute and 1-degree digital elevation models.** *Photogrammetric Engineering & Remote Sensing* 56:1523-1527.

For users of Geographic Information Systems. The authors compared two digital elevation models for the Echo Mountain SE quadrangle in the Cascade Mountains of Oregon. Comparisons were made between 7.5-minute and 1-degree images by using the variables of elevation, slope aspect, and slope gradient. Both visual and statistical differences are presented.

Jarmer, C., and L. Kellogg. 1991. **Delimber/skyline tower: a reasonable choice in Northwest.** *Forest Industries* 118(1):24-24.

For those interested in harvesting and forestry in general. This study showed advantages and disadvantages of combining a large skyline tower and a mechanical processor at one yarding site.

Jensen, E.C., and B.A. Middleton. 1990. **Educating the public about old-growth forests.** *Northwest Environmental Journal* 6:315-330. (For. Res. Lab.)

For educators and resource professionals. Oregon State University recently completed an Old-Growth Forest Management Project for the USDA Forest Service's Natu-

ral Resources in Environmental Education Program. This paper discusses the final product: (1) an educational package containing an audio-visual program and five sets of supplemental printed documents and (2) a dual delivery system that includes a mail-based system for audiences across the country and a workshop-based system for teachers in the Pacific Northwest.

Johnson, R.L. 1989. **Marketing fee hunting opportunities in the presence of abundant public land.** *Western Journal of Applied Forestry* 4:24-26. (For. Res. Lab.)

For private land owners. Hunters holding elk and deer permits for northeastern Oregon were surveyed to determine their attitudes toward fee hunting in an area where public land access is readily available. Forty-five percent of the respondents were willing to pay an access fee to hunt on private lands. Preferable characteristics of private land were also assessed.

Johnson, R.L., and M.J. Manfredo. 1989. **An evaluation of the relationship between nongame wildlife use and donation to nongame tax checkoffs.** *Society and Natural Resources* 2:345-352. (For. Res. Lab.)

For fish and wildlife agency personnel and recreation professionals. This study investigated the pattern of donations by users and nonusers in the Oregon nongame tax checkoff program. Twenty-six percent of the taxpayers with refunds were users of nongame who did not donate. On the other hand, 3.8 percent were nonusers who did donate; these made up 60.4 percent of all those who donated.

Kellogg, L., P. Bettinger, S. Robe, and A. Steffert, compilers. 1992. **Mechanized harvesting: a compendium of research.** Forest Research Laboratory, Oregon State University, Corvallis. 401 p. (For. Res. Lab.)

For forest engineers. This compendium provides an organized collection of productivity information about mechanized harvesting. The primary focus is on operations that are appropriate to the Pacific Northwest. It also identifies gaps in literature that delineate areas where additional research is needed.

Kellogg, L., S. Pilkerton, and R. Edwards. 1991. **Logging requirements to meet new forestry prescriptions. P. 43-49 in Forestry Operations in the 1990's; Challenges and Solutions. Proceedings of the 14th Annual Meeting of the Council of Forest Engineering, Nanaimo, British Columbia. Forest Engineering Research Institute of Canada, Vancouver, British Columbia and Faculty of Forestry, University of British Columbia, Vancouver, British Columbia.**

For resource managers. The costs and logistics of ground skidding and cable logging are compared for three alternative silvicultural systems. Logging layout time was 2 to 5 times longer in partial cuts than in clearcuts, and increased logging cost ranged from 2.5 percent to 25 percent.

Kellogg, L., and S. Robe. 1989. **Cable landing organization for mechanized delimiting.** *American Society of Agricultural Engineers, St. Joseph, Michigan. ASAE Paper 89-7064.* 19 p.

For logging managers and forest engineers. Operations with a stroke-boom delimber and a mobile skyline yarder

were studied on nine landing areas. Landing size, equipment arrangement on the landing, delimiting boom design, and yarding production rate are contributing factors to delimeter utilization and harvesting system balance.

**Kendrick, D., and J. Sessions. 1991. A solution procedure for calculating the standing skyline load path for partial and full suspension. *Forest Products Journal* 41(9):57-60. (For. Res. Lab.)**

For forest engineers. Many harvesting operations use a standing skyline cable system in steep topography or on fragile soils. The authors present an efficient algorithm with good convergence properties for calculating the load path for a standing skyline. The technique works equally well where logs are fully suspended or have one end suspended above the ground.

**Kershaw, Jr., J.A., D.A. Maguire, and D.W. Hann. 1990. Longevity and duration of radial growth in Douglas-fir branches. *Canadian Journal of Forest Research* 20:1690-1695.**

For forest researchers. Duration of branch radial growth and longevity were summarized for 2,153 branches immediately below the current live crown of Douglas-fir trees in southwestern Oregon. Results suggest that the standard convention of pruning no more than the basal third of the live crown may be a reasonable compromise between the objectives of maximizing wood quality and total volume production.

**Kirk, R., and L. Kellogg. 1990. Mechanized felling on a cable yarding operation. P. 168-175 in *Proceedings of the 13th Annual Meeting of the Council on Forest Engineering*, North Carolina State University, Raleigh, North Carolina.**

For logging managers and forest engineers. A swing boom feller-buncher working in conjunction with a mobile yarder achieved a production rate of 32.1 cunits per productive machine hour at a cost of \$3.87 per cunit.

**Knowe, S.A. 1992. Basal area and diameter distribution models for loblolly pine plantations with hardwood competition in the Piedmont and Upper Coastal Plain. *Southern Journal of Applied Forestry* 16:93-98. (For. Res. Lab.)**

For forest managers and researchers. The effects of hardwoods were incorporated into basal area and diameter distribution components of a yield prediction system. Comparisons of the model with existing models indicate that it has greater flexibility in predicting distributions and constant total basal area of pine and hardwoods, regardless of the proportion of hardwood basal area.

**Krankina, O.N., and R.K. Dixon. 1992. Forest management in Russia. *Journal of Forestry* 90(6):29-34.**

For policy analysts and forest managers. The history of forest management and administration in the former USSR is reviewed. Recent changes in the former Soviet Union provide the opportunity for cooperation in the forest sector.

**Larose, A., and B. Greber. 1991. Multi-level harvest planning and log merchandising using goal-program-**

**ming. P. 24-30 in *Proceedings of the 1991 Symposium on Systems Analysis in Forest Resources*. USDA Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina. General Technical Report SE-74.**

For forest managers and operations researchers. A multi-level planning model was developed to help define harvest plans intended to maximize a company's net present income. The model was based on factors that control the generation and merchandising of the logs obtained from harvesting forest stands. The information used by the model can be directly obtained from existing technical information systems.

**Maguire, D.A., and D.W. Hann. 1989. The relationship between gross crown dimensions and sapwood area at crown base in Douglas-fir. *Canadian Journal of Forest Research* 19:S57-S65.**

For forest modelers and silviculturists. Crown dimensions and sapwood area near crown base were measured on Douglas-fir trees in southwestern Oregon. Sapwood areas were interpolated or extrapolated to crown base with a sapwood taper function. Crown base sapwood area and gross crown dimensions prove complementary in modeling the growth and structure of forest trees.

**Maguire, D.A., and D.W. Hann. 1990. Bark thickness and bark volume in southwestern Oregon Douglas-fir. *Western Journal of Applied Forestry* 5:5-8.**

For forest managers and modelers. A segmented polynomial taper equation for southwestern Oregon Douglas-fir predicts double bark thickness at any point above breast height. Equations for predicting thickness below breast height are also presented. The equations facilitate estimation of inside bark diameter given outside bark measurement.

**Maguire, D.A., and D.W. Hann. 1990. Constructing models for direct prediction of 5-year crown recession in southwestern Oregon Douglas-fir. *Canadian Journal of Forest Research* 20:1044-1052.**

For forest modelers. Crown recession rates were estimated by branch mortality dating on 357 sectioned Douglas-fir stems from temporary plots. Numerous non-linear, logarithmic, and gamma-theory generalized linear models were developed for predicting 5-year crown recession for various tree, stand, and site conditions. Results demonstrated that a multiplicative model with lognormal errors was the most appropriate model form.

**Maguire, D.A., and D.W. Hann. 1990. A sampling strategy for estimating past crown recession on temporary growth plots. *Forest Science* 36:S49-S63. (For. Res. Lab.)**

For forest researchers. Seven alternative sampling strategies for estimating past crown recession on temporary plots were compared with known 5-year recession rates reconstructed on permanent plots. Simple linear regressions of estimated recession on actual recession demonstrated that several of the sampling strategies produced an intercept not significantly different from zero and a slope not significantly different from one; these strategies were satisfactory for estimating past 5-year crown recession on these plots.

- Maguire, D.A., J.A. Kershaw, Jr., and D.W. Hann. 1991. Predicting the effects of silvicultural regime on branch size and crown wood core in Douglas-fir. *Forest Science* 37:1409-1428.
- For silviculturists and wood quality specialists. Three major determinants of wood quality in Douglas-fir—branch whorl frequency, branch size, and crown wood core—were estimated from the dynamics of crown structure in ORGANON, an individual-tree, distance-independent growth model. This approach to incorporating determinants of wood quality into growth and yield predictions produced a behavior in the simulated stand consistent with limited field-trial data.
- Means, J.E., and T.E. Sabin. 1989. Height growth and site index curves for Douglas-fir in the Siuslaw National Forest, Oregon. *Western Journal of Applied Forestry* 4:136-142.
- For forest managers. Height-growth patterns of trees on the Siuslaw National Forest were found to differ significantly from commonly used regional height-growth curves. Height-growth patterns also differed significantly among plant associations. Height-growth and site-index curves for Douglas-fir in the Siuslaw National Forest are constructed. Forest managers should consider building local height-growth and site-index curves.
- Nelson, J., and J.D. Brodie. 1990. Comparison of a random search algorithm and mixed integer programming for solving area-based forest plans. *Canadian Journal of Forest Research* 20:934-942. (For. Res. Lab.)
- For forest planners. An area-based forest plan is formulated and solved by mixed integer programming and a random search algorithm. The random search algorithm easily identified several solutions with objective function values within 10 percent of the true optimum. This algorithm provides an effective technique for generating acceptable alternatives to complex area-based planning problems.
- Nelson, J., J.D. Brodie, and J. Sessions. 1991. Integrating short-term, area-based logging plans with long-term harvest schedules. *Forest Science* 37:101-122. (For. Res. Lab.)
- For forest operations analysts and researchers. Procedures were developed and evaluated for integrating short-term, area-based plans with long-term, strata-based harvest schedules. It was shown that a combination of these two approaches to forest planning provides a spatially feasible, short-term solution that can also incorporate strategic harvest goals over a long-term period.
- Norris, L.A., H.W. Lorz, and S.V. Gregory. 1991. Forest chemicals. The influence of forest and rangeland management on salmonid fishes and their habitat. *American Fishery Society Special Publication* 19:207-296.
- For forest and rangeland managers and fisheries biologists. This is an in-depth review of the direct and indirect effects of insecticides, herbicides, fire retardants, and fertilizers on aquatic habitat, especially with reference to anadromous species in the Pacific Northwest. It includes an extensive review of toxic effects and estimates likely "safe" concentrations in water.
- O'Hara, T.J., and A.S. Reed. 1991. Timber market development from private forests in northwestern Minnesota. *Northern Journal of Applied Forestry* 8:153-155.
- For professional foresters especially procurement officers, with an interest in private forest issues. Results of a survey of landowners and wood industry personnel that explores the motivation for and benefit of landowner cooperatives are reported along with other timber marketing issues. The authors focus on the significance of activities of former landowners and the role of absentee owners.
- Olsen, E., J. Garland, and J. Sessions. 1989. Value loss from measurement error in computer-aided bucking at the stump. *Applied Engineering in Agriculture* 5:283-285. (For. Res. Lab.)
- For forest engineers and loggers. The accuracy of diameter measurements was shown to be a critical input in computer-aided optimal bucking. The additional time required for making precise measurements increased the felling and bucking costs by about one-third.
- Olsen, E.D., S.J. Pilkerton, and J.J. Garland. 1991. Evaluating timber sale bids using optimal bucking technology. *Applied Engineering in Agriculture* 7(1):131-136. (For. Res. Lab.)
- For forest engineers and managers. This study documented and field tested a method of using optimal bucking procedures to aid in cruising and stand value appraisals. The CRUISE/BUCK<sup>®</sup> method can estimate the type of logs that should be cut from a stand and can evaluate the potential revenue if different sets of mills are chosen as the purchasers.
- Olsen, E.D., S. Pilkerton, J.J. Garland, and J. Sessions. 1990. Extending strategies for optimal bucking to harvesting and site preparation. *Western Journal of Applied Forestry* 5:12-15. (For. Res. Lab.)
- For logging and forest managers. Optimal bucking strategies can be implemented in the field with handheld computers, not only for matching market needs with logs cut but for other modes of harvest planning. The bucking optimization program can be used to examine the effects of (1) different utilization standards, (2) different log-weight and log-mix limitations, and (3) different methods of making logging-cost estimates.
- Olsen, E., S. Pilkerton, J. Garland, and J. Sessions. 1991. Computer aided bucking on a mechanized harvester. *Journal of Forest Engineering* 2(2):25-32. (For. Res. Lab.)
- For logging managers and forest engineers. This study evaluated the feasibility of using the computer program BUCK<sup>®</sup> to aid the Hahn Harvester operator in determining the best bucking cuts. Computer-aided bucking was able to increase the total value of harvested timber by 7.5 percent.
- Olsen, E.D., S. Pilkerton, J. Garland, and J. Sessions. 1991. Questions about optimal bucking. *Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin* 71. 18 p. (For. Res. Lab.)
- For logging managers and contractors. In this compilation of Oregon State University research work on com-

puter-aided crosscutting (bucking) of trees into logs, major considerations for deciding whether to adopt optimal bucking and steps to implement it are described.

**Peterson, C.E., and J.W. Hazard. 1990. Regional variation in growth response of coastal Douglas-fir to nitrogen fertilizer in the Pacific Northwest. *Forest Science* 36:625-640.**

For stand modelers and forest managers. Hypothesis testing for differences in growth responses among physiographic strata, thinning levels, and fertilizer dosage levels resulted in a set of empirical models for predicting volume increment response of even-aged coastal Douglas-fir to nitrogen fertilizer. Although not highly significant, the physiographic factor was retained in the models for purposes of refinement.

**Pilkerton, S., and L. Kellogg. 1989. Analysis of productivity and availability of two operations utilizing the Steyr KP-40 grapple processor. P. 17-22 in *Proceedings of the 12th Annual Meeting of the Council on Forest Engineering*. University of Idaho, Moscow, Idaho and Forest Engineering Inc., Corvallis, Oregon.**

For logging managers and forest engineers. A 6-month shift level study was conducted on two Steyr KP-40's that were processing log-length and tree-length material. Productivity averaged 42.5 m<sup>3</sup> per productive hour and mechanical availability averaged 67-78 percent.

**Plantinga, A., J. Buongiorno, and R. Alig. 1990. Determinants of changes in nonindustrial private timberland ownership in the United States. *Journal of World Forest Resources Management* 5:29-46.**

For resource economists, resource analysts, and policy analysts. Area of timberland in the United States owned by farmers decreased by 23 million ha between 1952-1977, while other nonindustrial private forests owners increased by 16 million ha. Econometric analyses indicate opposite trends were largely due to the same economic, demographic, and land endowment variables.

**Plantinga, A., J. Buongiorno, R. Alig, and J. Spencer. 1989. Timberland area change in the Lake States: past trends, causes, and projections. *USDA Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota. Research Paper NC-287. 17 p.***

For resource economists, resource analysts, and policy analysts. Area of timberland in the United States owned by farmers decreased by 23 million ha between 1952-1977, while area owned by other nonindustrial private forest (NIPF) owners increased by 16 million ha. Declines in farm forest and increases in other NIPF timberland tended to occur in states with rapid economic growth.

**Pyles, M.R., J.W. Anderson, and S.G. Stafford. 1991. Capacity of second-growth Douglas-fir and western hemlock stump anchors for cable logging. *Journal of Forest Engineering* 3(1):29-37.**

For forest engineers. The use of small instead of large stumps for cable-logging anchors will usually result in applied loads approaching the load capacity of the anchors more closely. The results of field load tests of Douglas-fir and western hemlock stump anchors are reported.

**Randhawa, S.U., and E.D. Olsen. 1990. LOGSIM: a tool for mechanized harvesting systems design and analysis. *Applied Engineering in Agriculture* 6(2):231-237. (For. Res. Lab.)**

For forest engineering researchers. This article describes a simulation model for planning and design of the entire harvesting system (tree to mill). The unique features of this model include a method for obtaining the system description and input parameters from the user, an output processor that reports simulation results, and a graphics package that produces graphical output of selected simulation results.

**Randhawa, S.U., T.M. Scott, and E.D. Olsen. 1992. Timber harvester: a microcomputer-based system for automatic selection of timber harvesting equipment. *Applied Engineering in Agriculture* 8(1):121-127. (For. Res. Lab.)**

For public agency engineers and private industry managers. This article describes a microcomputer-based system that queries a user on logging and market conditions. The system then matches these conditions to a level of mechanization that would maximize the efficiency of production.

**Rasker, R., R.L. Johnson, and D. Cleaves. 1991. The market for waterfowl hunting on private agricultural land in western Oregon. *Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin* 70. 14 p. (For. Res. Lab.)**

For public land managers and private landowners. Trends in fee hunting in Oregon are examined, with particular emphasis on waterfowl in the western part of the state. Farmers with potential or existing waterfowl habitat in western Oregon were surveyed about their views on managing their lands for waterfowl; incentives and deterrents to such practices are identified.

**Reed, A.S., D. Schen, and M.C. Koester. 1991. Stewardship Incentive Program: a part of the Forest Stewardship Act of 1990. *USDA Forest Service Fact Sheet*. USDA Forest Service, Washington, D.C. 2 p.**

For natural resource professionals involved in planning, promoting, or implementing the Stewardship Incentive Program. The basic cultural treatments eligible for cost-sharing assistance under the Stewardship Incentive Program are described. Sources for additional information are provided.

**Riitters, K.H., B.E. Law, R.C. Kucera, A.L. Gallant, R.L. DeVelice, and C.J. Palmer. 1992. A selection of forest condition indicators for monitoring. *Environmental Monitoring and Assessment* 20:21-33.**

For forest ecologists. A set of indicators to signal changes in forest ecosystem distribution, productivity, and disturbance are recommended in the context of an environmental monitoring and assessment strategy. Additional measurements are recommended to help ascribe those changes to climate variation, atmospheric deposition, and land use patterns.

**Ripple, W.J., and S. Wang. 1989. Quadtree data structures for Geographic Information Systems. *Canadian Journal of Remote Sensing* 15(3):172-176. (For. Res. Lab.)**

For users of Geographic Information Systems. This paper introduces and describes quadtree data models as a potential data structure for Geographic Information Systems (GIS), especially expert GIS, and discusses the advantages and disadvantages of quadtrees. Significant data storage and processing efficiencies can be realized under certain conditions with quadtrees.

**Ripple, W.J., S. Wang, D.L. Isaacson, and D.P. Paine. 1991. A preliminary comparison of Landsat Thematic Mapper and SPOT-1 HRV multispectral data for estimating forest volume. International Journal of Remote Sensing 12:1971-1977. (For. Res. Lab.)**

For foresters, biometricians, and resource managers. Digital Landsat Thematic Mapper and SPOT satellite images of conifer canopies in an Oregon State University research forest were compared in their relationship to forest wood volume with correlation and regression analyses. Significant inverse relationships were found between softwood volume and the spectral bands from both sensors.

**Ritchie, M.W., and D.W. Hann. 1990. Equations for predicting the 5-year height growth of six conifer species in southwest Oregon. Forest Research Laboratory, Oregon State University, Corvallis. Research Paper 54. 12 p. (For. Res. Lab.)**

For forest modelers, biometricians, and users of ORGANON. Equations are presented for predicting the 5-year height growth of individual trees of six species (Douglas-fir, white fir, grand fir, ponderosa pine, sugar pine, and incense-cedar) growing in the mixed-conifer zone of southwest Oregon. The model for height growth is expressed as a function of site index, total tree height, crown ratio, and percentage of crown closure at total height of the subject tree.

**Sabin, T.E., and S.G. Stafford. 1990. Assessing the need for transformation of response variables. Forest Research Laboratory, Oregon State University, Corvallis. Special Publication 20. 31 p. (For. Res. Lab.)**

For forestry researchers, faculty, and students. Violations of one or more of the assumptions made in analysis of variance or linear regression analysis may lead to erroneous results. This paper summarizes the appropriate techniques and methodology for testing the assumptions with PC-SAS and Statgraphics.

**Satterlund, D.R., and P.W. Adams. 1992. Wildland Watershed Management. Second edition. John Wiley & Sons, Inc., New York. 436 p.**

For students, natural resource professionals and others interested in watershed management. This newly revised textbook and reference reviews fundamentals of hydrology and watershed science and current management principles for forest and range lands.

**Schoenemann, M.R., and M.R. Pyles. 1990. Statistical description of triaxial shear test results. Geotechnical Testing Journal 13(1):58-62. (For. Res. Lab.)**

For geotechnical engineers. A statistical technique of soil strength description appropriate for the probabilistic assessment of stability in two-parameter ( $c'$ ,  $\phi'$ ) soils under drained conditions is developed here. The tech-

nique is applied to a set of results from triaxial strength tests on residual forest soil. Techniques for assessing the adequacy of a statistical description are discussed.

**Schowalter, T.D., and J.M. Sexton. 1989. Inventory monitoring as a means of assessing insect impact on Douglas-fir seed production in western Oregon. P. 151-160 in Proceedings, Third Cone and Seed Insect Working Party Conference, IUFRO Working Party S2.07-01. Forestry Canada, Pacific Forestry Centre, Victoria, British Columbia. (Dep. Entomol.)**

For entomologists and forest managers. Inventory monitoring in Douglas-fir seed orchards has permitted economic evaluation of various factors causing seed losses. During a good cone year, loss of 5 percent of potential seed production amounted to an economic loss of \$65,000.

**Schuh, D., and L. Kellogg. 1989. Mechanized delimiting at a cable landing. LIRA Technical Release 11(4). 11 p.**

For forest engineers. A stroke boom delimitter achieved a production rate of 82 logs per productive hour delimiting and processing second-growth timber in a cable logging operation. Factors contributing to low delimitter utilization were low stand volumes, a production quota limit, insufficient yarding production to balance delimitter capability, and interferences on small landings. Opportunities to enhance logging system efficiency are discussed.

**Sedell, J.R., and R.L. Beschta. 1991. Bringing back the "bio" in bioengineering. American Fisheries Society Symposium 10:160-175.**

For fisheries biologists, riparian ecologists, and hydrologists. Physical structures alone cannot replicate the important interactions between dynamic streams and associated riparian vegetation. Bioengineering approaches to fish habitat management must complement the natural dynamics of functional riparian plant communities. Changes in channel roughness due to riparian vegetation and in-channel large woody debris are summarized.

**Sessions, J., coordinator. Authors, Western Oregon: K.N. Johnson, J. Beuter, B. Greber, G. Lettman, and J. Sessions. Authors, Eastern Oregon: K.N. Johnson, J. Beuter, G. Lettman, and J. Sessions. Author, Economic Impacts: B. Greber. 1990. Timber for Oregon's tomorrow, the 1989 update. Forest Research Laboratory, Oregon State University, Corvallis. 183 p. (A single copy is free of charge; multiple copies are \$6.00 each.) (For. Res. Lab.)**

For government officials, public and private forest land owners, legislators, and interested citizens. In 1976, the School of Forestry at OSU published the landmark report "Timber for Oregon's Tomorrow," also known as the "Beuter report." The present study discusses timber availability in Oregon now and in the future in an update to that report.

**Sessions, J. 1992. Cost control in harvesting and road construction. Food and Agriculture Organization of the United Nations, Rome, Italy. FAO Forestry Paper 99. 105 p.**

For forest engineers and managers. This manual provides an introduction to break-even concepts, cost equations,

and calculation of machine rates for developing costs of harvesting and road construction. A computer disk for IBM microcomputers and compatibles is included.

Sessions, J., R.H. Iff, and P.L. Cottell. [1986.]. **Mountain logging in North America: trends for the next decade.** P. 180-189 in *Proceedings, 18th IUFRO World Congress, Ljubljana, Yugoslavia.* (Proceedings available from IUFRO Secretariat, Schonbrunn-Tirologarten, A-1131 Vienna, Austria.)

For forest engineers. This paper discusses current practice and probable trends in mountain harvesting technology during the next decade on the West Coast. The trend will be toward increasing mechanization of felling and bunching, substitution of ground-based systems for cable yarding where feasible, and selection of efficient silvicultural prescriptions that recognize the limitations imposed by harvesting technology and economics.

Sessions, J., and J. Mann. 1989. **Matching cable yarders to the job: interpreting equipment specification sheets.** P. 32-36 in *Proceedings, Implementing Techniques for Successful Forest Operations.* Council of Forest Engineering, Coeur D'Alene, Idaho.

For forest engineers. The authors describe the various types of information on typical equipment specification sheets and relate them to equipment performance.

Sessions, J., and J.B. Sessions. 1991. **Post new-forestry tools for tactical harvest planning.** *Western Wildlands, University of Montana, Missoula* 17(4):39-44.

For forest engineers, timber planners, and wildlife biologists. The authors discuss spatial issues in new forestry, information requirements, and a technique for finding feasible solutions.

Sessions, J., and J.B. Sessions. 1991. **SNAP—a scheduling and network analysis program for tactical forest planning.** P. 236-239 in *Proceedings: Elk Vulnerability.* Montana State University, Bozeman, Montana.

For forest engineers, timber planners, wildlife biologists. The authors describe the spatial issues in tactical forest planning and the capabilities of the computer program SNAP that has been developed to assist planners in identifying feasible alternatives.

Sessions, J., and Y.H. Yeap. 1989. **Optimizing road spacing and equipment allocation simultaneously.** *Forest Products Journal* 39(10):43-46. (For. Res. Lab.)

For logging contractors and forest engineers. A method is presented that allows a contractor who must allocate skidding and road-building equipment among several areas to optimize road spacing and equipment allocation simultaneously.

Shelby, B., J. Goodwin, M. Brunson, and D. Anderson. [1989.]. **Impacts of recreation use limits in the Alpine Lakes Wilderness.** Department of Forest Resources, Oregon State University, Corvallis. 105 p. (For. Res. Lab.)

For resource managers and researchers. A survey was administered to recreationists who applied for visitor permits in the Enchantments section of the Alpine Lakes Wilderness. The findings suggest that, while the permit

system has redistributed use, most people are still able to use the area. When visitors are unable to obtain a permit for their chosen day, they choose different times or permit strategies to gain access to the Enchantments area or they visit a similar wilderness area nearby.

Shelby, B., and W.L. Jackson. 1991. **Determining minimum boating flows from hydrologic data.** *Rivers* 2:161-167.

For researchers and resource managers. The authors review "A Method for Determining Minimum Instream Flow for Recreational Boating" by R.C. Corbett, 1990, Special Report 1-239-91-01, Science Applications International Corporation, McLean, Virginia. They describe the report as a pioneering attempt to use hydrological data from several rivers to develop a model for determining recreational boating needs. They conclude that this modeling approach, in spite of several shortcomings, has potential.

Shelby, B., R.L. Johnson, and M. Brunson. 1990. **Comparative analysis of whitewater boating resources in Oregon: toward a regional model of river recreation.** Final Technical Completion Report WRR1-108. Water Resources Research Institute, Corvallis, Oregon. 143 p.

For public land managers and researchers. This paper examines information necessary for developing a whitewater recreation management system that accounts for multi-use patterns. Characteristics of use and users are described for four popular whitewater boating resources (Clackamas, Deschutes, Rogue, Upper Klamath). Information on economic values, perceived social impacts of recreation use, and substitutability with other rivers is included.

Shelby, B., and J.J. Vaske. 1991. **Resource and activity substitutes for recreational salmon fishing in New Zealand.** *Leisure Science* 13:21-32.

For researchers and resource managers. This study examines perceptions of salmon angling on two New Zealand rivers noted for good fishing. Responses indicated that the two rivers are not considered to have equal value even although each is most often named by anglers as the best substitute for the other. This suggests that some recreation experiences are unique: substitutions do not provide the same benefits.

Shelby, B., J.J. Vaske, and T.A. Heberlein. 1989. **Comparative analysis of crowding in multiple locations: results from fifteen years of research.** *Leisure Sciences* 11:269-291. (For. Res. Lab.)

For resource managers, researchers, and students. A single-item measure was used in comparative analyses of aggregate data from 35 studies of crowding in outdoor recreation settings. Results suggest that crowding varies by time, resource availability, accessibility and convenience, and management strategy. The single-item measure is useful for making comparisons and identifying problem areas.

Shelby, B., D. Whittaker, and M. Danley. 1989. **Idealism versus pragmatism in user evaluations of allocation systems.** *Leisure Sciences* 11:61-70. (For. Res. Lab.)

For researchers, resource managers, and students. Data are used to analyze evaluations of allocation alternatives on the basis of perceived fairness and chances of success. Willingness to try a system is a pragmatic notion based more on likelihood of success, whereas acceptability is a more idealistic notion based more on fairness. Implications for designing allocation systems are discussed.

**Shen, Z., and J. Sessions. 1989. Log truck scheduling by network programming. *Forest Products Journal* 39(10):47-50. (For. Res. Lab.)**

For forest engineers and managers. The authors present a network approach to log truck scheduling for minimizing transport costs from log landings in the woods to the mill while achieving a desired mill delivery schedule. The network has been solved as a minimum cost flow problem by using the out-of-kilter algorithm.

**Stankey, G.H. 1989. Beyond the campfire's light: historical roots of the wilderness concept. *Natural Resources Journal* 29:9-24.**

For educators, students, and interested citizens. A historical review of the evolution of the wilderness concept in western society reveals a continuing ambivalence toward the idea. This is reflected, on the one hand, in a disposition to conquer the wilderness because it retards social-economic development and, on the other hand, to protect it for the wide range of values it provides society. Increased scientific understanding and growth in appreciative philosophical frameworks have helped support public interest.

**Stankey, G.H. 1989. Forestry and leisure: where to now? *Forest and Timber* 25:3-6. (Published by the Forestry Commission of New South Wales, Australia.)**

For students and managers. The debates over forest management in Australia and North America result from fundamental conflicts in community values. The growing public interest in and support for recreation and other amenity values will necessitate changes in management organization, structures, and skills.

**Stankey, G.H. 1989. Linking parks to people: the key to effective management. *Society and Natural Resources* 2(3):245-250.**

For managers and policymakers. This paper identifies two neglected and necessary aspects of park management. The first is an understanding of the social and cultural context in which parks are established. The second is a supplanting of the traditional rational model of park management with a broader conception that includes input by local landowners and traditional users.

**Stankey, G.H. 1990. Application of the recreation opportunity spectrum in Australian park planning. P. 84-94 in *Proceedings of the 19th IUFRO World Congress, Division 6, Montreal, Canada.***

For recreation planners and policymakers. This paper reviews the experience and lessons derived from application of the Recreation Opportunity Spectrum planning system in parks in Australia. The basic model works well in the Australian context if locally derived indicators and standards are used.

**Stankey, G.H. 1990. United States: wilderness areas. P. 431-450 in *International Handbook of National Parks and Nature Reserves.* Greenwood Press, New York.**

For educators, students, and interested citizens. The development of the wilderness protection program in the United States and its linkage to other nature conservation programs is reviewed.

**Stankey, G.H. 1991. Conservation, recreation, and tourism in marine settings: the good, the bad, and the ugly? P. 11-17 in *Proceedings of the 1990 Congress on Coastal and Marine Tourism.* National Coastal Resources Research and Development Institute, Newport, Oregon.**

For policymakers. This paper discusses the lack of an adequate framework for examining the benefits and costs of tourism development in areas that have high value for recreation and conservation.

**Stankey, G.H., and S.F. McCool. 1991. Beyond social carrying capacity. P. 497-516 in *Understanding Leisure and Recreation: Mapping the Past, Charting the Future.* Venture Publishing Co., State College, Pennsylvania.**

For educators, students, and managers. The early concepts of carrying capacity as applied to recreation management are reviewed. The focus on "how much is too much" needs to be replaced by a model that addresses decisions about desired resources and social conditions.

**Stankey, G.H., and S.F. McCool. 1991. Recreation use limits: the wildland manager's continuing dilemma. *Western Wildlands* 16(4):2-7.**

For managers and policymakers. This study concludes that there is often little clear evidence to support use limits on wild rivers. Other, better, techniques for controlling the impact of rising use could be applied.

**Tesch, S.D., J.W. Mann, and D.H. Lysne. 1990. Coordinating timber harvest activities with silvicultural objectives in the West. P. 198-202 in *Forestry on the Frontier. Proceedings, 1989 Society of American Foresters National Convention, Spokane, Washington.* Society of American Foresters, Bethesda, Maryland. (For. Res. Lab.)**

For silviculturists, timber harvesting specialists, and land management planners. Increasingly complex silvicultural strategies and more difficult harvesting operations necessitate greater interaction between harvesting and silviculture disciplines in the western United States. Evaluation of all probable harvest entries before cutting can increase silvicultural flexibility and provide increased silvicultural opportunities. Examples of the benefits of these operations for gently sloping and steep terrains are given.

**Torres-Rojo, J.M., and J.D. Brodie. 1990. Adjacency constraints in harvest scheduling: an aggregation heuristic. *Canadian Journal of Forest Research* 20:978-986. (For. Res. Lab.)**

For forest modellers and researchers using Geographic Information Systems. An heuristic for adjacency con-

straint aggregation in a formulation of the harvest scheduling problem is proposed. The procedure is based on the concept of penalties and the four-color theorem. Comparisons showed that the proposed procedure requires fewer than or the same number of constraints as two other algorithms.

**Torres-Rojo, J.M., and J.D. Brodie. 1990. Demonstration of benefits from an optimization approach to the economic analysis of natural pine stands in Central Mexico. *Forest Ecology and Management* 36:267-278. (For. Res. Lab.)**

For forest managers and tropical foresters. A whole-stand/diameter-function growth-and-yield prediction model based on the three-parameter Weibull probability density function was developed for *Pinus hartwegii*. It was used to perform an economic analysis of natural pine stands in the central region of Mexico. Results showed that the efficiency of forest production in the region would be improved by allowing stumpage producers to market larger trees to lumber and plywood manufacturers.

**Walstad, J.D., S.R. Radosevich, and D.V. Sandberg, editors. 1990. Natural and Prescribed Fire in Pacific Northwest Forests. Oregon State University Press, Corvallis. 336 p. (Available at \$25.00 plus \$2.00 postage and handling from Oregon State University Press, 101 Waldo Hall, Corvallis, Oregon 97331-6407.)**

For forest managers and policymakers. Deciding whether fire is likely to be beneficial or harmful in specific situations is a matter of judgment and experience. This book provides state-of-the-art information on topics ranging from the role of fire in natural ecosystems to the practical application of fire in managed forests and rangelands, including environmental impacts and mitigation measures.

**White, G.J., G.A. Baker, M.E. Harmon, G.B. Wiersma, and D.A. Bruns. 1990. The use of forest ecosystem process measurements in an integrated environmental monitoring program in the Wind River Range. P. 214-222 in *Whitebark Pine Ecosystems: Ecology and Management of a High Mountain Resource*. USDA Forest Service, Intermountain Research Station, Ogden, Utah. General Technical Report INT-270.**

For ecologists, foresters, and land managers. This report examines the utility of various process measures in monitoring ecosystem "health." Measures examined include decomposition rates, litterfall production, needle demography, and tree growth rates.

**Yeap, Y.H., and J. Sessions. 1989. Optimizing road spacing and road standards simultaneously on uniform terrain. *Journal of Tropical Forest Science* 1:215-228.**

For forest engineers and managers. The authors derive the equations for determining the optimal road spacing and road standard simultaneously. The Hook-Jeeves pattern search algorithm is used to solve the equations.

**Yoshimoto, A., R.G. Haight, and J.D. Brodie. 1990. A comparison of the pattern search algorithm and the modified PATH algorithm for optimizing an individual tree model. *Forest Science* 36:394-412. (For. Res. Lab.)**

For researchers in forest system analysis. A new stand-level dynamic programming algorithm was developed for determining the optimal residual diameter distribution for multiple stand entries. For problems with three or more thinnings, the proposed algorithm yielded superior solutions with less computation time than did a nonlinear programming algorithm, the Hooke and Jeeves method.



## Wood Processing and Product Performance

**Aslam Ali, M., M.L. Laver, C.J. Biermann, R.L. Krahmer, and R.D. Sproull. 1990.** The characterization of charcoal and high-density carbon pellets produced from Douglas-fir bark. *Applied Biochemistry and Biotechnology* 24/25:75-86. (For. Res. Lab.)

For sawmill owners and carbon manufacturers. High-density carbon pellets (HDCP) produced from Douglas-fir bark could provide an alternate source of carbon for industry. HDCP produced from Douglas-fir bark in this work have 90 percent fixed carbon, an average density of 1.3 g/ml, and 1.18 percent average ash content with negligible metal impurities. These pellets should be particularly suited for use in the production of adsorbents, high-grade carbons, reductants, carbon black, carbon electrodes, and activated carbons.

**Barnes, H.M., J.J. Morrell, and S.T. Lebow. 1990.** Pressure treatments of softwoods with polyborates. P. 71-75 in *First International Conference on Wood Protection with Diffusible Preservatives*. Forest Products Research Society, Madison, Wisconsin. (For. Res. Lab.)

For wood treaters. The application of pressure cycles for treating green and dry wood of Douglas-fir and southern pine with borates was explored. The results suggest that, while pressure treatment of Douglas-fir and southern pine with borates is feasible, more research is needed to refine treatment conditions.

**Biermann, C.J. 1992.** Rosin sizing with polyamine mordants from pH 3 to 10. *Tappi Journal* 75(5):166-171. (For. Res. Lab.)

For people responsible for paper machines at paper mills. Sizing with rosin soap size and polyamine mordants was predicted to be highly effective. The most effective mordant was polyallylamine, which was extraordinarily more effective than rosin-alum sizing at pH 4.5, even in the alkaline region. Polyallylamine was a suitable mordant for rosin sizing up to pH 10.

**Biermann, C.J., and M.-K. Lee. 1990.** Analytical techniques for analyzing white pitch deposits. *Tappi Journal* 73(1):127-131. (For. Res. Lab.)

For paper machine superintendents. Determining the origin of pitch contamination is crucial for solving the problem of pitch deposits on paper machines and other equipment. Analytical techniques include gas chromatography, size exclusion chromatography, and nuclear magnetic resonance spectrometry.

**Biermann, C.J., and G.D. McGinnis. 1990.** Enzymatic hydrolysis of pretreated oak, sweetgum, pine and cedar. *Holzforchung* 44:229-233. (For. Res. Lab.)

For those interested in biomass conversion. The authors developed a simplified enzymatic assay to characterize pretreated lignocellulosic material by the amount of cellulose available for cellulase hydrolysis and the relative speed at which the available cellulose is hydrolyzed. Of the three pretreatment processes tested, rapid steaming for 1 minute was more effective than either wet oxidation or autohydrolysis.

**Biermann, C.J., and R. Narayan. 1990.** Grafting of poly(ethylenimine) onto mesylated cellulose acetate, poly(methyl methacrylate) and poly(vinyl chloride). *Carbohydrate Polymers* 12:323-327. (For. Res. Lab.)

For those interested in advanced cellulose-based high-performance composites and plastics. Work on the formation of graft copolymers of cellulose derivatives has been continued by grafting poly(ethylenimine) onto mesylated cellulose acetate by second-order nucleophilic displacement of mesylate groups by amine groups. These grafting reactions could be used to produce cross-linked resins with high ion-exchange capacity.

**Bolton, A.J., P.E. Humphrey, and P.K. Kavvouras. 1989.** The hot pressing of dry-formed wood-based composites. Part III. Predicted vapour pressure and temperature variation with time, compared with experimental data for laboratory boards. *Holzforchung* 43:265-274. (For. Res. Lab.)

For academic and industrial researchers working in composite materials. The variation of temperature and vapour pressure within wood-based composites during the hot-pressing operation is predicted with a theoretical model. The effect of a number of processing variables on temperature and vapour pressure variation is analyzed, and model predictions are compared with experimental data.

**Bolton, A.J., P.E. Humphrey, and P.K. Kavvouras. 1989.** The hot pressing of dry-formed wood-based composites. Part IV. Predicted variation of mattress moisture content with time. *Holzforchung* 43:345-349. (For. Res. Lab.)

For academic and industrial researchers working in composite materials. A theoretical model is used to predict the variation of moisture content and relative humidity within wood-based composites during the hot pressing operation. The effect of a number of processing variables on moisture content variation is analyzed, and the predictions of the model are compared with the limited experimental data available.

**Bolton, A.J., P.E. Humphrey, and P.K. Kavvouras. 1989.** The hot pressing of dry-formed wood-based composites. Part VI. The importance of stresses in the pressed mattress and their relevance to the minimisation of pressing time, and the variability of board properties. *Holzforchung* 43:406-410. (For. Res. Lab.)

For academic and industrial researchers concerned with composite materials and materials scientists. The origins of stresses in composite materials during pressing are outlined. Up to a point, the apparent properties of a composite can be seen as the outcome of the interaction between the strength development of bonds and the residual stresses which these must contain. This ap-

proach helps to explain systematic variations of properties across the panel plane.

**Brown, T.D. 1989. Lumber quality control and the role of the sawfiler. Filer to Filer Trade Report 1(1):6-7, 10.**

For lumber manufacturing managers and sawfiling supervisors. This article describes the key role performed by sawfilers and activities that must be accomplished as part of an overall lumber-quality and process-control program.

**Brown, T.D. 1990. What makes a lumber quality and process control program succeed or fail. P. 123-129 in Proceedings of Process Control/Production Manager of Wood Products. Forest Products Research Society, Madison, Wisconsin.**

For lumber manufacturing managers and quality control supervisors. Program pitfalls and the opportunities for improving an existing lumber quality and process control program or starting a successful program are described.

**Brunner, C.C., D.A. Butler, A.G. Maristany, and D. VanLeeuwen. 1990. Optimal clear-area sawing patterns for furniture and millwork blanks. Forest Products Journal 40(3):51-56. (For. Res. Lab.)**

For researchers and practitioners interested in secondary manufacturing. Knowing the optimal sawing patterns for a board's clear areas is an important part of determining a suitable sawing pattern for an entire board. This paper briefly discusses various methods for finding these patterns and presents a modified version of the Gilmore and Gomory algorithm, which is well suited to this task.

**Brunner, C.C., G.B. Shaw, D.A. Butler, and J.W. Funck. 1990. Using color in machine vision systems for wood processing. Wood and Fiber Science 22:413-428. (For. Res. Lab.)**

For researchers interested in the use of color in machine vision applications to wood products manufacturing. Color information, already shown to be valuable in distinguishing wood surface features, should prove especially useful for future applications of machine vision in the wood products industry. This review provides information for understanding the benefits—and associated difficulties—of using color. Various standard color-measurement systems ("color spaces") are discussed.

**Butler, D.A., and P.K. Pierson. 1991. A distortion-correction scheme for industrial machine-vision applications. IEEE Transactions on Robotics and Automation 7:546-551. (For. Res. Lab.)**

For researchers in machine vision and robotics. This paper discusses practical ways to measure and correct distortion in industrial vision systems, with an emphasis on ease of use. Study results show that substantial increases in accuracy can be gained.

**Clauson, M.L., and J.B. Wilson. 1991. Comparison of video and x-ray for scanning wood density. Forest Products Journal 41(3):58-62. (For. Res. Lab.)**

For scientists and production personnel interested in wood quality assessment and process control. Video scanning and x-ray densitometry were compared for use in commercial grading and inspection of wood density

and growth-ring characteristics by scanning cross sections of Douglas-fir with both methods. The two scanning methods produced comparable results; however, the video method is faster, requires less sample preparation, is independent of moisture content, and allows a much larger surface area to be examined.

**Dawson-Andoh, B., and J.J. Morrell. 1990. Effects of chemical pretreatment of Douglas-fir heartwood on efficacy of potential bioprotection agents. International Research Group on Wood Preservation, Stockholm, Sweden. IRG/WP/1440. (For. Res. Lab.)**

For wood microbiologists. Biological protection against wood decay fungi represents an environmentally attractive alternative to the use of chemicals. Many potential bioprotectants lack the ability to completely colonize and protect the wood, an essential property for commercial application of this strategy. Application of low levels of diffusible chemicals such as boron or fluoride can stimulate growth and colonization of bioprotectant fungi, improving the prospects for successful bioprotection.

**Dawson-Andoh, B., and J.J. Morrell. 1991. Integrated bioprotection of wood using *Trichoderma harzianum* and waterborne diffusible salts. Biodeterioration and Biodegradation 8:551-555.**

For wood scientists. This report describes the performance of a bioprotectant, *Trichoderma harzianum*, in the presence or absence of water-diffusible fungicides. Fluoride and boron appeared to synergistically improve the performance of the bioprotectant against wood decay fungi.

**Dawson-Andoh, B.E., and J.J. Morrell. 1992. Extraction of proteins from wood wafers colonized by decay fungi. Holzforschung 46:117-120. (For. Res. Lab.)**

For biochemists and wood microbiologists. Most studies of protein release and enzyme activity of wood decay fungi have been performed in liquid media. The conditions in these media may not accurately reflect those found in solid wood. In this study, a technique was developed to extract fungal proteins from Douglas-fir heartwood wafers and red alder sapwood wafers colonized by *Postia placenta* and *Trametes versicolor*, respectively.

**Dawson-Andoh, B.E., J.J. Morrell, C.J. Biermann, and J.L. Hull. 1991. Effect of fungal pretreatment on strength and optical properties of softwood and hardwood kraft pulps. Tappi Journal 74(10):187-189. (For. Res. Lab.)**

For personnel in the pulp and paper industry. Kraft pulps of Douglas-fir and red alder were treated with the fungus *Phanerochaete chrysosporium* Burds. under low and high nitrogen conditions for 14 days with periodic oxygen flushing. No significant change in pulp brightness or opacity was observed for either species, but fungal treatment did substantially improve several paper-strength properties.

**Falk, R.H., R.J. Leichtl, and D.S. Sharp. 1990. Wood I-joist: a look at research and production in North America. P. 460-463 in Proceedings of the 1990 International Timber Engineering Conference. Steering Commit-**

tee of the 1990 International Timber Engineering Conference, Tokyo, Japan.

For those interested in business and marketing. This paper presents important research performed on wood I-joists, examines the growth of the industry, and discusses the development of standard design methods for I-joists. The role of the Wood I-joist Manufacturers Association as a representative of the industry is also described.

Foo, L.Y., R. Helm, and J.J. Karchesy. 1992. [5',5']-bisdihydroquercetin: a B-ring linked biflavonoid from *Pseudotsuga menziesii*. *Phytochemistry* 31:1444-1445. (For. Res. Lab.)

For wood chemists. Identification of a new type of compound in Douglas-fir outer bark gives insight into how polyphenols change from the inner bark to outer bark. The structures of such outer bark polyphenols also give insight into methods for making new waterproof adhesives without formaldehyde.

Foo, L.Y., and J.J. Karchesy. 1989. Chemical nature of phlobaphenes. P.109-118 in *Chemistry and Significance of Condensed Tannins*. R.W. Hemingway and J.J. Karchesy, eds. Plenum Publishing Corporation, New York. (For. Res. Lab.)

For wood and adhesive chemists. The literature on phlobaphenes is surveyed, with emphasis on research reported since a 1982 review of this subject. In addition, the authors' studies on Douglas-fir bark phlobaphenes are discussed.

Foo, Y.L., and J.J. Karchesy. 1989. Procyanidin polymers of Douglas fir bark: structure from degradation with phloroglucinol. *Phytochemistry* 28:3185-3190. (For. Res. Lab.)

For wood and adhesive chemists. The degradation of procyanidin polymers with phloroglucinol is investigated, and the degradation products are identified.

Foo, L.Y., and J.J. Karchesy. 1991. Procyanidin tetramers and pentamers from Douglas fir bark. *Phytochemistry* 30:667-670. (For. Res. Lab.)

For wood chemists and forest scientists. The oligomeric fraction of an aqueous extract of the inner bark of Douglas-fir yielded two procyanidin tetramers and two pentamers, one of which was novel.

Forsyth, P.G., and J.J. Morrell. 1990. Hexavalent chromium reduction in CCA-treated sawdust. *Forest Products Journal* 40(6):48-50. (For. Res. Lab.)

For wood technologists and treaters. The presence of hexavalent chromium poses a potential danger to users of CCA-treated wood. A colorimetric assay with chromotropic acid as an indicator for hexavalent chromium was developed. At room temperature, nearly complete chromium reduction occurred in CCA-C-treated sawdust within 4 hours in Douglas-fir heartwood, 24 hours in western hemlock heartwood and sapwood, and 48 hours in Douglas-fir sapwood.

Forsyth, P.G., and J.J. Morrell. 1991. Diffusion of a copper naphthenate/boron paste through Douglas-fir heart-

wood. International Research Group on Wood Preservation, Stockholm, Sweden. IRG/WP/3671.

For wood treaters. The rate of movement of boron and copper naphthenate from a preservative paste through Douglas-fir heartwood was determined. Boron moved more readily than copper naphthenate, although both components were capable of considerable movement both radially and longitudinally.

Forsyth, P.G., and J.J. Morrell. 1992. The effect of selected additives and conditions on the decomposition of Basamid in Douglas-fir heartwood. International Research Group on Wood Preservation, Stockholm, Sweden. IRG/WP/3698-92. (For. Res. Lab.)

For wood preservationists. Basamid has some potential as a wood fumigant, but it decomposes too slowly to be effective. Various additives and conditions were tested for their ability to enhance Basamid decomposition in Douglas-fir heartwood.

Freitag, M., and J.J. Morrell. 1990. Wood sandwich tests of potential biological control agents for basidiomycetous decay fungi. *Material und Organismen* 25:63-70. (For. Res. Lab.)

For wood technologists and microbiologists. The potential for biological control of four basidiomycetous decay fungi with four microfungi was evaluated in small-scale soil and block tests. The block tests produced excellent results, but a smaller scale test with wafers produced similar results in less time and appeared to be a more promising screening test.

Freitag, M., J.J. Morrell, and A. Bruce. 1991. Biological protection of wood: status and prospects. *Biodeterioration Abstracts* 5(1):1-13. (For. Res. Lab.)

For researchers and practitioners in wood preservation. Established and new concepts in nonchemical or integrated wood preservation are reviewed.

Funck, J.W., J. Sessions, J. Garland, R. Avery, and P. Wilson. 1991. An allocation model for forest residue utilization. International Energy Report (Task 6, Activity 2). P. 21-31 in *Proceedings, Integrated Harvesting Systems*, Portland, Oregon. Aberdeen University, Aberdeen, Scotland. Forestry Research Paper 2.

For forest engineers, mill managers, and forest economists. The authors describe development of a linear programming model of residue allocation. This model was designed for analyzing the effects of merchandizing on the utilization of logging residue, beetle-killed material, and residue from precommercial thinning operations. The model includes tons of volume removed, species composition, distribution of log grades and the percentage upgradeable, harvest and transport costs, and production systems for logs, lumber, veneer, and chips along with associated recoveries and the values of resulting products.

Gebremedhin, K.G., S.S. Jagdale, and R. Gupta. 1989. An expert system for optimizing computer aided design of post frame buildings. *Journal of Applied Engineering in Agriculture* 5:447-452.

For wood engineers. This paper describes a procedure to optimize the designs of metal-clad post-frame buildings with an expert system.

**Groom, K.M., and R.J. Leichti. 1991. Finite-element model of a nonlinear intercomponent connection in light-framed wood structures. P. 4.346-4.353 in Proceedings of the 1991 International Timber Engineering Conference. Volume 4. Timber Research and Development Association, High Wycombe, England.**

For those involved with structural modeling. This study examines the load displacement characteristics of a light-gauge framing anchor connecting an interior wall to a roof truss. A discrete finite-element model of the anchor was developed and reduced to a simple set of computationally efficient nonlinear springs for use in a full-structure model. The results were verified by testing.

**Gupta, R., and K.G. Gebremedhin. 1990. Destructive testing of metal plate connected wood truss joints. Journal of Structural Engineering 116:1971-1982.**

For wood engineers. Load-displacement characteristics and failure modes of metal-plate-connected tension, heel, and web joints are presented. The results are useful for semirigid joint analysis and for design of metal-plate-connected wood trusses.

**Gupta, R., and K.G. Gebremedhin. 1990. Resistance distribution of metal plate connected residential wood trusses. P. 287-294 in Proceedings of the 1990 International Timber Engineering Conference. Volume 1. Steering Committee of the International Timber Engineering Conference, Tokyo, Japan.**

For wood engineers. Resistance distributions of a metal-plate-connected truss were generated with a simulation technique. The reliability of the truss with pin, rigid, and semirigid joint assumption was 2.99, 3.49, and 3.54, respectively.

**Gupta, R., and K.G. Gebremedhin. 1990. Semirigid analysis of metal plate connected wood trusses. American Society of Agricultural Engineers, St. Joseph, Michigan. ASAE Paper 90-4527. 18 p.**

For structural engineers. Metal-plate-connected wood trusses with semirigid connections were investigated by using the matrix method of structural analysis. Behavior of semirigid connections was included by modifying an element-stiffness matrix and fixed-end forces.

**Helm, R.F., and J.J. Karchesy. 1989. A novel cyclic carbamate from the acid-catalyzed reaction of D-glucose and urea. Journal of Carbohydrate Chemistry 8:687-692. (For. Res. Lab.)**

For wood chemists. The acid-catalyzed reaction of D-glucose with urea in a phenol-water solution has provided  $\alpha$ -D-glucopyranosylamine 1,2-(cyclic carbamate) (1). The use of  $^1\text{H}$ - $^{13}\text{C}$  correlated NMR spectroscopy involving indirectly bonded hydrogens and carbons proved to be indispensable in determining the structure.

**Helm, R.F., and J.J. Karchesy. 1991. Carbohydrate-urea-phenol based adhesives. P. 50-53 in Wood Adhesives 1990. Forest Products Research Society, Madison, Wisconsin.**

For wood and adhesive chemists. The chemistry of carbohydrate-urea-phenol based wood adhesives is discussed. Such adhesives systems from renewable resources hold promise of replacing adhesives based on petro-chemicals in the future.

**Helm, R.F., J.J. Karchesy, and D.F. Barofsky. 1989. Carbohydrate-urea-phenol-based adhesives: transient formation of mono- and di-D-glucosylurea. Carbohydrate Research 189:103-112.**

For wood and adhesive chemists. The chemistry of the acid stage of the synthesis of carbohydrate-based adhesives has been investigated. The sulfuric acid-catalyzed reactions of D-glucose with urea in a phenol-water solution provided both N- $\beta$ -D-glucopyranosylurea and N,N'-di- $\beta$ -D-glucopyranosylurea.

**Hemingway, R.W., and J.J. Karchesy, editors. 1989. The Chemistry and Significance of Condensed Tannins. Plenum Press, New York. 553 p.**

For chemists and biologists. This is a comprehensive book on the science and significance of polyphenolic tannins.

**Highley, T.L., and T.D. Scheffer. 1989. Controlling decay in waterfront structures: evaluation, prevention, and remedial treatments. USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin. Research Paper FPL-RP-494. 26 p.**

For managers of waterfront facilities. This paper describes causes of deterioration, methods of inspection for internal decay, and means of decay prevention. It discusses simple in-place preservative treatments to control decay in deck planking, cut-off pile tops, and ends of timbers. A new method of controlling and eradicating internal decay is described.

**Highley, T.L., and T.C. Scheffer. 1991. In-place treatment for preventing decay in waterfront structures. Material und Organismen 26:1-11.**

For managers of waterfront facilities. Brush applications of pentachlorophenol and fluor-chrome-arsenic-phenol (FCAP) to in-place deck planking greatly prolonged its service life. Cut-off pile tops were protected by ammonium bifluoride and by Osmoplastac.

**Hoag, M.L. 1990. Influence of furnish moisture content and press cycle on briquette integrity. Forest Products Journal 40(1):21-24. (For. Res. Lab.)**

For manufacturers of compressed wood fuel products and researchers. The influence of furnish moisture content (MC), dwell time, and compression load on the integrity of Douglas-fir briquettes, as measured by centerline shear strength and density distribution, was investigated. Briquette shear strength increased and density decreased as furnish MC increased. However, briquette delamination increased as dwell times and compression loads decreased. All factors tested are probably interrelated.

**Hoag, M.L., and R.L. Krahmer. 1991. Polychromatic X-ray attenuation characteristics and wood densitometry applications. Wood and Fiber Science 23:23-31. (For. Res. Lab.)**

For researchers, scientists, and systems designers. The use of polychromatic X-ray energy in wood densitometry complicates the mathematical relationship between the material and X-ray attenuation. Attenuation of polychromatic X-ray energy through cellulose acetate and Douglas-fir wood was investigated and characterized.

**Humphrey, P.E., and A.J. Bolton. 1989. The hot pressing of dry-formed wood-based composites. Part V. The effect of board size: comparability of laboratory and industrial pressing. *Holzforschung* 43:401-405. (For. Res. Lab.)**

For academic and industrial researchers concerned with composite materials. The effect of panel size on the variation of temperature and vapor pressure within hot-pressed mattresses is discussed in the light of theoretical (computer-simulated) and experimental (laboratory and industrial) data. Considerable differences between laboratory and industrial-scale pressing are to be expected. The ability offered by the simulation models to predict how the environment inside industrial-sized panels changes is highly desirable.

**Humphrey, P.E., and L.J. Ostman. 1989. Bolted timber connections. Part I. A wafer technique to model wood deformation around bolts. *Wood and Fiber Science* 21:239-251. (For. Res. Lab.)**

For researchers and design engineers working on timber structures and materials scientists. An experimental technique to model wood material behavior in the plane perpendicular to the axes of bolts in joint members is described. Preliminary findings suggest that information can be gained which sheds light on the effects of growth-ring orientation, wood defects, bolt end-distance, and multiple-bolt positions.

**Humphrey, P.E., and L.J. Ostman. 1989. Bolted timber connections: Part II. Bolt bending and associated wood deformation. *Wood and Fiber Science* 21:354-366. (For. Res. Lab.)**

For researchers (mechanics and materials science) and design engineers working on timber structures. The main objectives of this research, and of a related study by the same authors, have been to develop two complementary experimental techniques (X-ray scanning to quantify bolt bending, and wafer testing for modeling wood deformation around bolts) and to demonstrate their usefulness as tools in designing joints efficiently.

**Humphrey, P.E., and D. Zavala. 1989. A technique to evaluate the bonding reactivity of thermosetting adhesives. *Journal of Testing and Evaluation* 17:323-328. (For. Res. Lab.)**

For academic and industrial adhesives technologists and materials scientists. A new technique has been developed which provides a direct and relatively convenient means to investigate the bonding reactivity of a wide range of adhesive and adherend systems. This technique will enable adhesive systems to be tailored to specific conditions that occur within a diverse range of bonded products during their manufacture.

**Jang, S., and A. Polensek. 1989. Theoretical models for creep slip of nailed joints between wood and wood-**

**based materials. *Wood Science and Technology* 23:237-249. (For. Res. Lab.)**

For civil engineers, wood scientists, and writers of testing standards. Theoretical procedures were developed that use test data for constant loads to predict stiffness under variable in-service loads. More specifically, five nonlinear, viscous-viscoelastic models were developed on the basis of existing formulations of creep and mechanisms of load transfer between nails and wood.

**Karchesy, J.J. 1989. Analytical methods: an overview. P. 197-202 in *Chemistry and Significance of Condensed Tannins*. R.W. Hemingway and J.J. Karchesy, eds. Plenum Publishing Corporation, New York. (For. Res. Lab.)**

For wood chemists. Rapid advances are being made in the ability to determine structure and conformation of proanthocyanidins as a result of recent developments in NMR, MS, and other spectrometric techniques. More needs to be learned about the structure of phlobaphenes, the nature of the molecules that serve as building blocks, and the reaction mechanisms that lead to phlobaphene formation.

**Karchesy, J.J., Y. Bae, L. Chalker-Scott, R.F. Helm, and L.Y. Foo. 1989. Chromatography of proanthocyanidins. P. 139-151 in *Chemistry and Significance of Condensed Tannins*. R.W. Hemingway and J.J. Karchesy, eds. Plenum Publishing Corporation, New York. (For. Res. Lab.)**

For wood chemists. Current trends in chromatographic isolation and analyses of proanthocyanidins are reviewed. Column chromatography, counter-current chromatography, paper and thin-layer chromatography, high-performance liquid chromatography, and gel-permeation chromatography are discussed.

**Karchesy, J.J., L.Y. Foo, E. Barofsky, B. Arbogast, and D.F. Barofsky. 1989. Negative-ion fast-atom-bombardment mass spectrometry of procyanidin oligomers. *Journal of Wood Chemistry and Technology* 9:313-331. (For. Res. Lab.)**

For wood chemists. A quinone-methide mechanism of interflavanoid bond cleavage is proposed to account for observed ions of different molecular weight originating from isomeric upper and lower flavan units. These ions can be used to establish the sequence of monomer units and also to distinguish a linear from a branched trimer.

**Kasal, B., M. Wang, and R.J. Leichtl. 1991. A nonlinear finite-element model for wood-frame stud walls. P. 4.325-4.332 in *Proceedings of the 1991 International Timber Engineering Conference. Volume 4. Timber Research and Development Association, High Wycombe, England.***

For those involved with structural modeling. This paper illustrates how a three-dimensional finite-element model of a wood-frame stud-wall with many degrees of freedom and material nonlinearities was transformed into a simple, two-dimensional finite-element model energetically equivalent to the original structure and having the same load-deformation characteristics.

- Kelsey, R.G., and M.E. Harmon. 1989. Distribution and variation of extractable total phenols and tannins in the logs of four conifers after 1 year on the ground. Canadian Journal of Forest Research 19:1030-1036.**  
For wood chemists, entomologists, and ecologists. Concentrations of extractable total phenols and tannins were analyzed in the outer bark, inner bark, sapwood, and heart wood from logs of Pacific silver fir, western hemlock, Douglas-fir, and western red cedar. Within a species, outer bark contained the greatest quantities of extractable total phenols and also had the highest extractable tannin concentrations.
- Krahmer, R.L., E.C. Lowell, E.F. Dougal, and J.D. Wellons. 1992. Durability of southeast-Asian hardwood plywood as shown by accelerated-aging tests and 10-year outdoor exposure. Forest Products Journal 42(4):40-44. (For. Res. Lab.)**  
For researchers and plywood manufacturers. Shear-test results from five accelerated-aging treatments at time of panel manufacture were compared with delamination and shear-test data after 10 years of outdoor exposure. Percentages of wood failure after 127 months of outdoor exposure differed least from shear-test samples aged by the 25-cycle standard-boil method at time of panel fabrication.
- Kumar, S., and J.J. Morrell. 1989. Moisture content of western hemlock: influence on treatability with chromated copper arsenate type C. Holzforschung 43:279-280. (For. Res. Lab.)**  
For wood treaters and technologists. This note describes the effect of moisture level on treatment of western hemlock with chromated copper arsenate. Drying to moisture content below fiber saturation results in deeper preservative penetration and retention; however, drying to very low moisture content does not appear to improve treatment.
- Kumar, S., and J.J. Morrell. 1989. Penetration and adsorption of different CCA compositions in six western conifers. Forest Products Journal 39(10):19-24. (For. Res. Lab.)**  
For wood preservationists. The treatability of six western conifers with three formulations of chromated copper arsenate (CCA) was investigated. Treatability varied widely among species; generally, sapwood was more easily treated than heartwood. Of the three compositions tested, CCA-Type C oxide was associated with the highest chemical loadings, deepest preservative penetration, and most uniform chemical distribution.
- Kumar, S., and J.J. Morrell. 1990. Treatment of western softwoods with boron-amended inorganic preservatives. Forest Products Journal 40(3):25-29. (For. Res. Lab.)**  
For wood preservationists. The effect of adding boron to waterborne inorganic preservatives in the treatment of western softwoods was evaluated. Results suggest that the addition of boron can enhance both the penetration and retention of the preservatives.
- Kumar, S., and J.J. Morrell. 1992. Effect of surfactants on penetration and absorption of chromated copper arsenate in Douglas-fir. Forest Products Journal 42(5):54-56. (For. Res. Lab.)**  
For wood technologists and treaters. Five commercial cationic, anionic, and nonionic surfactants were tested for their capacity to improve treatment of Douglas-fir heartwood with chromated copper arsenate (CCA). The results suggest that altering surface tension of the solution with the surfactants did not markedly improve treatability of Douglas-fir heartwood with CCA.
- Laver, M.L. 1991. Bark. P. 409-434 in Wood Structure and Composition. M. Lewin and I.S. Goldstein, eds. Marcel Dekker, Inc., New York. (For. Res. Lab.)**  
For researchers interested in bark utilization. This chapter discusses the anatomy and chemistry of tree bark and research into the chemical utilization of bark.
- Lee, M., and C.J. Biermann. 1992. Grafting of maleic anhydride copolymers onto cellulose acetate and methyl cellulose. Journal of Wood Chemistry and Technology 12:231-240. (For. Res. Lab.)**  
For research scientists interested in making new cellulose fiber/plastic-based composites. Ethylene/maleic anhydride copolymer and styrene/maleic anhydride copolymer were grafted onto cellulose acetate and methyl cellulose in a simple and effective way under homogeneous reaction conditions.
- Leichti, R.J. 1990. In the literature: effect of fire on design and performance of wood construction. Wood Design Focus 1(2):20-21.**
- Leichti, R.J. 1990. In the literature: performance, design and analysis of wood structures under seismic loading. Wood Design Focus 1(4):22-23.**
- Leichti, R.J. 1990. In the literature: timber bridge analysis, design, and performance. Wood Design Focus 1(3):22-23.**
- Leichti, R.J. 1991. In the literature: inspection of timber structures and subsystems. Wood Design Focus 2(4):21-22.**
- Leichti, R.J. 1991. In the literature: roof systems design and performance. Wood Design Focus 2(3):21-22.**
- Leichti, R.J. 1991. In the literature: wood preservation—methods, chemicals, performance. Wood Design Focus 2(1):20-21.**
- Leichti, R.J. 1991. In the literature: world wide changes in timber design formats. Wood Design Focus 2(2):20-21.**
- Leichti, R.J. 1992. In the literature: post-frame structures. Wood Design Focus 3(1):20-21.**
- Leichti, R.J., and E. Landis. 1990. In the literature: I-joint design and performance. Wood Design Focus 1(1):20-21.**  
For structural engineers involved with wood engineering. Each of the above nine literature reviews includes three abstracted citations, a list of related citations, new thesis and dissertation titles, and a list of new technical materials. The topic for each review is given in the title.

**Leichti, R.J., R.H. Falk, and T.L. Laufenberg. 1990. Prefabricated wood composite I-beams: a literature review. *Wood and Fiber Science* 22:62-79. (For. Res. Lab.)**

For scientists and engineers. This paper reviews the available literature on the state of the art of prefabricated wood composite I-beams. The results of analytical and experimental investigations illustrate the effects of materials, joint, geometry, and environment on the short- and long-term performance of I-beams.

**Leichti, R.J., R.H. Falk, and T.L. Laufenberg. 1990. Prefabricated wood I-joists: an industry overview. *Forest Products Journal* 40(3):15-20. (For. Res. Lab.)**

For those interested in business and marketing. Currently, nine manufacturers produce more than 95 percent of the wood I-beams, commonly termed "I-joists," in North America. This paper reports the results of a survey of these manufacturers on a wide range of topics, including production volume and capacity, products manufactured, materials used, design and use considerations, quality control, code approvals, market barriers, and research needs.

**Leichti, R.J., and P.E. Humphrey. 1990. Wood composites: an evolution. *Crow's Digest* 5(9):4-8.**

For those interested in the development of wood-based composites. Specific wood-based composites are discussed and several examples of product development are given.

**Leichti, R.J., and R.C. Tang. 1989. Predicting the load capacity of wood composite I-beams using the tensor polynomial strength theory. *Wood Science and Technology* 23:109-121. (For. Res. Lab.)**

For research scientists and engineers. The tensor polynomial strength theory for anisotropic materials was coupled with finite-element analyses to predict the ultimate load capacity of several wood-composite I-beams. Analytical results were in excellent agreement with data from full-scale I-beam tests and demonstrated the influence of web joints and material strengths on failure characteristics.

**McMahon, R.O., and W.L. Galligan. 1989. Wood supply restrictions—is demand being ignored? *The Construction Specifier* 42(10):41-42.**

For materials specialists including those who specify and use high-quality structural lumber. The capability to continue meeting the demand for structural wood products is limited by the harvest restrictions already imposed and will be even more seriously affected by any further reductions. Equitable resolutions to the resource controversy must be devised so that the capability of meeting crucial human needs with renewable, energy-efficient products is not precluded.

**Miller, D.B., and J.J. Morrell. 1989. Stability and methylisothiocyanate production of 12 potential solid fumigants for controlling wood decay. *Holzforschung* 43:191-194. (For. Res. Lab.)**

For wood preservationists. A series of covalent sulfur compounds and metallic salts of methylthiocarbamate was evaluated for the potential effectiveness of the chemicals as remedial decay-control agents. Two metal-

lic salts and two covalent compounds showed promise as wood fumigants and may provide safe alternatives to currently registered liquid fumigants.

**Miller, D.B., and J.J. Morrell. 1990. Interactions between sodium N-methylthiocarbamate and Douglas-fir heartwood. *Wood and Fiber Science* 23:135-141. (For. Res. Lab.)**

For wood products technologists and wood scientists. Vapam® (NaMDC), the fumigant most commonly used to arrest and control decay of utility poles, decomposes to produce volatile fungicides as well as a number of nonvolatile products that may provide long-term protection. The authors evaluate the decomposition of NaMDC in wood in order to determine the kinds and amounts of products generated and their potential for protecting wood against fungal invasion.

**Miller, D.J. 1989. Strength of wood-lath filters after 11 years of service in a waste-water treatment plant. *Forest Products Journal* 39(11/12):73-75. (For. Res. Lab.)**

For sanitary engineers and sewage plant operators and designers. Untreated laths of Douglas-fir, western hemlock, southern pine, and redwood containing sapwood and laths treated with chromated copper arsenate (CCA-C) or pentachlorophenol were compared with redwood heartwood laths after 11 years of exposure to waste water. The strength of untreated and treated Douglas-fir and southern pine and CCA-C treated redwood laths containing sapwood equalled or exceeded that of redwood heartwood.

**Miller, D.J. 1990. Controlling sapstain: trial of strong stain-preventive solutions on selected western softwoods in storage prolonged for 12 months. *Forest Research Laboratory, Oregon State University, Corvallis. Research Paper* 53. 10 p. (For. Res. Lab.)**

For producers of export lumber. Ten alternative stain preventives were compared with a traditional penta product on studs of Douglas-fir, hem-fir, and sugar pine in field trials over a 12-month period. Strong solutions of most preventives provided good to excellent protection for 2 months. Efficacy decreased substantially after the studs were stored 6 months through warm weather.

**Miller, D.J. 1991. Untreated and preservative-treated western woods as roof shingles: 10th-year appraisal. *Forest Products Journal* 41(6):7-14. (For. Res. Lab.)**

For shingle/shake producers and consumers and those who maintain wooden roofs. Under conditions intermediately favorable to decay, untreated shingles of sugar pine and western hemlock seriously decayed. Western larch had less decay, western redcedar little or no decay. Under conditions highly favorable to decay, untreated redcedar shingles remained essentially sound, but the other untreated shingles were seriously decayed or destroyed. Preservative treatment greatly reduced decay.

**Miller, D.J., and J.J. Morrell. 1989. Controlling hardwood sapstain: trials of stain-preventive products on red alder lumber. *Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin* 68. 8 p. (For. Res. Lab.)**

- For red alder lumber producers. Production of hardwood lumber (mostly red alder) has been a small but growing part of the forest products industry in the Pacific Northwest. In laboratory tests, Rodewod® 200 EC plus borax protected alder at nearly all levels tested. Strong solutions of Rodewod® 300, PQ-8 plus borax, and Permatox 101 protected solid-piled red alder lumber during 2 months of summer weather.
- Miller, D.J., J.J. Morrell, and M. Mitchoff. 1989. Controlling sapstain: trials of product group II on selected western softwoods. Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin 66. 10 p. (For. Res. Lab.)**
- For lumber producers and exporters. Alternative preventives were compared with a traditional penta product on Douglas-fir, hem-fir, and pine lumber in an accelerated 6-week test on small specimens in the laboratory and in field trials on bundled studs exposed outdoors for 2 and 6 months.
- Milota, M.R. 1991. Correction factors for moisture-meter measurements of jelutong (*Dyera costulata*). Forest Products Journal 41(2):49-50. For. Res. Lab.)**
- For importers of jelutong. Species correction factors for kiln-dried jelutong were determined by using conductance- and dielectric-type handheld moisture meters. Results indicate that the true moisture content is 2.5 to 2.8 percentage points higher than that indicated by a conductance-type meter.
- Milota, M.R. 1991. Method for the measurement of bow and crook. Forest Products Journal 41(9):65-67. (For. Res. Lab.)**
- For wood researchers and engineers. A laboratory method for measuring bow and crook in lumber was developed by fitting seven linear variable differential transducers along the length of a 16-foot-long table. A cubic polynomial was used to express the shape of the board. The method closely approximated conventional warp measurements and also described board shapes.
- Milota, M.R. 1992. Effect of kiln schedule on warp in Douglas-fir lumber. Forest Products Journal 42(2):57-60. (For. Res. Lab.)**
- For lumber manufacturers. Lumber from large and small Douglas-fir logs was dried by slow and fast schedules at conventional and elevated temperatures. Neither drying temperature nor drying rate affected warp. Proper technique may be the best defense against warp in lumber, regardless of the source of the wood or the drying schedule.
- Milota, M.R., and S.L. Quarles. 1990. The influence of kiln temperature on the performance of handheld moisture meters. Forest Products Journal 49(11/12):35-38. (For. Res. Lab.)**
- For kiln operators, grading agencies, and moisture meter manufacturers. The effect of high-temperature drying on the performance of a resistance and a capacitive-admittance moisture meter was investigated for Douglas-fir and lodgepole pine. Results indicate that the dry-bulb temperature at which these species were dried had a minimal effect on meter performance.
- Milota, M.R., and J.B. Wilson. 1990. Analysis of the fluidized bed drying of wood particles. Wood and Fiber Science 22:193-203. (For. Res. Lab.)**
- For scientists, engineers, and equipment designers in the forest products industry. Engineering parameters necessary to design an industrial, continuous, fluidized-bed dryer for wood particles were examined by using a 0.21-m-square batch fluidized-bed dryer. Parameters of main interest were gas velocity and drying curves. Drying curves for all particle sizes were predicted by developing a new method that accounts for both internal and external resistances to drying.
- Mitchoff, M.E., and J.J. Morrell. 1991. Preservative treatment of plywood panels from the Pacific Northwest. Forest Products Journal 41(9):11-18. (For. Res. Lab.)**
- For wood users. The effect of panel source on treatability by preservatives was investigated by treating panels produced in various Pacific Northwest mills with chromated copper arsenate or ammoniacal copper zinc arsenate. Ammoniacal preservatives may mitigate some of the wide variations in treatability, but none of the panels were completely penetrated.
- Morrell, J.J. 1988. Protection of wood prior to preservative treatment. P. 123-126 in Wood Protection Techniques and the Use of Treated Wood in Construction. Proceedings 47358. Forest Products Research Society, Madison, Wisconsin.**
- For wood treaters and technologists. This paper discusses some of the problems associated with wood prior to treatment, the steps that can be taken to minimize these problems, and several pretreatment methods for prolonging the service life of treated wood.
- Morrell, J.J. 1988. Recent developments in fumigant treatment of electric transmission poles. P. 57-61 in Wood Pole Conference Proceedings. J.J. Morrell, ed. Cooperative Pole Research Program, Oregon State University, Corvallis.**
- For utilities engineers and managers. Liquid fumigants extensively used for arresting decay and prolonging pole service life have handling characteristics that make them difficult or dangerous to apply in some situations. Recent research has investigated the use of encapsulating agents for safer handling of liquid fumigants and has identified several effective solid fumigants.
- Morrell, J.J. 1989. Controlling fumigant release for increased safety and improved performance in wood utility poles. P. E 37-46 in Proceedings, International Conference on Wood Poles and Piles. Colorado State University, Fort Collins, Colorado.**
- For wood treaters and utilities personnel. The effect of various additives for improving and controlling the release of metham sodium in wood was explored. In general, pH had a significant effect on decomposition of metham sodium to fungitoxic compounds. Field tests of these additives are planned.
- Morrell, J.J. 1989. Fumigant treatment of wood. P. 119-122 in Concise Encyclopedia of Wood and Wood-based Materials. Pergamon Press, Inc., New York.**

For wood treaters and utilities personnel. Fumigant treatment of wood including space fumigation for insect control and internal remedial treatment for decay control is reviewed.

**Morrell, J.J. 1989. Fumigant treatments for prolonging utility pole service life: recent developments. *Transmission and Distribution* 41(5):38-39, 42, 44.**

For utilities personnel. This article reviews fumigant usage in the United States with particular emphasis on methylisothiocyanate, a treatment identified at Oregon State University.

**Morrell, J.J. 1990. Effect of kerfing on performance of Douglas-fir utility poles in the Pacific Northwest. *International Research Group on Wood Preservation, Stockholm, Sweden. IRG/WP/3604. (For. Res. Lab.)***

For wood technologists and utilities engineers. Preservative treatment produces an external layer of protection in Douglas-fir poles, but the development of deep checks as the wood dries after treatment can permit entry by fungi and insects. Remedial treatments can arrest this decay; however, kerfing, which limits the development of deep checks, is a more efficient method of treatment.

**Morrell, J.J. 1990. Effects of volatile chemicals on the ability of microfungi to arrest basidiomycetous decay. *Material und Organismen* 25:267-274. (For. Res. Lab.)**

For wood microbiologists. The feasibility of using volatile chemicals to encourage growth of biological control agents was evaluated. Addition of exogenous nitrogen appears to have no influence on successful biological control, whereas mild sterilization with fumigants may provide a viable method for encouraging successful control.

**Morrell, J.J. 1990. Fumigation of wood. P. 923-926 in *Encyclopedia of Materials Science and Engineering, Supplementary Volume 2*. Pergamon Press, Oxford, New York. (For. Res. Lab.)**

For engineers and architects. This reprint of the entry "Fumigation of Wood" from the *Encyclopedia of Materials Science and Engineering* discusses short- and long-term fumigation, fumigant applications, and the future of wood fumigation. This same article also appears on pages 119-122 in *Concise Encyclopedia of Wood and Wood-Based Materials*. Pergamon Press, Oxford, New York, 1989.

**Morrell, J.J. 1990. Initial preservative of wood poles. P. 6-11 in *Proceedings, Third Wood Pole Conference, Edmonton, Alberta*.**

For utilities personnel. This paper presents an overview of the chemicals employed for treatment of wood poles and methods by which these chemicals are delivered into the wood.

**Morrell, J.J. 1991. Maximizing the service life of wood poles. In *Proceedings, Pacific Coast Electrical Association, Engineering and Operating Conference, Irvine, California*.**

For utilities personnel. Methods for prolonging the service life of wood poles through improved initial specifica-

tions and the use of vigorous inspection and maintenance programs are discussed.

**Morrell, J.J. 1991. Preservative treatment of wood used for construction. *Wood Design Focus* 2(1):10-13.**

For wood specifiers. The author discusses the chemicals available for protection of wood used in construction and the methods by which these chemicals are delivered into the wood.

**Morrell, J.J. 1992. Effect of wood species on decomposition efficiency of metham sodium. *International Research Group on Wood Preservation, Stockholm, Sweden. IRG/WP/3699-92. (For. Res. Lab.)***

For wood preservationists. The effect of wood species and temperature on efficiency of metham sodium decomposition to methylisothiocyanate was investigated on 10 hardwoods and 9 conifers over a 144-hour period. Decomposition was generally better with hardwoods and at higher temperatures, although there were exceptions with some species.

**Morrell, J.J., and D.J. Blake. 1991. Effect of kerfing on the incidence of internal decay in Douglas-fir utility poles. *Transmission and Distribution* 43(4):26-30.**

For utilities personnel. Poles that were kerfed before preservative treatment to control the development of deep checks had extremely low levels of internal decay in comparison to similar unkerfed poles. The results illustrate the benefits of this simple decay-prevention technique.

**Morrell, J.J., and M.Y. Giron. 1992. Philippine wood pole maintenance manual: a guide to the specification, inspection, and maintenance of wood poles. *Forest Research Laboratory, Oregon State University, Corvallis. Special Publication* 23. 29 p. (For. Res. Lab.)**

For Australian and Asian utilities personnel. This manual is designed as a user's guide to wood pole maintenance in the Philippines, where tropical conditions create an environment conducive to decay. Basic information is provided on the properties of wood, including native hardwoods, and on fungi and insects as agents of biodegradation. The manual covers methods of preserving poles, pole maintenance, pole-system inspection, and remedial treatments.

**Morrell, J.J., and S.T. Lebow. 1991. Borate treatment of seasoned western hemlock and Douglas-fir lumber. *Forest Products Journal* 41(1):27-29. (For. Res. Lab.)**

For lumber producers and wood treaters. Dry (12 percent moisture content), incised or nonincised Douglas-fir and western hemlock lumber was treated with sodium borate tetrahydrate and subjected to dip or pressure treatments. Gross retentions and boron penetration were higher in pressure-treated material, particularly when the wood was incised.

**Morrell, J.J., and M.A. Newbill. 1990. Movement of chloropicrin or methylisothiocyanate through the boles of Douglas-fir trees. *Forest Science* 36:192-195. (For. Res. Lab.)**

For wood preservationists. Movement of the wood fumigants chloropicrin and methylisothiocyanate (MITC) in

Douglas-fir trees was measured 18 and 42 months after treatment. MITC concentrations were higher than those of chloropicrin after both periods of time. Both chemicals moved through the heartwood as far as 4 m from the point of application and should, therefore, protect wounded trees from fungal infection.

**Morrell, J.J., and M.A. Newbill. 1991. Survival of Basidiomycetes in Cellon®-treated Douglas-fir heartwood. Forest Products Journal 41(2):37-39. (For. Res. Lab.)**

For wood treaters and utilities personnel. The internal temperature of Douglas-fir poles was monitored during commercial treatment with pentachlorophenol by the Cellon® process. Internal temperatures during the process failed to reach those considered to be necessary for sterilization; however, fungi colonizing the poles treated by this process were eliminated despite the lower temperatures.

**Morrell, J.J., M. Newbill, and R.D. Graham. 1990. Evaluation of protective treatment for field-drilled bolt holes. Forest Products Journal 40(11/12):49-50. (For. Res. Lab.)**

For utilities personnel. Field drilling of preservative-treated wood breaks the protective barrier provided by the treatment, permitting colonization by decay fungi. The use of pentachlorophenol (penta) to protect against this damage in utility poles has been discontinued by many companies. Of four potential penta replacements evaluated over an 8-year period, the water-soluble chemicals ammonium bifluoride, Timbor®, and Boracol® provided the highest degree of protection.

**Morrell, J.J., M.A. Newbill, and C.M. Sexton. 1991. Basidiomycete colonization of Douglas-fir poles after polyborate treatments. Forest Products Journal 41(6):28-30. (For. Res. Lab.)**

For wood treaters and preservers. This study evaluated the ability of polyborates to protect air-seasoning Douglas-fir logs at sites in Oregon and California. Polyborate sprays at regular intervals or dip treatments at the start of air seasoning limited but did not completely prevent Basidiomycete colonization.

**Morrell, J.J., and M. Ritter. 1990. Bridge inspection for decay and other deterioration. P. 13.1-13.67 in Timber Bridges: Design, Construction, Inspection, and Maintenance. USDA Forest Service, Engineering Staff, Washington, D.C. EM 7700-8.**

For timber engineers. This chapter discusses the inspection process for assessing the condition of timber bridges.

**Morrell, J.J., and M. Ritter. 1990. Preservation and protection of timber bridges. P. 4.1-4.36 in Timber Bridges: Design, Construction, Inspection, and Maintenance. USDA Forest Service, Engineering Staff, Washington, D.C. EM 7700-8.**

For timber engineers. Processes by which wood used for timber bridges is treated are reviewed. The chapter includes descriptions of specifications and details about pretreatment methods for improving performance.

**Morrell, J.J., and T.C. Scheffer. 1989. Using the *Aspergillus* bioassay to detect and measure preservatives in wood.**

**Journal of Testing and Evaluation 17:310-314. (For. Res. Lab.)**

For quality control specialists and wood inspectors. The *Aspergillus niger* bioassay, which is based on the absence of dark-pigmented spores in the presence of toxicants, is one method for detecting and estimating levels of preservatives in wood. The *A. niger* bioassay is simple and inexpensive to perform, sensitive to many wood preservatives, highly reproducible, and, potentially, widely applicable.

**Morrell, J.J., and C.M. Sexton. 1990. Evaluation of a biological agent for controlling Basidiomycete attack of Douglas-fir and southern pine. Wood and Fiber Science 22:10-21. (For. Res. Lab.)**

For wood microbiologists and mycologists. This report details the ability of the *Trichoderma*-based biological control agent Binab® to limit growth of 10 Basidiomycetes commonly isolated from Douglas-fir or yellow pine. Binab® does not appear to be a feasible method for preventing or controlling decay of service poles without supplemental treatments that favor growth and activity of *Trichoderma*.

**Morrell, J.J., and C.M. Sexton. 1992. Effect of nutrient regimes, temperature, pH, and wood sterilization method on performance of selected bioprotectants against wood staining fungi. International Research Group on Wood Preservation, Stockholm, Sweden. IRG/WP/1551-92. (For. Res. Lab.)**

For mill operators and researchers. The effect of nutrient regimes, incubation temperature, media pH, and wood sterilization method on performance of four potential bioprotectants against wood-staining fungi were evaluated on small ponderosa pine samples over a 4-week period. The results illustrate the complexity of developing bioprotectants that can effectively compete under the array of conditions common to freshly sawn lumber and suggest that considerable additional research is needed.

**Morrell, J.J., C.M. Sexton, and M.A. Newbill. 1992. Fumigant treatment of wood species used for railroad ties: a preliminary evaluation. Forest Products Journal 42(1):58-61. (For. Res. Lab.)**

For railway maintenance personnel. The feasibility of fumigant treatment to extend the service life of railway crossties was evaluated in a small-block test of 18 wood species commonly employed in U.S. rail systems. Although results varied widely, most species were receptive to fumigant treatment. The authors conclude that field trials of fumigants for protecting wood ties are warranted.

**Morrell, J.J., C.M. Sexton, and A.F. Preston. 1990. Effect of moisture content of Douglas-fir heartwood on longitudinal diffusion of boron from fused borate rods. Forest Products Journal 40(4):37-40. (For. Res. Lab.)**

For wood treaters and utilities personnel. The effect of wood moisture content (MC) on the longitudinal diffusion of boron was investigated in Douglas-fir heartwood blocks equilibrated to MCs ranging from 20 to 100 percent. The results indicate that boron from fused

borate rods will diffuse well through Douglas-fir heartwood when the MC exceeds 40 percent.

**Morrell, J.J., and R.A. Zabel. 1990. Influence of temperature on soft rot capability of fungi isolated from preservative-treated southern pine utility poles. *Material und Organismen* 25:81-85. (For. Res. Lab.)**

For wood microbiologists. This study examined how several species of soft rot fungi isolated from preservative-treated blocks of southern pine respond to a range of incubation temperatures. Results suggest that at least two incubation temperatures are warranted when evaluating soft rot fungi.

**Morrell, J.J., A.R. Zahora, M.E. Corden, and M.A. Newbill. 1990. Performance of gelatin-encapsulated methylisothiocyanate in Douglas-fir poles. *Forest Products Journal* 40(7/8):37-40. (For. Res. Lab.)**

For wood technologists. The ability of gelatin-encapsulated methylisothiocyanate (MITC) to eliminate Basidiomycetes and prevent reinfestation by these fungi was evaluated in Douglas-fir poles treated with pentachlorophenol or chromated copper arsenate. Results reconfirm that gelatin encapsulation provides a highly effective method for safely containing MITC prior to application and does not adversely affect fumigant performance.

**Newbill, M.A., and J.J. Morrell. 1989. Effect of isolate source on the capacity of the *Aspergillus niger* bioassay to resolve preservative retention. *Material und Organismen* 24:251-257. (For. Res. Lab.)**

For wood treaters and pathologists. The variation in response of 10 *Aspergillus niger* isolates to pentachlorophenol, copper-8-quinolinolate, or 3-iodopropynyl butylcarbamate was evaluated. The results suggest that any *A. niger* isolate may be used for the bioassay, provided it is tested against blocks containing known levels of the test chemical.

**Newbill, M.A., and J.J. Morrell. 1990. Marine capping in combination with chemical treatments to prevent and arrest pile-top decay. *Holzforschung* 44:73-75. (For. Res. Lab.)**

For users of creosote-treated marine piling. The effectiveness of various chemical treatments applied to pile tops alone or in combination with water-shedding pile caps was tested. Virtually any cap that sheds water provides some protection, but chemicals in combination with a water-shedding cap provide optimum protection for marine piling.

**Newbill, M.A., and J.J. Morrell. 1990. Protection of western redcedar sapwood from decay. *Forest Products Journal* 40(6):29-32. (For. Res. Lab.)**

For wood preservers and utilities personnel. Thirty chemical formulations including pentachlorophenol were evaluated for their ability to prevent decay of western redcedar sapwood during and after 2 years' exposure on a test fence. *Aspergillus* bioassays revealed that 22 of the 30 formulations tested produced some measurable zone of effect 2 years after treatment. Modified soil block tests showed that six chemical formulations were comparable with penta.

**Newbill, M.A., and J.J. Morrell. 1991. Effect of elevated temperatures on survival of Basidiomycetes that colonize untreated Douglas-fir poles. *Forest Products Journal* 41(6):31-33. (For. Res. Lab.)**

For wood treaters and utilities personnel. The effect of elevated temperatures on Basidiomycete survival in air-seasoned Douglas-fir poles was investigated by exposing sapwood and heartwood blocks colonized by common fungi to a range of temperatures. Results indicated that a 1.25-hour exposure at 65.6°C will eliminate all fungi tested from air-seasoned poles.

**Newbill, M.A., and J.J. Morrell. 1991. Fumigant control of marine borer attack in Douglas-fir piling. *Forest Products Journal* 41(5):49-52. (For. Res. Lab.)**

For marine wood users, harbormasters, and wood scientists. Experimental Douglas-fir pile sections were exposed for 3 years in marine waters to assess the feasibility of using the fumigants chloropicrin, Vorlex®, or methylisothiocyanate to enhance piling performance. Visual and chemical tests indicated that fumigant treatments did not provide long-term protection against marine borer attack when untreated wood was exposed during construction.

**Pellerin, R.F., W.L. Galligan, M.A. Barnes, P.M. Kent, and R.J. Leichti. 1990. Developing continuing education in wood engineering for design professionals. P. 917-921 in *Proceedings of the 1990 International Timber Engineering Conference. Steering Committee of the 1990 International Timber Engineering Conference, Tokyo, Japan.***

For those interested in continuing education. The Wood Design Advisory Committee is a leader of successful program opportunities in continuing education for the practicing engineer. This paper offers a discussion of the many facets of their continuing education and technical activities.

**Polensek, A., and S. Jang. 1989. Predicting creep of nailed lumber-to-plywood joints. *Journal of Engineering Mechanics* 115:2182-2198. (For. Res. Lab.)**

For structural engineers, wood scientists, and designers of wood buildings. Two theoretical models were developed to predict creep of joints under variable loads from test data on creep under constant loads. Predicted and experimental data agreed closely for all solutions, but the simplest and most accurate predictions were based on the modified superposition principle.

**Polensek, A., and M. Kazic. 1991. Reliability of nonlinear wood composites in bending. *Journal of Structural Engineering* 117:1685-1702.**

For wood engineers. A simplified procedure developed for probability-based analysis of bending/compression systems in light-frame wood buildings showed that Douglas-fir and southern pine wall systems behaved nonlinearly long before collapse. Though walls proved highly reliable, the probability of failure was increased by including axial load and composite action, was unaffected by errors in lumber grading, and was strongly affected by changes in variability of framing modulus of rupture and wind velocity.

- Polensek, A., and B.D. Schimel. 1991. Dynamic properties of light-frame wood subsystems.** *Journal of Structural Engineering* 117:1079-1095. (For. Res. Lab.)
- For structural, wood, and consulting engineers. Static and dynamic testing of three panel types simulating typical subsystems in light-frame wood buildings showed that lumber properties had a negligible effect on damping and stiffness. These findings should be useful for identifying subsystem degrade in existing wood structures and for developing degradation models.
- Resch, H. 1989. Case studies: how mills produce fuel from residues.** *Forest Industries* 116(12):16-23.
- For executive and strategic planners for wood processing plants, consulting engineers who design wood processing plants, and those interested in energy sources. This article, part II of a two-part series on current methods of manufacturing pellets and briquettes, looks at practical applications of the theoretical data and the performance of different types of machines in terms of output and power consumption.
- Resch, H. 1989. Fuel from wood residues: a "profit center" for mills.** *Forest Industries* 116(11):24-31.
- For executive and strategic planners for wood processing plants, consulting engineers who design wood processing plants, and those interested in energy sources. Forest products processors may be able to boost their incomes by converting wood and bark residues into densified fuels. This article, the first of a two-part series that focuses on current methods of manufacturing pellets and briquettes, discusses preparation of the raw material and underlying principles of densification.
- Resch, H., H. Kang, and M.L. Hoag. 1989. Drying Douglas-fir lumber: a computer simulation.** *Wood and Fiber Science* 21:207-218. (For. Res. Lab.)
- For researchers and dry-kiln operators. Three experimental kiln runs were designed to investigate how well the drying rate of 2-inch-thick lumber from Douglas-fir heartwood can be simulated by a computer model. Simulated data were compared with gravimetric records and with electrical measurements obtained from a thermomisture meter. Both the computer model and thermomisture meter proved to be excellent tools for future lumber drying research and improvement of kiln schedules.
- Scheffer, T.C. 1991. Damage to West Coast wood structures by decay fungi, insects, and marine borers.** *Forest Research Laboratory, Oregon State University, Corvallis. Special Publication 22. 32 p.* (For. Res. Lab.)
- For wood users. A condensed account of the chief wood-destroying organisms on the West Coast, with guidance on ways of recognizing and controlling them. Suggestions are provided on how to avoid conditions that favor rot or invite insect damage in buildings or boats. Protection of waterfront structures against marine borers is discussed.
- Sexton, C.M., and J.J. Morrell. 1992. Effects of *Trichoderma harzianum* on enzyme activity and oxalic acid production of *Gloeophyllum trabeum* in ponderosa pine sapwood blocks.** *International Research Group on Wood Preservation, Stockholm, Sweden. IRG/WP/1550-92.* (For. Res. Lab.)
- For wood preservationists and mycologists. The effect of a bioprotectant, *Trichoderma harzianum*, on the activity of *Gloeophyllum trabeum* was investigated by means of wood wafer sandwiches. The bioprotectant was not capable of completely inhibiting the decay fungus. Further trials to evaluate the effect of prior bioprotectant colonization on basidiomycete activity are planned.
- Sexton, C.M., J.J. Morrell, and M.Y. Giron. 1990. Survival of selected wood-inhabiting fungi in Tangile after exposure to chloropicrin or methylisothiocyanate.** *Material and Organismen* 25:115-121. (For. Res. Lab.)
- For wood preservationists, microbiologists, and mycologists. The ability of two microfungi, one Ascomycete, and eight Basidiomycetes, all growing in Tangile blocks, to survive exposure to chloropicrin or methylisothiocyanate was evaluated in a closed desiccator system. The results suggest that higher chemical dosages or more frequent reapplications may be necessary to eliminate tolerant fungi from wood.
- Sexton, C.M., J.J. Morrell, and M.A. Newbill. 1991. Controlling decay fungi in Douglas-fir heartwood with pelletized sodium n-methylthiocarbamate.** *Wood and Fiber Science* 23:590-596. (For. Res. Lab.)
- For wood preservers and utilities personnel. A small block test was used in assessing whether pelletized sodium n-methylthiocarbamate (NaMDC) would decompose and produce methylisothiocyanate, thereby eliminating colonies of *Antrodia carbonica* from Douglas-fir heartwood. The results indicate that pelletized NaMDC can effectively control fungal infestations in Douglas-fir heartwood.
- Sharp, D.J., and S.K. Suddarth. 1991. Volumetric effects in structural composite lumber. P. 3.427-3.437 in Proceedings of the 1991 International Timber Engineering Conference. Volume 3. Timber Research and Development Association, High Wycombe, England.**
- For those interested in mechanical properties of composite materials. The low variances in mechanical properties of structural composite lumber lead to relatively high design values; because of this, factors that might encroach on adequate margins of safety must be evaluated. A significant factor is member volume. Standard theory and tests were employed to quantify the effect for engineering application.
- Smith, S.M., and J.J. Morrell. 1991. Measuring distribution of chromated copper arsenate around incisions in Douglas-fir heartwood by direct-scan X-ray techniques.** *Wood Protection* 1(1):31-37. (For. Res. Lab.)
- For wood treaters and wood products researchers. This study investigated the use of direct-scan X-ray techniques to determine the distribution of chromated copper arsenate around incisions in Douglas-fir heartwood wafers. Results suggested that direct X-ray scanning provided accurate representations of preservative distribution patterns. These patterns can be used to develop models which optimize incising patterns to achieve maximum preservative distribution.

- Smith, S.M., J.J. Morrell, and C. Sexton. 1992. Residual strength of Douglas-fir sapwood and heartwood as affected by fungus colony size and number of colony forming units. *Forest Products Journal* 42(4):19-24. (For. Res. Lab.)
- For wood inspectors and researchers. Small Douglas-fir specimens were inoculated with a drop of water containing fungus spores or mycelial fragments to simulate fungal infection of wood through air-seasoning checks. Complete colonization and subsequent strength loss were apparent after 3 months, although, in practice, colony size and strength loss are probably limited by adverse temperatures and moisture and competing microorganisms. The number of colony-forming units had no relation to loss of wood strength during the 12 months of incubation.
- Smith, S.M., J.J. Morrell, and J.E. Winandy. 1990. Measuring retention of chromated copper arsenate in conifer sapwood by direct-scan X-ray techniques. *Journal of Wood Chemistry and Technology* 10(1):21-38. (For. Res. Lab.)
- For wood incisers, preservers, and scientists. This study was designed to determine how well direct-scan X-rays measure retention and distribution of chromated copper arsenate in wafers of conifer sapwood. X-ray intensities predicted 98 percent of the variation in preservative retention among the wafers. Direct X-ray scanning of wood treated with inorganic arsenicals can provide a non-destructive way to assess preservative content and map preservative distribution.
- Subrahmanyam, S., and C.J. Biermann. 1992. Generalized rosin soap sizing with coordinating elements. *Tappi Journal* 75(3):223-228. (For. Res. Lab.)
- For people responsible for paper machines at paper mills. The pulp and paper industry is shifting toward paper manufacture under alkaline conditions. This study examined the fundamental coordinate chemistry of sizing in order to extend the use of rosin sizing into the alkaline range, and also characterized the role of alum so that it might be made more efficient or replaced in rosin sizing.
- White, M.S., T.E. McLain, D. Padla, and B. Kasal. 1990. Hardness gradients within roll-threaded steel nails. *Journal of Testing and Evaluation* 18:128-130.
- For those interested in steel hardness of nails. The Vickers micro-hardness test was used to demonstrate that hardness is relatively uniform across the nail shank diameter; hence, a single Rockwell micro-hardness measure of several properly prepared surfaces should give a reliable indication of nail-shank hardness.
- Wilson, J. 1989. Radio-frequency drying of wood veneer—commercial use. *Journal of Microwave Power and Electromagnetic Energy* 24(2):67-73. (For. Res. Lab.)
- For microwave-equipment and veneer users and plywood producers. A 300-kW radio-frequency (RF) oven was studied for redrying wood veneer in a plywood operation to identify optimum operating conditions for output and cost savings. Installing the RF oven increased plant production by 25 percent.
- Wilson, J.B. 1990. Nondestructive evaluation of wood utility poles in service. P. 73-77 in *Fifth International Conference on Transmission and Distribution Construction and Live Line Maintenance. Proceedings, IEEE Meeting of Electrical Safety and Maintenance Operation-90*. Institute of Electrical Engineers, New York.
- For personnel in the electrical and communications utilities. An instrument for predicting pole strength on the basis of nondestructive tests would be valuable to pole inspectors. In this review, use of sonic testing instruments is discussed in terms of principles of instrument operation, accuracy, reliability, factors affecting predictions, and zones of influence.
- Winandy, J.E., and J.J. Morrell. 1990. Protection of wood designs in adverse environments. P. 303-313 in *Serviceability and Durability of Construction Materials. Proceedings of the First Materials Engineering Congress. American Society of Civil Engineers, New York*. (For. Res. Lab.)
- For civil engineers and wood designers. This paper discusses organisms that attack wood, preservative treatments available, wood products with which preservatives are most often used, treating standards of the American Wood-Preservers' Association (AWPA), and the effects of AWPA-specified preservative treatments on mechanical properties.
- Wolcott, M.P., B. Kasal, F.A. Kamke, and D.A. Dillard. 1989. Modeling wood as a polymeric foam: an application to wood-based composite manufacture. P. 53-61 in *Mechanics of Cellulosic and Polymeric Materials. AMD-Volume 99. American Society of Mechanical Engineering, New York*.
- For those interested in mechanics of materials. This research examines the modeling of micro-structure collapse according to theories of cellular materials. The objective was to use the information as a form of nonlinearizing function in a viscoelasticity analysis with application to hot-pressed wood-based composites.
- Wolcott, M.P., B. Kasal, F.A. Kamke, and D.A. Dillard. 1989. Testing small wood specimens in transverse compression. *Wood and Fiber Science* 21:320-329.
- For those interested in wood mechanics and mechanical testing. The standard test for compression perpendicular to grain is examined. Pure compression tests were conducted. Specimen height influenced Young's modulus and yield strain, but did not affect yield stress.
- Zahora, A.R., and J.J. Morrell. 1989. The influence of wood moisture content on the fungitoxicity of methylisothiocyanate in Douglas-fir heartwood. *Wood and Fiber Science* 21:343-353. (For. Res. Lab.)
- For wood preservationists. The toxicity of low levels of methylisothiocyanate (MITC) to the decay fungus *Poria carbonica* and the influence of wood moisture content (MC) on the performance of MITC were investigated. The MC of Douglas-fir heartwood greatly influenced the susceptibility of the fungus to MITC vapors and the amount of MITC adsorbed by the wood.



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