United States
Department of
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Forest Service

Pacific Northwest
Research Station

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April 2005

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Pacific Northwest Research Station Publications

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Aquatic/Riparian Systems

01-210

Kovalchik, B.L.; Clausnitzer, R.R.
2004. Classification and management of aquatic, riparian, and wetland sites on the national forests of eastern Washington: series description. Gen. Tech. Rep. PNW-GTR-593. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 354 p. In cooperation with: Pacific Northwest Region, Colville, Okanogan, and Wenatchee National Forests.

This is a classification of aquatic, wetland, and riparian series and plant associations found within the Colville, Okanogan, and Wenatchee National Forests. It is based on the potential vegetation occurring on lake and pond margins, wetland fens and bogs, and fluvial surfaces along streams and rivers within Forest Service lands. Data used in the classification were collected from 1,650 field plots sampled across the three forests. This classification identifies 32 series separated into four physiognomic classes: coniferous forests, deciduous forests, shrubs, and herbaceous vegetation. In addition, keys to the identification of 163 plant associations or community types are presented. The report includes detailed descriptions of the physical environment, geomorphology, ecosystem function, and management of each series. This classification supplements and expands information presented in upland forest plant association classifications previously completed for these three eastern Washington forests. It is a comprehensive summary of the aquatic, riparian, and wetland series and contributes to the understanding of ecosystems and their management in eastern Washington.

Keywords: Riparian, aquatic, wetland, vegetation classification, series description, plant association, plant community, riparian vegetation, riparian ecosystems, eastern Washington.

Economics

04-093

Garber-Yonts, B.E.
2004. The economics of amenities and migration in the Pacific Northwest: review of selected literature with implications for national forest management. Gen. Tech. Rep. PNW-GTR-617. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48 p.

This paper reviews literature on the influence of nonmarket amenity resources on population migration. Literature reviewed includes migration and demographic studies; urban and regional economics studies of amenities in labor markets, retirement migration, and firm location decisions; nonmarket valuation studies using hedonic price analysis of amenity resource values; land use change studies; and studies of the economic development influence of forest preservation. A synthesis of the literature finds that the influence of amenities is consistently

shown to be a positive factor contributing to population growth in urban and rural areas characterized by proximity to public forest lands. Beyond this broad finding, however, little research has been conducted at an appropriate scale to be directly useful in forest management and planning decisions. Areas for further research are identified.

Keywords: Amenities, migration, hedonic studies, rural development, land use change, regional economics.

04-269

Tsournos, P.; Haynes, R.W.
2004. An assessment of growth and development paths for southeast Alaska. Gen. Tech. Rep. PNW-GTR-620. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27 p.

The intuitive explanation for why an economy grows or develops often involves the ways in which land (resources), labor, and capital interact. Here we review the literature for what is known about the different pathways for economic growth and development in resource-abundant regions. We discuss the effectiveness of the forest products industry as a determinant of economic development and how comparative advantages of different forest goods and services have changed. Much of our discussion is based on southeast Alaska where the development of a forest products industry was seen as offering potential economic opportunities that would increase the stability of local communities. The experience of the last several decades there suggests that a more comprehensive strategy than just the development of a timber industry is required to sustain economic growth.

Keywords: Economic development, southeast Alaska, Tongass National Forest.

Ecosystem Structure and Function

04-123

Hessl, A.E.; Milesi, D.; White, M.A. [and others]
2004. Ecophysiological parameters for Pacific Northwest trees. Gen. Tech. Rep. PNW-GTR-618. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 14 p.

We developed a species- and location-specific database of published ecophysiological variables typically used as input parameters for biogeochemical models of coniferous and deciduous forested ecosystems in the Western United States. Parameters are based on the requirements of Biome-BGC, a widely used biogeochemical model that was originally parameterized for the forests of the Pacific Northwest. Several other ecosystem models, including Century 5, Daycent, TEM, and PnET, also use some of the inputs described here. This database provides a compendium of ecophysiological data for the Pacific Northwest that will provide easily accessible information for particular tree species, parameters, and ecosystems for application to simulation modeling.

Keywords: Ecological modeling, ecophysiology, Pacific Northwest forests.

Fire

04-290

Kline, J.D.
2004. Issues in evaluating the costs and benefits of fuel treatments to reduce wildfire in the Nation's forests. Res. Note PNW-RN-542. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 46 p.

Wildland fire has been perhaps the most vexing forest management and policy issue in the United States in recent years, stirring both passionate and reasoned debate among managers, policymakers, researchers, and citizens alike. Years of fire suppression and increasing constraints on natural and prescribed burning, possibly along with climate change, have altered

historical wildfire regimes resulting in increased wildfire severity in the Nation's forests. The growing wildfire threat has motivated increasing interest in reducing hazardous fuels through prescribed burning, thinning, and harvesting. Debate about whether such fuel treatments are necessary persists owing in part to the complexity of the wildfire issue and to general disagreement among managers, policymakers, researchers, and citizens about whether long-term wildfire impacts and current trends present a real problem. Although scientific research continues to resolve many aspects of the wildfire issue, comprehensive economic analyses examining the wisdom of investing in fuel treatments to reduce wildfire threat are lacking. This report presents one way of conceptualizing the costs and benefits of fuel treatments and wildfire and briefly reviews issues related to their evaluation. The intent is to enrich ongoing debate by organizing management and policy dialogue around a conceptual framework that characterizes the long-term impacts of fuel treatments on forest conditions and wildfires, within an analytical context that includes both wildfire- and nonwildfire-related forest management activities.

Keywords: Fuel treatments, wildfire, wildland/urban interface, cost-benefit analysis.

Forest Management

04-077

Fiedler, C.E.; Keegan, C.E., III; Woodall, C.W.; Morgan, T.A.

2004. A strategic assessment of crown fire hazard in Montana: potential effectiveness and costs of hazard reduction treatments. Gen. Tech. Rep. PNW-GTR-622. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48 p.

Estimates of crown fire hazard are presented for existing forest conditions in Montana by density class, structural class, forest type, and land-ownership. Three hazard reduction treatments were evaluated for their effectiveness in treating historically fire-adapted forests (ponderosa pine [*Pinus ponderosa* Dougl. ex Laws.], Douglas-fir [*Pseudotsuga menziesii* (Mirb.) Franco], dry mixed conifer) that rate high/moderate for fire hazard. Comprehensive restoration treatments that address density, structure, and species composition of high-hazard forests are significantly more effective at reducing hazard than thin-from-below approaches that remove smaller trees only. Trees removed as a byproduct of the restoration treatment yielded net revenues averaging over $600 per acre, whereas the thin-from-below treatment conditions were projected forward 30 years and reevaluated for hazard. Projections revealed that effectiveness of all treatments diminished over time; however, forests receiving the comprehensive restoration treatment maintained substantially lower hazard 30 years after treatment than they would have had they received the alternative treatments.

Keywords: Montana, wildfire, forest inventory, forest restoration, Forest Inventory and Analysis, hazard reduction, treatments, costs.

04-238

Liang, J.; Buongiorno, J.; Monserud, R.A.

2004. CalPro: a spreadsheet program for the management of California mixed-conifer stands. Gen. Tech. Rep. PNW-GTR-619. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 32 p.

CalPro is an add-in program developed to work with Microsoft Excel to simulate the growth and management of uneven-aged mixed-conifer stands in California. Its built-in growth model was calibrated from 177 uneven-aged plots on industry and other private lands. Stands are described by the number of trees per acre in each of nineteen 2-inch diameter classes in two species groups, hardwoods and softwoods. CalPro allows managers to predict stand development by year and for many decades from a specific

initial state. Users can choose cutting regimes by specifying the interval between harvests (cutting cycles) and a target distribution of trees remaining after harvest. A target distribution can be a reverse-J-shaped distribution or any other desired distribution. Diameter-limit cuts can also be simulated. Tabulated and graphic results show diameter distributions, basal area, volumes, income, net present value, and indices of stand diversity by species and size. This manual documents the program installation and activation, provides suggestions for working with Excel, and gives background information on CalPro's growth model. It offers a comprehensive tutorial in the form of two practical examples that explain how to start the program, enter simulation data, execute a simulation, compare simulations, and plot summary statistics.

Keywords: Mixed conifers, uneven-age management, economics, ecology, CalPro, simulation, software, growth model, diversity.

03-402

Pacific Northwest Research Station
2004. Maybeso Experimental Forest [Brochure]. Portland, OR: U.S. Department of Agriculture, Forest Service. [Irregular pagination].

Maybeso Experimental Forest, located on Prince of Wales Island in southeast Alaska, is important for studying silviculture, forest management, fish habitat, and hydrology in hemlock-spruce forests. Past research began with studies of timber harvest techniques and broadened into studies of forest fragmentation, slope stability, effects of timber harvest on salmon spawning habitat, and ecological roles of red alder. Current research focuses on the management of second-growth forests, the development and evaluation of watershed restoration methods, fish habitat, and hydrologic processes. The research is expected to provide findings applicable to watersheds throughout southeast Alaska and the Pacific Northwest.

Keywords: Maybeso, experimental forest, Prince of Wales Island, Sitka spruce, silviculture.

Resource Inventory

04-078

Campbell, S.; Dunham, P.; Azuma, D.
2004. Timber resource statistics for Oregon. Resour. Bull. PNW-RB-242. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 67 p.

This report is a summary of timber resource statistics for all ownerships in Oregon. Data were collected as part of several statewide multiresource inventories, including those conducted by the Pacific Northwest Region (Region 6) on National Forest System lands in Oregon, by the Bureau of Land Management (BLM) on BLM lands in western Oregon, and by the Pacific Northwest Research Station Forest Inventory and Analysis (FIA) Program on BLM lands in eastern Oregon and state and private lands across Oregon. Statistical tables provide estimates of land area, timber volume, growth, mortality, and harvest for the state and half-state units (western and eastern Oregon).

Keywords: Forest inventory, statistics (forest), timber resources, timberland, resources (forest), Oregon, western Oregon, eastern Oregon.

04-356

Donnegan, J.A.; Butler, S.L.; Grabowiecki, W. [and others]

2004. Guam's forest resources, 2002. Resour. Bull. PNW-RB-243. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 32 p.

The Forest Inventory and Analysis Program collected, analyzed, and summarized field data on 46 forested plots on the island of Guam. Estimates of forest area, tree stem volume and biomass, the numbers of trees, tree damages, and the distribution of tree sizes were summarized for this statistical sample. Detailed tables and graphical highlights provide a summary of Guam's forest resources and a baseline from which to detect future change following remeasurement of the permanent field plots.

Keywords: Guam, biomass, damage, FIA, forest inventory, volume.

04-355

Donnegan, J.A.; Mann, S.S.; Butler, S.L.; Hiserote, B.A.

2004. American Samoa's forest resources, 2001. Resour. Bull. PNW-RB-244. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 32 p.

The Forest Inventory and Analysis Program of the Pacific Northwest Research Station collected, analyzed, and summarized data from field plots, and mapped land cover on four islands in American Samoa. This statistical sample provides estimates of forest area, stem volume, biomass, numbers of trees, damages to trees, and tree size distribution. The summary provides detailed tables and graphical highlights to help inform resource managers and policymakers, as well as educating the public regarding the status and trends in their natural resources.

Keywords: American Samoa, biomass, damage, FIA, forest inventory, timber volume.

Publications Available Elsewhere

The following publications are available through interlibrary loan, by writing to the locations indicated, or by using the form indicated. Many journal articles are available on our Web site at http://www.fs.fed.us/pnw/publications/nonstation.shtml.

Aquatic and Riparian Systems

Orlikowska, E.H.; Deal, R.L.; Hennon, P.E.; Wipfli, M.S.
2004. The role of red alder in riparian forest structure along headwater streams in southeastern Alaska. Northwest Science. 78(2): 111-123.

We assessed the influence of red alder on tree species composition, stand density, tree size distribution, tree mortality, and potential for producing large conifers in 38- to 42-year-old riparian forests along 13 headwater streams in the Maybeso and Harris watersheds on Prince of Wales Island, Alaska. Red alder ranged from zero to 53 percent of the total live basal area of the stands. Tree density, basal area of live and dead trees, and mean diameter of live conifers were not significantly related to the percentage of alder as a proportion of the total stand live basal area within these riparian forests. The mean diameter of the 100 largest conifers per hectare was similar among different sites and seemed unrelated to the amount of alder in the stand. The mean diameter of dead conifers increased slightly with increasing proportion of red alder. Most dead trees were small and died standing. Red alder was much more concentrated immediately along stream margins. The presence of red alder did not inhibit the production of large-diameter conifers, and both alder and conifers provided small woody debris for fishless headwater streams in southeastern Alaska. Red alder is an important structural component of young-growth riparian stands.

Keywords: Red alder, conifer, riparian forest, stand structure, tree mortality, woody debris recruitment, headwater streams.

(See Juneau order form.)

Wondzell, S.M.; Bisson, P.A.
2003. Influence of wood on aquatic biodiversity. American Fisheries Society Symposium. 37: 249-263.

Wood influences the full variety of life in aquatic and riparian areas, from genes and species to ecosystems and landscapes. We review the role of wood in mediating biodiversity in aquatic and riparian ecosystems, identifying the topics, types of diversity, taxonomic groups, and scales that have been studied and highlight gaps in existing knowledge. The components of biodiversity most frequently studied include species diversity (or richness) of macroinvertebrates and fishes, structural complexity within habitat units, and the diversity of habitats found within a stream reach. Many of these studies show that large wood increases biodiversity. The abundance of wood in channels and adjacent riparian zones, as well as its functional role, differs greatly in longitudinal, lateral, and vertical dimensions along the river corridor. The influence of wood on community structure and ecosystem processes also differs across these dimensions and from stream headwaters to river mouths and near-shore marine environments. Thus wood can influence biodiversity at all these scales. It also is important to note that many studies failed to show an effect of wood on biodiversity. These conflicting results illustrate that wood abundance, its functional role in streams, and its influence on biodiversity are dependent on a variety of factors, and it is the total effect of all of these factors, not simply the presence of large wood, which determines patterns of biodiversity.

Keywords: Biodiversity, large wood, species richness, habitat complexity.

(See Olympia order form.)

Biometrics

Ralston, R.; Buongiorno, J.; Fried, J.S. 2004. Potential yield, return, and tree diversity of managed, uneven-aged Douglas-fir stands. Silva Fennica. 38(1): 55-70.

The effects of different management regimes on uneven-aged Douglas-fir stands in the Pacific Northwest of the United States were predicted with a simulation model. Simulation results were compared in terms of financial returns, timber productivity, species group diversity (hardwoods versus softwoods), size class diversity, and stand structure. Other things being equal, there was little difference between 10- and 20-year cutting cycles. The highest financial returns were obtained with either a 23-inch diameter-limit cut, or a basal area-diameter-q-ratio distribution with 90 ft^2 of residual basal area, a 28-inch maximum diameter, and a q-ratio of 1.2. Using the current stand state as the residual distribution was the best way to obtain high tree-size and species diversity.

Keywords: Uneven-age management, diversity, WestPro, simulation, economics, Douglas-fir.

(See Portland order form.)

Ralston, R.; Buongiorno, J.; Schulte, B.; Fried, J. 2003. Non-linear matrix modeling of forest growth with permanent plot data: the case of uneven-aged Douglas-fir stands. International Transactions in Operations Research. 10: 461-482.

A simple stage-structured matrix growth-and-yield model is presented for mixed, uneven-aged Douglas-fir and hardwood stands, calibrated with data from 66 permanent plots measured by the Forest Inventory and Analysis Program in Oregon and Washington. The density-dependent matrix model predicts the number of trees by diameter class and species type, softwood or hardwood. The parameters are based on individual tree growth equations, individual tree mortality equations, and stand ingrowth equations. Two kinds of model validation are described. Effects of different cutting cycles on productivity, diversity, and financial returns are estimated. Results suggest that uneven-age management of the Douglas-fir forest type in the Pacific Northwest can be as productive as even-age management.

Keywords: Uneven-age, selection, matrix, mortality, diversity, ecology, economics, biometrics, management, Douglas-fir.

(See Portland order form.)

Botany

Lindh, B.C. 2003. Understory herb and shrub responses to root trenching, pre-commercial thinning, and canopy closure in Douglas-fir forests of the western Cascades, Oregon. Corvallis, OR: Oregon State University. 119 p. Ph.D. dissertation.

This dissertation examines factors limiting understory herb presence and flowering in young second-growth Douglas-fir (*Pseudotsuga menziesii*) forests on the west side of the Cascade Range in Oregon. I focused on three groups of understory herb species in young stands: disturbance responsive (release), forest generalist, and old-growth associated. Stands that had been precommercially thinned 20 years earlier exhibited understory composition more similar to old growth than did unthinned stands. Flowering of old-growth-associated and disturbance-responsive species was negatively correlated with conifer basal area.

Keywords: Young stands, old growth, herbs, understory, thinning, flowering, phenology.

(Available only through library or interlibrary loan.)

Ecosystem Structure and Function

Mote, P.W.; Parson, E.A.; Hamlet, A.F. [and others]
2003. Preparing for climatic change: the water, salmon, and forests of the Pacific Northwest. Climatic Change. 61: 45-88.

Impacts of climatic variation on some of the Pacific Northwest's key natural resources can be quantified to estimate sensitivity to regional climatic changes expected as part of anthropogenic global climatic change. During the 20th century, the region experienced a warming of 0.8 °C. With output from eight climate models, we project further warming that will reduce regional snowpack that presently supplies water for ecosystems and human uses during the dry summers. Our understanding of past climate also illustrates the responses of human management systems to climatic stresses and suggests that a warming of the rate projected would pose significant challenges to the management of natural resources.

Keywords: Climate variations, Pacific Decadal Oscillation, salmon, resource management, water management.

(See Wenatchee order form.)

Pincheira, M.E.
2004. Changes in population structure, mortality, and biomass of trees in old-growth Sitka spruce/western hemlock stands on the Olympic Peninsula of Washington. Seattle, WA: University of Washington. 85 p. M.S. thesis.

A detailed study of ecosystem, population, and structural changes in old-growth Sitka spruce and western hemlock forests is the topic of this thesis. Data are from permanent sample plots at seven forested sites located on the west side of the Olympia Peninsula of Washington; these plots are part of the Pacific Northwest long-term permanent vegetation plot series. Forests ranged in age from 210 to 256 years at the time of plot establishment and have long (15 to 22 years) records of repeated observation. The primary objectives of this study were (1) to evaluate changes in tree population structure, (2) to determine rates and causes of mortality, and (3) to determine trends in biomass accumulation.

Keywords: Spruce/hemlock forests, forest dynamics, tree mortality, tree biomass, tree populations structure.

(Available only through library or interlibrary loan.)

Fire

Kruger, L.; Sturtevant, V.
2004. Roslyn, WA: steps to improve community preparedness for wildfire. Case study 9. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 4 p.

Fifteen case studies were conducted around the country in an effort to understand community efforts to be better prepared for wildfire. Each case study documents keys for wildfire preparedness, next steps for the community, and lessons from other communities. In Roslyn, cooperation and collaboration across agencies and with private property owners, taking advantage of teachable moments, and using demonstration projects and field trips were important for success.

Keywords: Community preparedness for wildfire, community fire planning, outreach and education, cooperation.

(See Juneau order form. Available in electronic format at http://ncrs.fs.fed.us/pubs/bro/roslyn.pdf.)

Rorig, M.L.; Ferguson, S.A.; Sandberg, D.V. 2003. Fire weather indexes and fuel condition in Alaska. In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G., eds. Proceedings of Fire Conference 2000: the first national congress on fire ecology, prevention, and management. Misc. Publ. 13. Tallahassee, FL: Tall Timbers Research Station: 202-210.

The National Fire Danger Rating System and the Canadian Forest Fire Danger Rating System were developed to assess and predict wildfire danger and to model fuel conditions for prescribed fires in the forests of the United States and Canada. Meteorological and fuel moisture data from the 1999 Alaska FrostFire experimental burn were used to evaluate the ability of these indexes to determine fuel condition in black spruce and hardwood boreal forests. The indexes were compared with moss and fuel stick moistures collected in and near the watershed that was burned.

Keywords: Fire weather, fire prescription, Canadian Forest Fire Weather Index System, fuel moisture, National Fire Weather Danger Rating System.

(See PWFSL order form.)

Rorig, M.L.; Ferguson, S.A.; Sandberg, D.V. 2003. The use of historical fire weather indexes in planning a prescribed fire. In: Galley, K.E.M.; Klinger, R.C.; Sugihara, N.G., eds. Proceedings of Fire Conference 2000: the first national congress on fire ecology, prevention, and management. Misc. Publ. 13. Tallahassee, FL: Tall Timbers Research Station: 197-201.

In Alaska, the Canadian Forest Fire Weather Index System is used to track the effect of weather on fuel moisture conditions. The prescription for the FrostFire experimental burn near Fairbanks was predicated on the basic weather conditions as well as on the fire weather index codes that represent the moisture content of forest fuels. To determine the likelihood of the weather and fuels coming into prescription, the fire weather index codes for 31 previous fire seasons were computed. Based on these indexes and other considerations, the window for the experimental burn in 1999 was set from June 23 to July 31. Conditions came into prescription on July 8, and the fire was successfully ignited.

Keywords: Fire weather, fire prescription, Canadian Forest Fire Weather Index System, fuel moisture.

(See PWFSL order form.)

Fish

Latterell, J.J.; Naiman, R.J.; Fransen, B.R.; Bisson, P.A. 2003. Physical restraints on trout (*Oncorhynchus* spp.) distribution in the Cascade Mountains: a comparison of logged and unlogged streams. Canadian Journal of Fisheries and Aquatic Sciences. 60: 1007-1017.

The upstream extent of coastal cutthroat (*Oncorhynchus clarki clarki*) and rainbow trout (*O. mykiss*) distribution in logged and unlogged streams on the west side of the Cascade Range seems to be primarily constrained by steep channel gradient and sparse pool habitat. Narrow or intermittent wetted channels are also important constraints in logged drainages. The upstream extent of trout distribution seems to be resilient to the combined impacts of historical and current forest management activities, in the absence of impassable road culverts. Reductions in wetted channel width reduced the likelihood of trout presence in logged streams. The pervasive extent of native trout emphasizes the ecological importance of small streams in watershed planning.

Keywords: Trout, Cascade Range, logging effects, distribution models.

(See Olympia order form.)

Forest Management

Kakoyannis, C.
2004. Learning to address complexity in natural resource management. Corvallis, OR: Oregon State University. 200 p. Ph.D. dissertation.

Conventional natural resource management has struggled with effectively addressing dynamically complex natural resource issues. Many organizations structured in the rational-analytical paradigm of resource management are recognizing the need for new management approaches. The purpose of this research was to understand what organizational structures and processes inhibit or facilitate opportunities for organizational learning when addressing complex resource problems.

Keywords: Natural resource institutions, ecosystem management, policy, institutional change.

(Available only through library or interlibrary loan.)

Kruger, L.E.; Jakes, P.J.
2003. The importance of place: advances in science and application. Forest Science. 49(6): 809-821.

The concept of place is introduced and an orientation to literature about place is provided. Following the introduction, an overview is given of the papers in this special issue of *Forest Science*. The papers included in this issue were presented at the 2000 international symposium on society and resource management in Bellingham, Washington.

Keywords: Place, attachment to place, place-based planning, sense of place, resource management.

(See Juneau order form.)

Marshall, D.D.; Johnson, G.P.; Hann, D.W.
2003. Crown profile equations for stand-grown western hemlock trees in northwestern Oregon. Canadian Journal of Forest Research. 33: 2059-2066.

Crown profile equations were developed for stand-grown western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) in northwest Oregon. The profile model uses a segmented approach, dividing the crown into an upper and lower portion at the point of the largest crown width (LCW). The model explains about 86 percent of the variation in crown width when LCW is known, but only 66 percent when LCW is predicted by using a model devloped from a larger data set collected in the same area as the data for developing the crown profile models. The model can be adjusted by using measurements or predictions of LCW for western hemlock in other populations. Comparisons are made to the crown form of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco).

Keywords: Crown width, profile, western hemlock.

(See Olympia order form.)

McGaughey, R.J.
2001. Using data-driven visual simulations to support forest operations planning. In: Precision forestry: Proceedings of the 1st international precision forestry cooperative symposium. Seattle, WA: University of Washington, College of Forest Resources: 173-179.

Foresters and engineers charged with selecting stands for treatment, developing silvicultural prescriptions, and designing forest operations to meet specific goals often find it difficult to comprehend the complex interactions that occur across landscapes. Visual simulations based on

accurate terrain models and vegetation data provide a visual environment that can significantly improve the design and implementation of forest operations. Currently, visual simulations are used to present the final results of planning efforts. The use of visual simulations to support operational planning, implementation, and monitoring is relatively new. Visual simulation can provide feedback during the design of silvicultural prescriptions and unit boundaries; facilitate operator training by using equipment simulators; supply in-cab displays to provide information to equipment operators; and assist in monitoring compliance with designated travel paths, cut/leave tree specifications, and forest practice regulations. Current computers have sufficient computing power and graphics capability to make data-driven visual simulations a valuable part of forest operations planning.

Keywords: Visual simulation, forest operations, precision forestry.

(See PWFSL order form.)

Miner, C.; Kleine, M.
2003. Means of implementation: technology transfer and capacity building for sustainable forest management. In: Buck, A.; Parrotta, J.; Wolfrum, G., eds. Science and technology: building the future of the world's forests—planted forests and biodiversity. Occasional Pap. 15. Vienna, Austria: International Union of Forest Research Organizations: 15-18.

As scarce resources for forestry research are allocated, clear articulation of benefits of research is imperative. Technology transfer is a process toward assuring use and benefit. Communication among research stakeholders, developers, potential users, and community members creates a fluid process that can be highly effective. People come to use a concept, set of knowledge, methods, or technology through becoming aware of them, deciding if they will adopt them, and perhaps eventually incorporating them into regular use. This paper describes categories and characteristics of users of forest technologies and information, characteristics of scientific information and knowledge as innovations, technologies and intellectual property rights, and the importance of building capacity for technology transfer. Proposed actions to build such capacity are provided for policy- and decisionmakers.

Keywords: Technology transfer, capacity building, forest research, innovation diffusion.

(See headquarters mailing list.)

Szaro, R.C.; Peterson, C.E.
2004. Evolving approaches toward science-based forest management. Forest, Snow and Landscape Research. 78(1/2): 9-20.

The scale, scope, and complexity of natural resource and environmental issues have dramatically increased, yet the urgency to solve these issues often requires immediate information that spans disciplinary boundaries, synthesizes material from a variety of sources, draws inferences, and identifies levels of confidence. Credible science information is increasingly necessary to gain public support and acceptance. But what are the appropriate roles for science and scientists versus managers and policymakers in natural resource decisions? Scientists can provide managers and policymakers with the underlying information needed for making reasoned decisions. The prerequisites for science-based decisionmaking are understanding and appreciating what science can and cannot offer; fulfillment of the proper roles for the different participants; evaluation of how science information is used in a decision with the full consideration and correct interpretation of all relevant science information. The scientific understanding must be revealed to all interested parties.

Keywords: Decisionmaking, science-based resource management, Pacific Northwest.

(See Portland order form.)

Genetics

Johnson, G.R.; St. Clair, J.B.; Lipow, S.R.
2003. Conserving genes and genetic diversity in Pacific Northwest forests. In: Forest science in practice: Proceedings of the Society of American Foresters 2003 national convention. Bethesda, MD: Society of American Foresters: 207-212.

The appropriate numbers of trees needed for gene conservation are discussed in the context of gene resource, breeding, and production populations. In situ and ex situ genetic resources were surveyed in western Oregon and Washington for eight timber species, and the results are presented.

Keywords: Gene conservation, in situ, ex situ.

(See Corvallis order form.)

Momen, B.; Anderson, P.D.; Sullivan, J.H.; Helms, J.A.
2004. A multivariate statistical approach to predicting mature tree performance based on seedling characteristics. New Forest. 27: 303-313.

A common objective in reforestation is to plant seedling stock that will produce adult trees of superior performance. We used canonical discriminant analysis to identify and rank a set of seedling characteristics for *Pinus ponderosa* that could predict the vigor and growth performance of mature trees. Results indicated that metabolic heat rate, a measure of total metabolism, of 1-year-old foliage during the peak growth in May was the most important seedling characteristic that predicted mature-tree performance. Increased metabolic heat rate in seedlings corresponded with greater vigor of mature trees. In order of importance, other variables measured in November that defined the vigor class of mature clones were seedling basal stem diameter, height, and needle length.

Keywords: Canonical discriminant analysis, juvenile-mature correlation, metabolic heat rate, respiration, Pinus ponderosa*.*

(See Corvallis order form.)

Geomorphology and Hydrology

Wilcock, P.R.; Schmidt, J.C.; Wolman, M.G. [and others]
2002. When models meet managers: examples from geomorphology. In: Wilcock, P.R.; Iverson, R.M., eds. Prediction in geomorphology. AGU Geophysical Monograph Series. 135: 27-40.

We present five examples of natural resource managers and their use of models to consider factors that influence their success or failure. Essential elements include common objectives for management and models and clear communication of the assumptions, limitations, and uncertainty of models and their predictions. Where management and modeling objectives cannot be matched, it may be possible to define management actions that do not depend on exact predictions or to pursue alternatives to modeling such as monitoring or environmental history. In some cases, model predictions may be less important than the educational value of model construction and operation. An adaptive modeling process, in which the objectives, mechanisms, and tolerances of a model are adjusted interactively with ongoing manager input, may be useful, particularly when the policy context is contested or incompletely defined, or when the social mandate is ahead of the science.

Keywords: Geomorphology, debris flow, landscape modeling, landscape analysis, watershed management.

(See Corvallis order form.)

Invasive Plants and Animals

Harrington, T.B.; Rader-Dixon, L.T.; Taylor, J.W., Jr.

2003. Kudzu (*Pueraria montana*) community responses to herbicides, burning, and high-density loblolly pine. Weed Science. 51: 965-974.

Interference between kudzu and associated vegetation was studied for 4 years following six herbicide treatments and three planting densities of loblolly pine designed to restore native plant species to forest sites. Herbicide treatments applied at four sites near Aiken, SC, included summer 1997-1999 applications of clopyralid, triclopyr, metsulfuron, picloram plus 2,4-D, or tebuthiuron, and a nonsprayed check. In winter 1997-1998, sites were burned and pines were planted in a split-plot design at 0, 1, or 4 seedlings per square meter to induce variable competitive pressure on recovering kudzu. In 1999 kudzu cover in each herbicide treatment was less than 2 percent versus 93 percent in the check. These kudzu responses were maintained through 2001 except in clopyralid plots where cover increased to 15 percent. Only 8 to 9 percent of planted pines survived in nonsprayed and tebuthiuron plots compared to 76 to 79 percent in the other treatments. Light availability in nonsprayed plots averaged half or less than that of other treatments, whereas soil water was lowest in treatments with dense blackberry or herbaceous cover. Pine shade was associated with 26, 52, and 66 percent reductions in 2001 biomass of kudzu, blackberry, and herbaceous vegetation, respectively. None of the treatments completely eradicated kudzu, but combinations of herbicides and induced pine competition strongly delayed its recovery.

Keywords: Invasive plant species, interference, resource availability, cover, biomass.

(See Olympia order form.)

Invertebrates

Morales-Ramos, J.A.; Rojas, M.G.; Hennon, P.E.

2003. Black-staining fungus effects on the natural resistance properties of Alaskan yellow cedar to the Formosan subterranean termite (Isoptera: Rhinotermitidae). Environmental Entomology. 32(5): 1234-1241.

The effects of a black-stained Alaskan yellow cedar (AYC), *Chamaecyparis nootkatensis* (D. Don) Spach, on the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, were studied. All termite groups feeding on unstained AYC died by the end of week 14. At the end of week 32, mortality of termite groups feeding on fully and partially black-stained AYC was significantly higher than that of groups feeding on pine. Termite mortality was significantly higher when feeding on partially than on fully black-stained AYC at the end of 32 weeks. Wood consumption was significantly different among all treatment groups, with means of 4.07, 8.76, 19.81, and 29.77 mg/d in the unstained, partially, and fully black-stained AYC, and loblolly pine, *Pinus taeda* L., respectively. This suggests that toxic and feeding deterrence properties of AYC heartwood were significantly reduced by black-staining fungus infection but were not totally lost. Ecological implications are discussed.

Keywords: Coptotermes formosanus*, feeding deterrence,* Chamaecyparis nootkatensis*, nootkatone, wood chemistry.*

(See Juneau order form.)

Land Use

Kline, J.D.; Azuma, D.L.; Alig, R.J.
2004. Population growth, urban expansion, and private forestry in western Oregon. Forest Science. 50(1): 33-43.

Private forest lands in the United States face increasing pressures from growing populations that are resulting in greater numbers of people living in closer proximity to forests. What often is called the forest-urban interface is characterized by expansion of residential and other developed land uses onto traditionally forested landscapes, in a manner that threatens forest lands as productive socioeconomic and ecological resources. Prevailing hypotheses suggest that these forest lands can become less productive, because forest landowners manage less intensively and reduce investment in forest management. We develop empirical models describing harvest, thinning, tree planting, and forest stocking in western Oregon as functions of stand and site characteristics, ownership, and building densities. We use the models to examine the potential impacts of population growth and urban expansion, as described by increasing building densities, on the likelihood that forest owners harvest, precommercial thin, plant trees following harvest, and maintain forest stocking. The empirical results support the general conclusion that population growth and urban expansion are correlated with less intensive forest management and investment on private forest lands in western Oregon.

Keywords: Economic values and tradeoffs, water quality and quantity, riparian species.

(See Corvallis order form.)

Landscape Ecology

Harcombe, P.A.; Greene, S.E.; Kramer, M.G. [and others]
2004. The influence of fire and windthrow dynamics on a coastal spruce-hemlock forest in Oregon, USA, based on aerial photographs spanning 40 years. Forest Ecology and Management. 194: 71-82.

Three canopy cover classes (second growth, old growth with some partial burn, and blowdown) were mapped at Neskowin Crest Research Natural Area on the Oregon coast. Change in blowdown area was measured over 40 years by using aerial photography. Successive blowdown patches grew incrementally and coalesced to cover 15 percent of the 500-hectare area. A long-term windthrow susceptibility model accurately predicted location of the blowdown, supporting the hypothesis that windthrow effects may be topographically constrained. In this area, at the scale of hundreds of hectares, biomass may not fluctuate strongly over time unless stand-destroying fires occur.

Keywords: Wind, forest structure, landscape dynamics, natural forests.

(See Corvallis order form.)

Mycology

Kretzer, A.M.; Dunham, S.; Molina, R.; Spatafora, J.W.
2003. Microsatellite markers reveal the below ground distribution of genets in two species of *Rhizopogon* forming tuberculate ectomycorrhizas on Douglas fir. New Phytologist. 161: 313-320.

From field-collected ectomycorrhizal roots of Douglas-fir, we have cloned and sequenced 14 microsatellite loci from the ectomycorrhizal basidiomycete *Rhizopogon vesiculosus*. The largest distance observed between tuberculate ectomycorrhizae of the *R. vesiculosus* clone was about 13.4 m, but only about 2 m for *R. vinicolor*. We hypothesize that these two fungi have different life histories that contributed to their widespread success as mycorrhizal fungi in Douglas-fir ecosystems.

Keywords: Mycorrhizae, microsatellites, fungi clones.

(See Corvallis order form.)

Plant Ecology

Harrington, T.B.; Dagley, C.M.; Edwards, M.B.
2003. Above- and belowground competition from longleaf pine plantations limits performance of reintroduced herbaceous species. Forest Science. 49(5): 681-695.

Overstory trees limit abundance and species richness of herbaceous vegetation in longleaf pine (*Pinus palustris* Mill.) plantations, yet the specific mechanisms are poorly understood because of confounding that exists among limiting factors. In fall 1998, research was initiated to determine the separate effects of above- and belowground competition and needlefall from overstory pines on understory plant performance. Four levels of overstory removal were applied to three 13- to 15-year-old plantations near Aiken, SC. Within each plot, four split plots were randomly assigned combinations of trenching (to eliminate root competition) and needlefall, and containerized seedlings of 14 perennial herbaceous species (6 grasses and 8 forbs) and longleaf pine were planted within each. Overstory cover ranged from none to 81 percent, and soil water and available nitrogen differed consistently with pine stocking, trenching, or their combination. For most species, shade more strongly limited plant performance than root competition or needlefall, whereas needlefall effects were either positive, negative, or zero. Compounding limitations to plant performance resulted from specific levels of competition and needlefall. Results imply that understory restoration will be most successful when critical growth-limiting factors are minimized, for example, by establishing species within canopy gaps greater than 0.1 hectare managed to minimize negative effects from shade, root competition, and needlefall.

Keywords: Pinus palustris*, resource availability, light, soil water, nitrogen, trenching, cover, biomass.*

(See Olympia order form.)

Hennon, P.E.; McClellan, M.H.
2003. Tree mortality and forest structure in the temperate rain forests of southeast Alaska. Canadian Journal of Forest Research. 33: 1621-1634.

Tree mortality in 27 old-growth stands at three locales in southeast Alaska was evaluated to determine how types of tree death contributed to stand structure, production of woody debris, and small-scale disturbance. Basal area, density of stems, and types of dead tree structures were described for each tree species. Broken boles were most common, followed by dead standing and uprooted trees. The frequencies of dead trees within snag and log deterioration classes indicated that most trees died standing and subsequently broke. Reconstructed annual mortality rates for overstory trees averaged 0.3 to 0.5 percent per year for the three locales and were relatively stable through the previous century. Treefall direction for both uprooted and broken trees aligned significantly with downslope direction. The number and basal area of dead trees, annual mortality rates, and percentage of uprooted trees did not differ significantly among wind exposure classes. All three types of tree mortality contributed substantially to structural diversity, reflecting a high degree of complexity associated with small-scale disturbance at these three study locales.

Keywords: Tree mortality, gapmaker, forest structure, small-scale disturbance, mortality rate, tree fall.

(See Juneau order form.)

Kerns, B.K.; Ohmann, J.L.
2004. Evaluation and prediction of shrub cover in coastal Oregon forests (USA). Ecological Indicators. 4: 83-98.

We present a landscape-scale study of relations between shrub abundance and stand structure, site disturbance history, and environment in the Oregon coastal province. We used data from regional forest inventories and research programs, coupled with mapped climatic and topographic information to explore relations and develop predictive models and maps by using multiple regression and regression tree analysis. Forest structure variables were most important for explaining both total and deciduous shrub abundance. Four trends were noted: (1) the abundance of *Tsuga heterophylla* and density of shade-tolerant trees limit shrub abundance; (2) shrub abundance is negatively associated with variables that characteristically peak during early and midsuccession; (3) shrub abundance is positively associated with variables that characterize later successional stages; and (4) higher total abundance, especially of deciduous shrubs, is positively associated with hardwood stands. Environmental variables were more important for explaining deciduous shrub abundance compared to total shrub abundance, but they have an indirect effect on total shrub abundance by influencing tree composition. Our models provide both a predictive and conceptual tool for understanding shrub abundance patterns across this landscape.

Keywords: CART, forest understory, multiple regression, predictive models, regression tree analysis, shrubs, Pacific Northwest.

(See Corvallis order form.)

Lehmkuhl, J.F.
2004. Epiphytic lichen diversity and biomass in low-elevation forests of the eastern Washington Cascade Range, USA. Forest Ecology and Management. 187: 381-392.

I used litterfall sampling to estimate the biomass, diversity, and community structure of epiphytic lichens in three dry-forest cover types on the east side of the Washington Cascade Range. Lichen litter biomass increased with increasing stand complexity and moisture. Lichen litter biomass was 1.67 kg/ha in open pine, 4.86 kg/ha in young mixed-species stands, and 8.37 kg/ha in mature mixed-species stands. Six species accounted for 63 percent of the total biomass. Epiphytic lichen species richness and dominance did not differ among forest types, but lichen associations differed. Variable-density thinning and other practices that maintain open- and closed-canopy patchiness and large trees would lessen impacts on forage lichens.

Keywords: Lichens, dry forest, Bryoria tortuosa*, Washington.*

(See Wenatchee order form.)

Lindh, B.C.; Gray, A.N.; Spies, T.A.
2003. Responses of herbs and shrubs to reduced root competition under canopies and in gaps: a trenching experiment in old-growth Douglas-fir forests. Canadian Journal of Forest Research. 33: 2052-2057.

Root exclusion plots (belowground gaps) were installed in conjunction with a study on experimental canopy gaps. We sampled the plant communities in these plots in the summer of 2000, 10 years after installation. Tree roots were severed to a depth of 1 meter and excluded by using physical barriers. The treatments were replicated four times, in high- and low-canopy-cover areas within two old-growth forests. Trenched plots averaged 70 percent total understory cover whereas untrenched plots averaged

32 percent cover. Soil moisture was also higher in trenched than in control plots. Responses to trenching were greater in high-canopy-cover areas than in low-canopy-cover areas. Different species responded most vigorously to trenching at the two sites. We conclude that at these sites, understory plants were limited at least as much by belowground competition as by aboveground competition.

Keywords: Root trenches, canopy gaps, plant cover.

(See Corvallis order form.)

Lookingbill, T.
2003. Communities in transition: a multiphase study of the *Tsuga heterophylla/Abies amabilis* ecotone in the Oregon Cascades. Durham, NC: Duke University. 250 p. Ph.D. dissertation.

The author uses new approaches to empirically interpolate relative differences in temperature, radiation, and soil moisture across landscapes and a replicated study of plant demographics (growth, mortality, and regeneration) at the dominant community ecotone. These studies were intended to replace elevation and basal area from the working model with more plant-relevant explanatory variables and the demographic components they affect. The landscape-scale models illustrate that using elevation to approximate environmental variability ignores the multiscale structure of the physical template.

Keywords: Climate, ecotone, Tsuga heterophylla*,* Abies amabilis*.*

(Available only through library or interlibrary loan.)

Santiago, L.S.; Goldstein, G.; Meinzer, F.C. [and others]
2004. Leaf photosynthetic traits scale with hydraulic conductivity and wood density in Panamanian forest canopy trees. Ecophysiology. 140: 543-550.

We investigated how water transport capacity and wood density were related to leaf photosynthesis traits in two lowland tropical forests. Leaf-specific hydraulic conductivity (kL) of upper branches was positively correlated with maximum rates of net CO_2 assimilation (A) and stomatal conductance (gs) across 20 species of canopy trees. Branch wood density was negatively correlated with wood water storage at saturation, kL, and A, suggesting that wood density constrains physiological function to specific operating ranges. Overall, our results suggest that placing leaf functional traits in the context of hydraulic processes at the branch scale explains a significant fraction of the variation in apparent physiological “strategies” of different plant species.

Keywords: Leaf nitrogen, leaf-specific conductivity, stomata, tropical forest, xylem anatomy.

(See Corvallis order form.)

Remote Sensing

Parmenter, A.W.; Hansen, A.; Kennedy, R.E. [and others]
2003. Land use and land cover change in the Greater Yellowstone Ecosystem. Ecological Applications. 13(3): 687-703.

Shifts in demographic and economic character of the Greater Yellowstone Ecosystem (GYE) are driving new patterns of land cover and land use in the region. The objective of this paper is to quantify the trajectories and rates of change in the land cover and land use across the GYE for the period 1975 to 1995 by using satellite imagery. The largest changes in the GYE over the study period were the dramatic increases in burned, urban, and mixed conifer-herbaceous classes and decreases in woody deciduous, mixed woody deciduous-herbaceous, and conifer habitats.

Keywords: Disturbance, remote sensing.

(See Corvallis order form.)

Reutebuch, S.E.; Carson, W.W.; Ahmed, K.M.
2003. A test of the Applanix POS LS inertial positioning system for the collection of terrestrial coordinates under a heavy forest canopy. In: Precision forestry: Proceedings of the 2nd international precision forestry symposium. Seattle, WA: University of Washington, College of Forest Resources: 21-27.

The Applanix POS LS backpack-mounted inertial land positioning/navigation system was used to collect terrestrial coordinates along a previously surveyed closed traverse. A total station surveying instrument was used to establish 26 ground-level stakes along a 1-mile traverse under the canopy of conifer forest near Olympia, Washington. The system was initialized at a fixed monument and carried through the forest along the traverse 12 times. Coordinate readings were collected continuously, both at the survey posts and between posts. The system's location accuracy and its potential for developing terrain profiles were evaluated. The system's average real-time position accuracy was 2.3 feet and average post-processed accuracy was 1.4 feet, measured at each survey stake. An earlier study provided a 5- by 5-foot, gridded digital terrain model (DEM) derived from high-density LIDAR data. Profiles generated from the LDIAR DEM were compared with profiles measured by the POS LS system. Average post-processed elevation difference along the profiles was 0.7 feet.

Keywords: LIDAR, inertial navigation, global positioning system, surveying, forest canopy.

(See PWFSL order form.)

Reutebuch, S.E.; McGaughey, R.J.; Andersen, H-E.; Carson, W.W.
2003. Accuracy of a high-resolution LIDAR terrain model under a conifer forest canopy. Canadian Journal of Remote Sensing. 29(5): 527-535.

Accuracy of airborne laser mapping (LIDAR) in heavily forested areas has not been thoroughly tested. A high-resolution digital terrain model (DTM) was produced from high-density LIDAR data. Vegetation in the 500-hectare mountainous study area varied from bare ground to dense 70-year-old coniferous forest. Conventional ground survey methods were used to collect coordinates and near-ground vegetation heights at 347 ground checkpoints distributed under a range of canopy covers. These points were used to check the DTM accuracy. The mean DTM error was 0.22 ± 0.24 m (mean ± SD). Elevation errors in the DTM for four canopy cover classes were: clearcut, 0.16 ± 0.23 m; heavily thinned, 0.18 ± 0.14 m; lightly thinned, 0.18 ± 0.18 m; and uncut, 0.31 ± 0.29 m. These DTM errors show a slight increase with canopy density, but the differences are strikingly small. The mean DTM errors within uncut areas and areas with near-ground vegetation were significantly different from the mean DTM error within cut areas and areas without near-ground vegetation, respectively. The differences, however, were small and generally fell within the range of random variability owing to instrument and interpolation errors. In general, the LIDAR DTM was found to be extremely accurate and potentially very useful in forestry.

Keywords: Lidar, digital terrain model.

(See PWFSL order form.)

Silviculture

Harrington, C.A.; Kraft, J.M.
2004. Cold stratification of Pacific madrone seeds. Native Plants. Spring: 66-74.

We obtained 11 seed lots of Pacific madrone (*Arbutus menziesii*) from California, Oregon, and Washington with elevations of the lots ranging from 50 to 1270 meters. Germination was tested before stratification and after 20, 40, 60, and 73 days of stratification at 3 °C. All lots had <2 percent germination without stratification and excellent germination (>87 percent) after 40 days of stratification. Stratification periods longer than 40 days yielded little or no gain in percentage of germination. Germination after 20 days of stratification differed markedly with seed lot (from 10 to 100 percent of the maximum); 20-day germination was negatively correlated with latitude. Growers would need to test individual seed lots to determine if stratification times of less than 40 days would be adequate.

Keywords: Arbutus menziesii*, germination, seed lots, latitude, elevation.*

(See Olympia order form.)

Harrington, T.B.; Ezell, A.W.; Yeiser, J.L.; Cobb, J.O.
2002. First-year woody plant control following several formulations and timings of glyphosate with or without imazapyr. In: Proceedings: Southern Weed Science Society—new opportunities: 55th annual meeting. Champagne, IL: Southern Weed Science Society: 78-82.

Several formulations of glyphosate were applied with or without imazapyr in June and October 2000 at sites located in Georgia, Mississippi, and Texas. The objective of the research was to compare control of woody species between experimental and conventional formulations of glyphosate with or without imazapyr. Percentage of change in total length of woody stems was evaluated immediately before treatment and 1 year following treatment. In general, the experimental formulations of glyphosate provided levels of woody control similar to those observed for Accord SP® or generic glyphosate. Wood control for Accord SP® was often greater than that observed from generic glyphosate, especially at the Georgia site.

Keywords: Site preparation, woody control.

(See Olympia order form.)

McClellan, M.H.
2004. Development of silvicultural systems for maintaining old-growth conditions in the temperate rainforest of southeast Alaska. Forest, Snow and Landscape Research. 17(1/2): 173-190.

In the old-growth temperate rain forests of southeast Alaska, concerns about clearcutting effects on habitat, visual quality, slope stability, and biodiversity have created a demand for the use of other silvicultural systems. The forest vegetation and animal taxa of southeast Alaska seem to be well adapted to frequent, widespread, small-scale disturbance, suggesting that variable-retention harvesting and maintenance of important structural features could sustain desired old-growth conditions in wood-producing forests. This hypothesis is tested in the alternatives-to-clearcutting study that uses experimental and retrospective approaches to evaluate several silvicultural systems for managing old-growth western hemlock-Sitka spruce forests. The operational-scale, long-term experimental study integrates research on stand dynamics, forest health, understory vegetation, wildlife habitat, stream ecology, slope stability, hydrology, economics, visual quality, and social acceptability.

Keywords: Forest management, variable-retention harvesting, alternatives to clearcutting, temperate rain forest, old-growth forest.

(See Juneau order form.)

Social Science

Fischer, A.P.
2003. Mental and biophysical terrains of biodiversity: conservation of oak woodland on family forests. Corvallis, OR: Oregon State University. 137 p. M.S. thesis.

This research analyzes how family-forest owners conceptualize biodiversity in one high-conservation value area of oak woodland in the Willamette Valley of western Oregon. Oregon white oak (*Quercus garryana*) woodland, one of the most biologically diverse ecotypes in the state of Oregon, is in decline. Much of the oak ecotype occurs on the lands of family-forest owners. Understanding owners' conceptions of biodiversity is important for the conservation of this resource. Findings of this research indicated that (1) owners are knowledgeable about the key elements of biodiversity and (2) their use of this knowledge in management reflects their beliefs about human relations with nature and external market constraints.

Keywords: Biodiversity conservation, family-forest owners, nonindustrial private forests, oak woodland.

(Available only through library or interlibrary loan.)

Soil

Kerns, B.K.; Moore, M.M.; Timpson, M.E.; Hart, S.C.
2003. Soil properties associated with vegetation patches in a *Pinus ponderosa*-bunchgrass mosaic. Western North American Naturalist. 63(4): 452-462.

Since settlement of nonindigenous people, fire exclusion and other factors have dramatically altered interior Western coniferous forests. Once open and parklike, present-day structure in many Southwestern *Pinus ponderosa* forests consists of dense stands of young, small-diameter trees, with small patches of larger, old trees, and relict open bunchgrass areas. Our objectives were to assess differences in soil properties associated with these different vegetation patches. We examined soil morphological characteristics, pH, organic carbon (C), total nitrogen (N), C:N, and phytolith concentration from six transects (18 soil pedons) crossing patches of dense stands of small-diameter trees, patches of old-growth trees, and open grassy areas. Results indicate that old-growth plots had significantly lower A horizon pH and thicker O horizons compared to grass plots. We found few significant differences among plots for A and B horizons, as well as for C, N, and C:N. Carbon in the A horizon was positively correlated with the organic horizon accumulation. Greater accumulation of organic carbon in the A horizon of forested areas contrasted with commonly reported results from mesic midcontinental prairie-forest ecosystems but is typical for many arid, semiarid, and humid savanna ecosystems. Phytolith concentration was similar among old growth, dense younger pine, and open grassy plots; the lack of a spatial pattern in phytolith distribution could indicate that grass cover was more spatially continuous in the past. Additionally, this interpretation is consistent with current theories regarding historical vegetation change in these forests.

Keywords: Forest soils, grassland soils, phytoliths, biosequence, nonmetric multidimensional scaling.

(See Corvallis order form.)

Wildlife

Kie, J.G.; Bowyer, T.; Stewart, K.M.
2003. Ungulates in western coniferous forests: habitat relationships, population dynamics, and ecosystem processes. In: Zabel, C.J.; Anthony, R.G., eds. Mammal community dynamics: management and conservation in the coniferous forests of western North America: 296-340. Chapter 9.

Wild ungulates play important roles in coniferous forests throughout western North America. Not only do they respond to habitat changes at the landscape scale, but they also have important effects on basic ecosystem processes, thereby acting as keystone species. Furthermore, the dynamics of ungulate populations are complex. A complete understanding of how ungulate numbers are regulated over time requires consideration of interactions among climate, predation, and density dependence. The failure to integrate

all of these concepts into a cohesive management framework is likely to lead to a misunderstanding of their role in forested ecosystems.

Keywords: Ungulates, western coniferous forests, habitat relationships, population dynamics, ecosystem processes.

(Available from bookstores and libraries.)

Wood Utilization

Easton, I.L.; Roos, J.A.; Boardman, P. 2004. A technical assessment of the market for wood windows in Japanese post and beam construction. Forest Products Journal. 54(6): 23-30.

This research was conducted to develop a better understanding of the problems and opportunities confronting U.S. manufacturers of wooden windows in the post and beam segment of the Japanese residential construction industry. The specific objectives of this research were to (1) provide a description of the Japanese market for wood windows, (2) survey Japanese builders regarding use and specification of wood windows, both domestic and imported, and (3) recommend strategies for increasing the competitiveness of U.S. wooden windows in the Japanese post and beam market.

Keywords: Japan, lumber, windows, export, marketing.

(See Sitka order form.)

Lowell, E.C.; Thomas, E.; Todoroki, C. 2002. Linking simulation of primary and secondary products from small-diameter western softwoods. In: Nepveu, G., ed. 4th workshop IUFRO S5.01.04. Nancy, France: Laboratoire d'Etude des Ressources Foret Bois, INRA-ENGREF: 511-518.

Densely stocked stands of small-diameter softwoods present an important utilization challenge in the Western United States. Producing primary products from material removed from these stands is often not cost effective. Evaluation of the suitability of this resource for higher value products, with an attempt to minimize the amount of unusable material, may increase opportunities for offsetting costs of active management in these stands.

Keywords: Wood quality, Western softwoods, small-diameter timber, cut-stock simulation.

(See Portland order form.)

Nicholls, D.; Donovan, G.; Roos, J. 2003. Red alder stacks up to other hardwoods. Wood and Wood Products. October: 61, 63-64.

In the Pacific Northwest, red alder (*Alnus rubra*) is a commercially important species. In southeast Alaska, however, it has very little commercial value. Limited species recognition may present a barrier to the growth of a red alder industry in southeast Alaska. In this study, red alder cabinets having different levels of stain were compared to four other commercial hardwoods. Consumer preferences were measured in terms of market share and price premiums. The effect of species name and the presence of a logo on consumer preferences were evaluated. Results indicated that red alder cabinets were most popular when no species or brand information was provided. Heavy stain levels for alder cabinets were considerably more popular than light stain or no stain. Retail store sales staff were the most important information source influencing purchase decisions.

Keywords: Economics, red alder, wood utilization, marketing, consumer preference.

(See Sitka order form.)

Nicholls, D.; Kilborn, K.; Allen, T.
2004. Evaluating the potential for increased grade recovery in birch producing regions: how to make the grade. Sawmill and Woodlot. April: 16-21.

The objective of this study was to evaluate the potential increase in lumber value when a sample of birch logs from interior Alaska was sawn by live sawing methods versus sawing for grade, as graded under standard National Hardwood Lumber Association rules. All logs were graded according to USDA Forest Service standards for grading hardwood logs, and board-foot volumes were tallied for each log based on length and diameter. Logs sawn by the live sawing method had a somewhat higher overall log grade than logs sawn by grade sawing. Log grade had a direct influence on the lumber grade, and therefore value, regardless of sawing method. The overall lumber value was higher for grade-sawn boards than for live-sawn boards ($445 per thousand board feet [MBF] and $403 per MBF, respectively). This study on a small sawmill near Fairbanks, Alaska, suggests that improvements of greater than 10 percent in lumber value are possible when adopting grade-sawing procedures, compared to live sawing.

Keywords: Wood utilization, rural communities, land use.

(See Sitka order form.)

Nicholls, D.; Parrent, D.; Pavia, K.J.
2004. The potential for developing alternate grading rules for birch lumber in Alaska. Forest Products Journal. 54(1): 57-60.

Alaska birch lumber is often characterized by small knots and other character defects that can reduce its value when graded according to conventional hardwood grading rules. In this study 626 boards (2,782 board feet of lumber) were graded—first, according to standard National Hardwood Lumber Association (NHLA) rules, and then a second time with an alternative rule that did not consider defects less than 0.5 inches in diameter to be grade-reducing defects. Mill locations included two sites in interior Alaska and two sites in south-central Alaska. With the alternative grading rule, average lumber value across all grades increased by $138.31 per thousand board feet (MBF) (versus standard NHLA rules). The lower grades of lumber exhibited the greatest potential for upgrading, both in terms of volume and value. Nearly 74 percent of lumber in grades 2A, 3A, and 3B Common was upgraded as a result of the alternative grading rules, resulting in an overall increase in value of $154.37 per MBF.

Keywords: Wood utilization, rural communities, land use.

(See Sitka order form.)

Richard, T.L.; Nicholls, D.L.; Kim, B.T.
2003. Windrow design for high rainfall conditions. BioCycle. December: 31-33.

Compost moisture content has an important bearing on the composting process as well as the quality of finished products, including fertilizers and soil amendments. In this research, wood-fish mixtures were composted in lab-scale systems at Iowa State University. Composting runs lasted 14 weeks and were regulated by either oxygen feedback methods or temperature feedback methods. Moisture-holding capacity of compost piles was modeled for moisture contents ranging from 45 to 70 percent wet basis. For a given target pile moisture, higher piles would be required in wetter regions. For example, in Ketchikan a moisture content of 45 percent (wet basis) could be maintained with a pile approximately 11 feet high, while in Kake (a somewhat drier locale), this same moisture level could be maintained with a pile only about 4 feet tall. In Anchorage, the driest location evaluated, average pile depths of less than 3 feet would allow for satisfactory composting under most conditions.

Keywords: Wood utilization, rural communities, land use.

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