United States
Department of
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Forest Service

Pacific Northwest
Research Station

Recent Publications of the Pacific Northwest Research Station, First Quarter 2001

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The first section shows items published by the PNW Research Station. The second section shows publications available elsewhere. In each section, items are grouped alphabetically by author within categories.

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April 2001

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Pacific Northwest Research Station Publications

The following publications may be ordered by using the form on the inside back cover. Circle the code number for the publication.

Ecosystem Function

99-258

Riggs, Robert A.; Tiedemann, Arthur R.; Cook, John G. [and others]

2000. Modification of mixed-conifer forests by ruminant herbivores in the Blue Mountains ecological province. Res. Pap. PNW-RP-527. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 77 p.

Secondary plant succession and the accumulation of biomass and nutrients were documented at seven ruminant exclosures in *Abies* and *Pseudotsuga* forests variously disturbed by logging, burning, and grass seeding. Long-term foraging (25 or more years) by Rocky Mountain mule deer (*Odocoileus hemionus*) and Rocky Mountain elk (*Cervus elaphus*) suppressed the development of deciduous shrubs. Ruminant herbivores influenced vegetation to extents equal to those of the initial episodic disturbances. Food preferences of elk were linearly correlated with long-term development of plant taxa. Accumulations of understory and forest floor biomasses were greater inside exclosures than outside. Accumulations of nitrogen, phosphorus, calcium, magnesium, and potassium were greater inside exclosures than outside.

Keywords: Abies*, biomass,* Bos, Cervus*, cycling, disturbance, ecosystem, fire, forest, herbivory, logging, nutrients,* Odocoileus, Ovis*, productivity,* Pseudotsuga*, seeding, shrubs, site, succession, understory.*

(This publication is available to download in pdf at http://www.fs.fed.us/pnw/pubs.htm.)

Forest Management

00-052

DeMars, Donald J.

2000. Stand-density study of spruce-hemlock stands in southeastern Alaska. Gen. Tech. Rep. PNW-GTR-496. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 60 p.

The lack of growth and yield information for young even-aged western hemlock (*Tsuga heterophylla* (Raf.) Sarg.)-Sitka spruce (*Picea sitchensis* (Bong.) Carr.) stands in southeastern Alaska served as the impetus for a long-term stand-density study begun in 1974. The study follows permanent growth plots in managed stands under various thinning regimes. Between 1974 and 1987, 272 plots were established at 59 locations throughout southeastern Alaska. Remeasurement of the plots occurs every 2 to 4 years and will continue until harvest. Additional thinning will occur at a portion of the plots. Future plans include extending the study through establishment of installations in stand types not currently represented. Once data for an entire rotation are obtained, a comprehensive set of growth and yield tables for various management regimes can be developed. This information will answer questions forest managers have on whether and when to thin a stand, at what level of intensity to thin, and how frequently to enter the stand.

Keywords: Thinning, stand density, southeastern Alaska, western hemlock, Tsuga heterophylla*, Sitka spruce,* Picea sitchensis.

(This publication is available to download in pdf at http://www.fs.fed.us/pnw/pubs.htm.)

00-129

Stevens, James A.; Barbour, R. James
2000. Managing the stands of the future based on lessons of the past: estimating western timber species product recovery by using historical data. Res. Note PNW-RN-528. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 9 p.

Researchers at the Pacific Northwest Research Station have completed over 100 forest product recovery studies in the past 40 years. Tree, log, and product data from these studies have been entered into a database that will allow further analysis within, between, and across studies. Opportunities for analysis include stand-to-log-to-final-product estimates of volume, quality, and value. Examples of possible database queries include determining the variation in recovery volume and product yield from different age-per-diameter classes, the relation between percentage of sound log volume and product yield, and the relation between product quality and age.

Keywords: Wood quality, silviculture, modeling, simulation, timber, lumber recovery, veneer recovery.

(This publication is available to download in pdf at http://www.fs.fed.us/pnw/pubs.htm.)

Monitoring

00-219

Huff, Mark H.; Bettinger, Kelly A.; Ferguson, Howard L. [and others]
2000. A habitat-based point-count protocol for terrestrial birds, emphasizing Washington and Oregon. Gen. Tech. Rep. PNW-GTR-501. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 39 p.

A protocol is described and a summary provided for point-count monitoring of land birds that is designed for habitat-based objectives. Presentation is in four steps: preparation and planning, selecting monitoring sites, establishing monitoring stations, and conducting point counts. We describe the basis for doing habitat-based point counts, how they are organized, and how they differ from other approaches using point counts. Guidelines are included for counting birds and recording data.

Keywords: Bird sampling, avifauna, monitoring, point count, Pacific Northwest, bird protocol, avian field methods, populations trends, bird detections.

(This publication is available to download in pdf at http://www.fs.fed.us/pnw/pubs.htm.)

00-126

Waldren, Douglas W.
2000. Anabat bat detection system: description and maintenance manual. Gen. Tech. Rep. PNW-GTR-502. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 16 p.

Anabat bat detection systems record ultrasonic bat calls on cassette tape by using a sophisticated ultrasonic microphone and cassette tape interface. This paper describes equipment setup, layout and function of display panels, and some maintenance issues. A maintenance section describes opening the equipment, internal maintenance, and making an external power cable. A short discussion on the Anabat software describes how to access, install, and check the Anabat5 program for use with the Anabat equipment. The ZCAIM is briefly addressed as is handling of 12-volt rechargeable batteries.

Keywords: Anabat, delay switch, detector, N/S, ultrasonic, ZCAIM.

(This publication is available to download in pdf at http://www.fs.fed.us/pnw/pubs.htm.)

Plant Pathology

00-079

Campbell, Sally; Smith, Gretchen; Temple, Pat [and others]

2000. Monitoring for ozone injury in west coast (Oregon, Washington, and California) forests in 1998. Gen. Tech. Rep. PNW-GTR-495. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 19 p.

In 1998, forest vegetation was monitored for ozone injury on permanent plots in the Sierra and Sequoia National Forests in California, at three locations in Mount Rainier National Park in Washington, and at 68 forest health monitoring (FHM) locations throughout Oregon, Washington, and California. Injury was detected on ponderosa and Jeffrey pine at the Sequoia and Sierra permanent plots and on red elderberry at one FHM location in southwest Washington. No injury was detected at the Mount Rainier sites. We also report on the results of a trial where red alder, huckleberry, blue elderberry, and chokecherry were exposed to ozone under controlled conditions.

Keywords: Ozone, biomonitoring, biosite, forest health monitoring, plant injury.

(This publication is available to download in pdf at http://www.fs.fed.us/pnw/pubs.htm.)

Social Sciences

00-029

Findley, Angela J.; Carroll, Matthew S.; Blatner, Keith A.

2000. Social assessment for the Colville National Forest CROP program. Gen. Tech. Rep. PNW-GTR-499. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 106 p.

A qualitative social assessment was done for the Colville National Forest creating opportunities (CROP) research program, which examines forest management alternatives for small-diameter stands in northeastern Washington. Research spanned various communities in three counties and investigated the diversity of fundamental values people attach to small-diameter stands, beliefs about appropriate forest management directions, and perceived impacts from the CROP program. Several themes emerged from the applied grounded theory methodology that organized the complexity of this social situation. Practical implications of the themes that emerged were offered as guidelines to resource managers to improve public involvement as the decisionmaking process moves to public forums.

Keywords: Social assessment, qualitative methodology, natural resource conflict, public involvement, collaborative learning, Colville National Forest.

(This publication is available to download in pdf at http://www.fs.fed.us/pnw/pubs.htm.)

Science Findings

In 2000 the PNW Research Station continued its series that presents science findings for people who make and influence decisions about managing lands. The 2000 issues may be ordered by using the order form on the last page of this publication. These publications also are available in electronic format at http://www.fs.fed.us/pnw.

January 2000. DeBell, Dean; Curtis, Robert; Marshall, David. Developing new silvicultural regimes: the eyes have it.

February 2000. Cook, John G.; Kie, John G. Why do elk seek shelter? the case against the need for thermal cover.

April 2000. Kline, Jeff; Alig, Ralph. Where will they all live? the enduring puzzle of land use change.

May 2000. Swanson, Frederick; Green, Sarah. Beyond the limits of traditional science: bioregional assessments and natural resource management.

June 2000. Grant, Gordon. Seen one dam, seen 'em all? the surprising story of the Deschutes River

August 2000. Kruger, Linda. Community, know thyself: caring about place.

September 2000. Carey, Andrew B. If you take a stand, how can you manage an ecosystem? the complex art of raising a forest.

October 2000. Alexander, Susan; Pilz, David. Symbiosis and synergy: can mushrooms and timber be managed together?

November 2000. Kiester, Ross. From genes to landscapes: conserving biodiversity at multiple scales.

December 2000. Lowell, Eini; Christensen, Glenn; Stevens, Jim. Facing the challenge of the young, the small, and the dead: Alaska's new frontier.

Publications Available Elsewhere

The following publications are available through interlibrary loan, by writing to the locations indicated, or by using the form indicated.

Economics

Birdsey, Richard; Alig, Ralph; Adams, Darius
2000. Mitigation activities in the forest sector to reduce emissions and enhance sinks of greenhouse gases. In: Joyce, L.A.; Birdsey, R., tech. eds. The impact of climate change on America's forests: a technical document supporting the 2000 USDA Forest Service RPA assessment. Gen. Tech. Rep. RMRS-GTR-59. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 112-131. Chapter 8.

The 1974 Renewable Resources Planning Act (RPA) requires documentation of trends and impacts of climate change on America's forests. As part of the RPA documentation, this paper presents a summary of forestry options to reduce emissions or enhance sinks; discusses the 1993 U.S. Climate Change Action Plan to reduce greenhouse gases to 1990 levels by 2000 by using cost-effective domestic actions; presents methodology for estimating mitigation potential; and evaluates selected mitigation options.

Keywords: Renewable Resources Planning Act, RPA, climate change, forest emissions, greenhouse gas.

(The entire publication, RMRS-GTR-59, is available on the Web at http://www.fs.fed.us/rm. To order paper copies, send your mailing information to Publications Distribution, Rocky Mountain Research Station, 240 W. Prospect Rd., Fort Collins, CO 80526 or email Richard Schneider at rschneider@fs.fed.us.)

Haynes, Richard W.; Stevens, James A.; Barbour, R. James
2000. Criteria and indicators for sustainable forest management at the U.S.A. national and regional level. In: Krishnapillay, B.; Soepadmo, E.; Arshad, N.L. [and others], eds. Forests and society: the role of research: 21st IUFRO world congress. [Place of publication unknown]: International Union of Forestry Research Organizations: 238-250.

This paper uses readily available information to describe several broad-scale measures of sustainable forest management that can be used both to describe the state of ecological and social conditions and in a discussion of joint consequences of various management actions. These broad-scale composite measures helped us look at the notion of tradeoffs, compatible production, and the integrative nature of ecosystems. Our experience suggested that scientists can contribute to developing individual broad-scale measures and composite indexes and the process for aggregation to higher spatial scales and thus make the discussion about sustainable forest management more productive.

Keywords: Sustainable forest management, criteria and indicators.

(See Portland order form.)

Heath, Linda S.; Smith, James E.
2000. Soil carbon accounting and assumptions for forestry and forest-related land use change. In: Joyce, L.A.; Birdsey, R., tech. eds. The impact of climate change on America's forests: a technical document supporting the 2000 USDA Forest Service

RPA assessment. Gen. Tech. Rep. RMRS-GTR-59. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 89-101. Chapter 6.

Comprehensive, large-scale carbon accounting systems are needed as nations agree to work toward reducing their greenhouse gas (GHG) emissions. We review some issues in carbon accounting of a major GHG sink: forest soils, at a national scale. Specifically, we concentrate on how land use change and harvesting affect forest soil carbon, and how those effects may be described clearly in an accounting system that is easy to use.

Keywords: Forest carbon, soil carbon, accounting systems.

(The entire publication, RMRS-GTR-59, is available on the Web at http://www.fs.fed.us/rm. To order paper copies, send your mailing information to Publications Distribution, Rocky Mountain Research Station, 240 W. Prospect Rd., Fort Collins, CO 80526 or email Richard Schneider at rschneider@fs.fed.us.)

Mills, John R.; Alig, Ralph; Haynes, Richard W.; Adams, Darius M.

2000. Modeling climate change impacts on the forest sector. In: Joyce, L.A.; Birdsey, R., tech. eds. The impact of climate change on America's forests: a technical document supporting the 2000 USDA Forest Service RPA assessment. Gen. Tech. Rep. RMRS-GTR-59. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 69-78. Chapter 4.

We assess in broad terms our ability to model climate change impacts on the forest sector by using two of the three forest sector models available in the public domain: the timber assessment market model/North American pulp and paper model/aggregate timberland assessment system (TAMM/ATLAS) and the forest and agriculture sector optimization model (FASOM). Both TAMM and FASOM are affiliated models that share many common features and present similar views of the relation between forests and atmospheric issues. Using both models (1) helps to place prospective atmospheric concerns about ecological change associated with climate change in perspective; (2) challenges ecologists and policy analysts to be explicit in the size, location, and timing of various impacts, to consider the transition from current vegetation, and to gauge the tradeoffs between near-term policy concerns and long-term ecological impacts; and (3) offers a common framework for integrating biophysical and social systems and for tracing how changes in typically biophysical attributes affect various measures of economic benefits and costs.

Keywords: TAMM/ATLAS, FASOM, climate change, economic benefits.

(The entire publication, RMRS-GTR-59, is available on the Web at http://www.fs.fed.us/rm. To order paper copies, send your mailing information to Publications Distribution, Rocky Mountain Research Station, 240 W. Prospect Rd., Fort Collins, CO 80526 or email Richard Schneider at rschneider@fs.fed.us.)

Tomberlin, David; Buongiorno, Joseph; Brooks, David

1998. Trade, forestry, and the environment: a review. Journal of Forest Economics. 4(3): 177-206.

Despite an extensive conceptual literature on trade and environment, empirical work remains limited. Forest products and their distinguishing market characteristics have received little attention within this literature. The theories of comparative advantage and externalities link trade and environmental economics and thus

provide a framework for analyzing the environmental effects of free trade and the trade effects of environmental restrictions. The review assesses the state of the forest economics literature on these issues and suggests empirical work to support more informed deliberation of trade and other forest sector policies.

Keywords: Comparative advantage, environment, forest products, international trade.

(See Corvallis order form.)

Ecosystem Structure and Function

Everett, Richard; Lehmkuhl, John; Schellhaas, Richard [and others]

1999. Snag dynamics in a chronosequence of 26 wildfires on the east slope of the Cascade Range in Washington state, USA. International Journal of Wildland Fire. 9(4): 223-234.

Snag numbers and decay classes were measured on a chronosequence of 26 wildfires (ages 1 to 81 years) on the east slope of the Cascade Range in Washington. Snag longevity and resultant snag densities varied spatially across burns in relation to microtopographic position. Longevity of snags less than 41 centimeters diameter at breast height (dbh) was greater for thin-barked than for thick-barked species. The time required for recruitment of soft snags larger than 23 centimeters dbh was estimated to exceed snag longevity for ponderosa pine, Engelmann spruce, lodgepole pine, and subalpine fir. Snags of Douglas-fir at least 41 centimeters dbh stood long enough (40 percent standing after 80 years) to potentially overlap the recruitment of soft snags at least 23 centimeters dbh from the replacement stand. Providing continuity in soft snags following stand-replacing events would require a landscape-scale perspective to incorporate adjacent stands of different ages or distribution histories.

Keywords: Snag densities, snag decay, snag gaps, wildlife habitat, soil organic matter, ponderosa pine, Pinus ponderosa*, Douglas-fir,* Pseudotsuga menziesii*, lodgepole pine,* Pinus contorta*, subalpine fir,* Abies monticola*, Engelmann spruce,* Picea engelmannii*, Cascade Range, Washington.*

(See Wenatchee order form.)

Meinzer, Frederick C.; Andrade, José Luis; Goldstein, Guillermo [and others]

1999. Partitioning of soil water among canopy trees in a seasonally dry tropical forest. Oecologia. 121: 293-301.

We assessed spatial and temporal patterns of soil water utilization in several canopy tree species on Barro Colorado Island, Panama, during the 1997 dry season. Stable hydrogen isotope composition of xylem and soil water, soil volumetric water content, and sap flow were measured concurrently. Seasonal courses of water use and soil water partitioning were associated with leaf phenology. Species with the least seasonal variability in leaf fall also were able to tap increasingly deep sources of soil water as the dry season progressed. Comparison of xylem, soil, and stable hydrogen isotope composition of groundwater thus pointed to spatial and temporal partitioning of water resources among several tropical forest canopy tree species during the dry season.

Keywords: Roots, sap flow, leaf phenology, stable hydrogen isotope ratio, Panama.

(See Corvallis order form.)

Smith, J.E.; Molina, R.; Huso, M.M.P.; Larsen, M.J.

2000. Occurrence of *Piloderma fallax* in young, rotation-age and old-growth stands of Douglas-fir (*Pseudotsuga menziesii*) in the Cascade Range of Oregon, U.S.A. Canadian Journal of Botany. 78: 995-1001.

Yellow mycelia and cords of *Piloderma fallax* (Lib.) Stalp. were more frequently observed in old-growth stands than in younger managed stands of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco). Data on the frequency and percentage of cover for *P. fallax* were collected

from 900 plots in three replicate stands in each of three forest age classes over 2 years, in both spring and fall. *Piloderma fallax* was about 2.5 times more likely to occur in a plot with CWD decay class 5 present than in plots without. Frequency of occurrence did not differ among sampling times. Occurrence of *P. fallax* may indicate suitable substrate for ectomycorrhizal fungi associated with CWD and may be important in forest management for the maintenance of biodiversity and old-growth components in young managed stands.

Keywords: Piloderma fallax*, coarse woody debris,* Pseudotsuga menziesii*, forest management, ectomycorrhizal fungi, biodiversity.*

(See Corvallis order form.)

Turner, David P.; Cohen, Warren B.; Kennedy, Robert E.

2000. Alternative spatial resolutions and estimation of carbon flux over a managed forest landscape in western Oregon. Landscape Ecology. 15: 441-452.

Spatially distributed estimates of biologically driven carbon dioxide flux are of interest in relation to understanding the global carbon cycle. Global coverage by satellite sensors offers an opportunity to assess terrestrial carbon flux through various approaches and corresponding spatial resolutions. In this study, the effects of spatial resolution on estimates of total annual net primary production and net ecosystem production for a 96-square-kilometer area in the Cascade Range of western Oregon were examined.

Keywords: Biomass, carbon, Landsat TM, net primary production, net ecosystem production, carbon, forest, Oregon, spatial resolution, landscape scale.

(See Corvallis order form.)

Walker, M.D.; Walker, D.A.; Welker, J.M. [and others]

1999. Long-term experimental manipulation of winter snow regime and summer temperature in arctic and alpine tundra. Hydrological Processes. 13: 2315-2330.

Three 60-meter-long, 2.8-meter-high snow fences were erected at Niwot Ridge, Colorado, and Toolik Lake, Alaska, to study long-term effects of changing winter snow conditions on arctic and alpine tundra. The purpose of the experiment was to examine short- and long-term changes to the integrated physical-biological systems under simultaneous changes of winter snow regime and summer temperature, as part of the long-term ecological research network and the international tundra experiment. This paper describes the experimental design and short-term effects.

Keywords: Snow, arctic, alpine tundra, climate warming, ecosystems.

(See Fairbanks order form.)

Fire

Arcos, Aaron; Alvarado, Ernesto; Sandberg, David V.

1998. Volume estimation of large woody debris with a stereoscopic vision technique. In: Proceedings: 13th conference on fire and forest meteorology. [Place of publication unknown]: International Association of Wildland Fire: 439-447.

Assessment of the number, volume, or mass of large woody debris, also known as large fuels in fire terminology, is important for wildfire managers, wildlife biologists, hydrologists, and other resource managers. We present a prototype to estimate the volume of natural fuels that uses rectangular- and stereo-matching algorithms. The system needs two stereo-pair images and camera parameters as input to produce the

position, length, and volume of large woody debris in the image. To assess the performance of the system, an artificial image generator was developed to produce images as similar as possible to real images.

Keywords: Large woody debris, fuels, stereoscopic vision, volume estimation.

(See Seattle order form.)

Avalos, Carlos Diaz; Alvarado, Ernesto
1998. Space-time analysis of fire pattern in the Blue Mountains, Oregon. In: Proceedings: 13th conference on fire and forest meteorology. [Place of publication unknown]: International Association of Wildland Fire: 413-420.

The spatio-temporal pattern of fires occurring in the Blue Mountains of northeast Oregon was analyzed through exploratory data analysis. Log-linear models were fitted to test the significance of factors such as vegetation, elevation, and slope in the fire counts. Kernel estimators for point processes were computed to explore the monthly spatial structure of fire risk. The results showed that most of the fires are concentrated in a narrow elevational range, at low slopes, and in four vegetation types. Interactions among these factors were significant, which suggests a complex structure in the local conditions.

Keywords: Forest fires, statistical modeling, spatio-temporal modeling, fire occurrences, Blue Mountains.

(See Seattle order form.)

de Negreiros, Gustavo Hees; Nepstad, Daniel C.; Sandberg, David V. [and others]
1998. Fire along the transition between the Amazon forest and the cerrado ecosystems. In: Proceedings: 13th conference on fire and forest meteorology. [Place of publication unknown]: International Association of Wildland Fire: 63-67.

Most of the fires in Amazonia happen along an arc of deforestation, which generally follows the transition between the Amazon evergreen forests and the savannas (cerrado). The evergreen primary forest acts as a giant fire break, while the cerrado has adapted to frequent fires. The transitional zone between these two ecosystems is a fragile boundary controlled by highly dynamic ecosystem processes. It is also an area with heavy pressures from humans who use fire as a way to clear and manage the land. Canopy disturbance of the primary forest due to increased selective logging and deforestation along with extended droughts, alters the hydrological equilibrium of this ecosystem and therefore the ecotone.

Keywords: Fire, forest savanna ecotone, water stress, rooting, depth, GIS, modeling, tropics, Brazil.

(See Seattle order form.)

Rorig, Miriam L.; Ferguson, Sue A.
1999. Characteristics of lightning and wildland fire ignition in the Pacific Northwest. Journal of Applied Meteorology. 38: 1565-1575.

Lightning is the primary cause of fire in the forest regions of the Pacific Northwest, especially when it occurs without significant precipitation at the surface. By using thunderstorm occurrence and precipitation observations from 1948 to 1977 along with automated lightning strike data for the period 1986 to 1996, it was possible to classify convective days as either “dry” or “wet” for several stations in the Pacific Northwest. Findings potentially can be used by resource managers to gain a greater understanding of the atmospheric conditions conducive to lightning-induced fires in the Pacific Northwest.

Keywords: Lightning, wildland fire, atmospheric instability, fire ignition, disturbance, synoptic meteorology.

(See Seattle order form.)

Forest Management

[Fried, Jeremy; Leefers, Larry; Vasievich, Mike] 2000. Seventh symposium on systems analysis in forest resources. Gen. Tech. Rep. NC-205. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 470 p.

This international symposium included presentations by representatives from government, academia, and private institutions. Topics covered management objectives; information systems; modeling, optimization, simulation, and decision support techniques; spatial methods; timber supply; and economic and operational analyses.

Keywords: Simulation, optimization, modeling, spatial analysis, heuristics, systems analysis.

(This publication is available by writing Publications, North Central Research Station, 1992 Folwell Avenue, St. Paul, MI 55108.)

Scowcroft, Paul G.; Meinzer, Frederick C.; Goldstein, Guillermo [and others] 2000. Moderating night radiative cooling reduces frost damage to *Metrosideros polymorpha* seedlings used for forest restoration in Hawaii. Restoration Ecology. 8(2): 161-169.

Winter frosts caused by radiative cooling were hypothesized to limit successful reintroduction of Hawaiian plants other than *Acacia koa* to alien-dominated grasslands above 1700 meters elevation. We determined, in the laboratory, the temperature at which irreversible tissue damage occurred to *Metrosideros polymorpha* leaves. We also conducted a field study to determine if (1) leaf damage was correlated with subzero leaf temperatures, (2) radiative cooling could be moderated by canopies of *A. koa*, and (3) low soil temperatures contributed to seedling damage. In the laboratory, supercooling protected leaves from mild subzero temperatures. In the field, leaf damage was strongly correlated with degree-hours below freezing. Unprotected seedlings suffered the greatest leaf damage. Using *A. koa* or artificial devices to reduce radiative cooling during winter nights should enhance establishment of *M. polymorpha* in high-elevation rangeland.

Keywords: Acacia koa*, reforestation, frost injury, nurse, tree, tropical islands.*

(See Corvallis order form.)

Genetics

Johnson, Randy 2000. Tree improvement in the Pacific Northwest. In: Rose, R.; Haase, D.L., eds. Conference proceedings: advances and challenges in forest regeneration. Corvallis, OR: Oregon State University, College of Forestry: 29-34.

Advanced-generation tree breeding programs are underway for Douglas-fir and western hemlock. These programs will continue to improve growth rates and other traits. Regardless of whether seed is from a seed orchard or natural collection, it must be used in its appropriate breeding zone or seed zone. These zones differ by species. Breeding programs are underway for other species as well, with many of these programs emphasizing disease and insect resistance. Absolute gains at rotations still are unknown, but absolute (not percentage) gains observed early in the rotation should increase to some degree with time.

Keywords: Tree breeding, genetic gain, diversity, seed orchards, Douglas-fir, Pseudotsuga menziesii*, western hemlock,* Tsuga heterophylla*.*

(See Corvallis order form.)

Geomorphology and Hydrology

Fink, Jonathan H.; Connor, Charles B.; Ernst, W. Gary.

2000. Review of the U.S. Geological Survey's volcano hazards program. Washington, DC: National Academy Press. 138 p.

This review of the volcano hazards program of the U.S. Geological Survey commends many important contributions of the program to the science of volcanology and use of that understanding in helping deal with volcanoes in states of unrest. Recommendations are made concerning future staffing, data management, development of partnerships, and increased capability in areas of recent technology advances.

Keywords: Disturbance, volcanic, geology, geomorphology.

(This publication is available at http://www.nap.edu. Copies may be purchased from National Academy Press, 2101 Constitution Avenue NW, Box 285, Washington, DC 20025. Their telephone is 1-800-624-6242.)

Swanson, F.J.; Scatena, F.N.; Dissmeyer, G.E. [and others]

2000. Watershed processes–fluxes of water, dissolved constituents, and sediment. In: Dissmeyer, G.E., ed. Drinking water from forests and grasslands: a synthesis of the scientific literature. Gen. Tech. Rep. SRS-GTR-039. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 26-41. Chapter 3.

In this chapter, we provide general background information on the flow of water, chemical constituents, and sediment. This information is useful in assessing drinking water issues. We begin with discussion of hydrology, dissolve constituents, and sedimentation and then address cumulative watershed effects of land uses, management and policy implications, research needs, and key points.

Keywords: Water, water quality, watershed management, aquatic ecosystems, sedimentation, sediment routing.

(Copies are available from the Southern Research Station, 200 Weaver Boulevard, Asheville, NC 28804 or via email to pubrequest@srs.fs.usda.gov. Include author, title, and publication number. You also may download it from http://www.srs.fs.fed.us/pubs.)

Landscape Ecology

Sala, Osvaldo E.; Chapin, F. Stuart, III; Armesto, Juan J. [and others]

2000. Global biodiversity scenarios for the year 2100. Science. 287: 177-1774.

Scenarios of change in biodiversity for 2100 can now be developed based on scenarios of changes in atmospheric carbon dioxide, climate, vegetation, and land use and the known sensitivity of biodiversity to these changes. This study identified a ranking of the importance of drivers of change, a ranking of the biomes with respect to expected changes, and the major sources of uncertainties.

Keywords: Biodiversity, climate change, land use change, atmospheric carbon dioxide, vegetation change.

(See Fairbanks order form.)

Mycorrhizae

Molina, Randy

2000. Mycorrhizal symbiosis. In: Coulson, J.R.; Vail, P.V.; Dix, M.E. [and others]. 110 years of biological control research and development in the United States Department of Agriculture, 1883-1993. [Place of publication unknown]: U.S. Department of Agriculture, Agricultural Research Service: 458-463.

Mycorrhizal associations represent one of the more widespread forms of mutualistic symbioses in terrestrial ecosystems. Over the past 30 years, Forest Service scientists have provided world leadership in discovering the importance of mycorrhizae to the health of forest ecosystems. This brief review highlights the major achievements of Forest Service research in mycorrhizal sciences.

Keywords: Biological control, mycology, forestry, silviculture.

(See Corvallis order form.)

Population Management

Mills, L. Scott; Doak, Daniel F.; Wisdom, Michael J.

1999. Reliability of conservation actions based on elasticity analysis of matrix models. Conservation Biology. 13(4): 815-829.

Matrix population models have entered the mainstream of conservation biology, with analysis of proportional sensitivities (elasticity analysis) of demographic rates becoming important components of conservation decisionmaking. We identified areas where management applications using elasticity analysis potentially conflict with the mathematical basis of the technique, and we used a hypothetical example and three real data sets to evaluate the extent to which conservation recommendations based on elasticities might be misleading. We suggest that studies using analytical elasticity analysis explicitly consider the range of variation possible for different rates and that simulation methods are a useful tool to this end.

Keywords: Elasticity analysis, matrix population model, conservation, population management, population recovery, sensitivity analysis.

(See La Grande order form.)

Wisdom, Michael J.; Mills, L. Scott; Doak, Daniel F.

2000. Life stage simulation analysis: estimating vital-rate effects on population growth for conservation. Ecology. 81(3): 628-641.

We developed a simulation method, known as life-stage simulation analysis (LSA), to measure potential effects of uncertainty and variation in vital rates on population growth for purposes of species conservation planning. We applied LSA to vital rates for two vertebrates: desert tortoise (*Gopherus agassizii*) and greater prairie chicken (*Tympanuchus cupido*). Results for the prairie chicken indicated that a single vital rate consistently had the greatest effect on population growth. Results for the desert tortoise, however, suggested that a variety of life stages could have strong effects on population growth. The LSA is an important complement to other methods that evaluate population growth, including classical elasticity analysis, retrospective methods of variance decomposition, and simulation of the effects of environmental stochasticity.

Keywords: Demography, Gopherus agassizii*, desert tortoise, elasticity, finite rate of increase, life-stage simulation analysis, population growth,* Tympanuchus cupido*, greater prairie chicken.*

(See La Grande order form.)

Physiology

Becker, P.; Meinzer, F.C.; Wullschleger, S.D. 2000. Hydraulic limitation of tree height: a critique. Functional Ecology. 14: 4-11.

Evidence and arguments are presented that components of the soil-plant-atmosphere continuum, such as hydraulic resistance of the rhizosphere and leaves, and water storage in the stem, may reduce or eliminate the significance of axial resistance to water transport. We argue that the height of most tree species is more constrained by genetic rather than physical limitations. When height growth ceases to offer a competitive advantage through avoidance of shade, then resource allocation will be adjusted to enhance tree survival and reproduction and not necessarily wood production.

Keywords: Hydraulic limitation, tree height, xylem, resource allocation.

(See Corvallis order form.)

Cordell, S.; Goldstein, G.; Meinzer, F.C.; Handley, L.L. 1999. Allocation of nitrogen and carbon leaves of *Metrosideros polymorpha* regulates carboxylation capacity and $d^{13}C$ along an altitudinal gradient. Functional Ecology. 13: 811-818.

Metrosideros polymorpha (O'hia), the dominant tree species in Hawaiian forest ecosystems, grows from sea level to treeline. Consistent changes in its morphology and anatomy occur along this altitude-temperature gradient. Two major homeostatic responses in *M. polymorpha* were observed: (1) maintenance of similar photosynthetic rates per unit leaf surface area despite suboptimal conditions for CO_2 assimilation at high elevation, and (2) similar N content per leaf despite lower soil N availability at high elevations. These homeostatic mechanisms allow *M. polymorpha* to maintain a relatively high level of growth-related activities at high elevation, despite limiting environmental conditions.

Keywords: Carbon isotope ratios, homeostatic responses, photosynthesis, photosynthetic nitrogen-use efficiency, O'hia, Metrosideros polymorpha.

(See Corvallis order form.)

Kelsey, Rick G.; Joseph, Gladwin 1999. Ethanol and water in *Pseudotsuga menziesii* and *Pinus ponderosa* stumps. Journal of Chemical Ecology. 25(12): 2779-2792.

Douglas-fir west of the Cascade Range and ponderosa pine east of the Cascades were cut during fall in conjunction with various forest management practices. The cut trees differed in size and age, and the stumps were exposed to disparate winter temperatures and precipitation patterns. Nevertheless, the stumps showed similar responses in their synthesis and accumulation of ethanol. The following spring, tissues below the cut surface of stumps from both species contained significantly higher ethanol concentrations than corresponding tissues in their roots. Apparently, aboveground tissues had been more hypoxic or anoxic than were the roots because of the former's exposure to warmer temperatures and more water from precipitation. Tissues from ponderosa pine stumps contained higher ethanol concentrations than tissues from Douglas-fir stumps

Keywords: Pseudotsuga menziesii*, Douglas-fir,* Pinus ponderosa*, ponderosa pine, anaerobic respiration, fermentation, ethanol.*

(See Corvallis order form.)

Tausend, Peter C.; Goldstein, Guillermo; Meinzer, Frederick C.

2000. Water utilization, plant hydraulic properties and xylem vulnerability in three contrasting coffee (*Coffea arabica*) cultivars. Tree Physiology. 20: 159-168.

Water use, hydraulic properties, and xylem vulnerability to cavitation were studied in the coffee (*Coffea arabica* L.) cultivars San Ramon, Yellow Caturra, and Typica growing in the field under similar environmental conditions. The cultivars differed in growth habit, crown morphology, and total leaf surface area. All cultivars shared the same functional relation between integrated daily sap flow and hydraulic conductance of the soil-leaf pathway, but they had different operating ranges. The cultivars also shared common functional relations between hydraulic architecture and water use despite consistent differences in water use under irrigated and dry soil conditions. We concluded that hydraulic architectural traits, rates of water use per plant, and crown architecture are important determinants of short- and long-term variations in the water balance of *C. arabica*.

Keywords: Coffee, Coffea arabica*, hydraulic architecture, hydraulic conductance, sap flow, water deficits, water relations.*

(See Corvallis order form.)

Tausend, Peter C.; Meinzer, Frederick C.; Goldstein, Guillermo

2000. Control of transpiration in three coffee cultivars: the role of hydraulic and crown architecture. Trees. 14: 181-190.

Water use and hydraulic architecture were studied in the coffee (*Coffea arabica*) cultivars San Ramon, Yellow Caturra, and Typica growing in the field under similar environmental conditions. The cultivars differed in growth habit, crown architecture, basal sapwood area, and total leaf surface area. Transpiration per unit leaf area, stomatal conductance, crown conductance, total hydraulic conductance of the soil/leaf pathway, and the stomatal decoupling coefficient were assessed over a range of soil moistures and during partial defoliation treatments.

Keywords: Coffee arabica*, hydraulic conductance, sap flow, stomata, stomatal decoupling coefficient.*

(See Corvallis order form.)

Remote Sensing

Cohen, Warren B.; Justice, Christopher O.

1999. Validating MODIS terrestrial ecology products: linking in situ and satellite measurements. Remote Sensing of the Environment. 70: 1-3.

The moderate-resolution imaging spectrometer is the principal high temporal frequency global mapping sensor on board NASA's Earth observation system. Validation of the resulting global data products is crucial, to both establish the accuracy of the products for the science-user community and provide feedback so that the data processing algorithms and product-oriented models can be improved.

Keywords: Carbon cycling, landscape scales, mapping, ecosystem modeling, remote sensing.

(See Corvallis order form.)

Silviculture

Harms, William R.; Whitesell, Craig D.; DeBell, Dean S.

2000. Growth and development of loblolly pine in a spacing trial planted in Hawaii. Forest Ecology and Management. 126: 13-24.

Loblolly pine (*Pinus taeda* L.) was planted at four square spacings on Maui in 1961 and measured periodically for 34 years. Patterns of stand growth and development were examined and compared with yield model estimates of stand characteristics of plantations of the same initial spacings, ages, and site index in the

southeastern United States. The Hawaiian plantings had much higher survival at all spacings and sustained high diameter growth in the face of intense competition. The Hawaiian plantings demonstrated that growth potential of loblolly pine is far greater than is apparent from observations at plantations in its native habitat. To capture this potential in other situations, research must identify the tree, stand, and environmental characteristics associated with low mortality rates and high diameter growth in Hawaii, and conversely, the factors limiting the potential of this pine in the Southeastern United States.

Keywords: Pinus taeda*, stand dynamics, stockability, self-thinning, growth and yield.*

(See Olympia order form.)

Social Sciences

Kruger, Linda E.; Shannon, Margaret A.
2000. Getting to know ourselves and our places through participation in civic social assessment. Society and Natural Resources. 13: 461-478.

This paper reports on a study that used nontraditional research methods to actively involve citizens in a community assessment process. This paper (1) demonstrates that researchers can gain a more complete understanding of social systems by using nontraditional methods (2) illustrates how people can reconnect with their community and gain a new understanding of themselves and others through engagement in a self-assessment process and (3) describes one example of civic science used in community assessment.

Keywords: Civic science, community-forest relations, participatory research, sense of place, social assessment.

(See Seattle order form.)

Soil

Nay, S.M.; Bormann, B.T.
2000. Soil carbon changes: comparing flux monitoring and mass balance in a box lysimeter experiment. Soil Science Society of America Journal. 64(3): 943-948.

To test an infrared gas analyzer-based flux method under quasi-field conditions, we established field lysimeters without plants and with homogenized soils amended with manure that permitted us to calculate a reference carbon loss by mass balance. Instantaneous methods were used to monitor respiration rates and calculate long-term fluxes for comparison to mass balances.

Keywords: Carbon dioxide, soil respiration, lysimetry, mass balance, soil carbon.

(See Corvallis order form.)

Piatek, Kathryn B.; Allen, H. Lee
1999. Nitrogen mineralization in a pine plantation fifteen years after harvesting and site preparation. Soil Science Society of America Journal. 63: 990-998.

This study was conducted in a loblolly pine plantation in the Piedmont of North Carolina to evaluate the effects of nutrient removal on nitrogen availability at midrotation during harvest and site preparation. Treatments installed in 1981 consisted of a combination of harvest (stem only versus whole tree) and site preparation (chop and burn versus shear, pile, and disk) with a split plot of vegetation control (herbicide versus no herbicide). Net nitrogen mineralization was about three times lower at midrotation than shortly after treatment. Midrotation mineralization was positively correlated with soil temperature and negatively correlated with soil phosphorus

and soil carbon-to-nitrogen ratio. The effect of harvest on nitrogen mineralization was probably exerted through phosphorus nutrition, whereas the lack of site preparation effects suggested that large nutrient removals that occurred with shearing and piling did not have lasting and negative effects on nitrogen availability in this plantation.

Keywords: Nitrogen, Pinus taeda*, loblolly pine, North Carolina, fertilization.*

(See Olympia order form.)

Piatek, Kathryn B.; Allen, H. Lee

2000. Site preparation effects on foliar N and P use, retranslocation, and transfer to litter in 15-year old *Pinus taeda*. Forest Ecology and Management. 129: 143-152.

Intensive site preparation in loblolly pine (*Pinus taeda*) plantations may remove nutrients and lower site productivity. We evaluated the effects of nutrient removal in site preparation on midrotation pine foliar production, and foliar nitrogen and phosphorus use, retranslocation, and transfer to litter for 2 years. We also investigated changes in foliar nutrients 1 year after fertilization. The lack of site preparation effects may be related to the length of time after treatment; the stage of decomposition of organic matter that may be removed in site preparation may determine when nutrient supply will be affected. Competition with hardwoods decreased pine foliar production and nitrogen and phosphorus use, but not the percentage of retranslocation. Fertilization increased foliage production and nitrogen and phosphorus use, thereby indicating some luxury consumption.

Keywords: Pinus taeda*, loblolly pine, nitrogen, phosphorus, retranslocation, productivity, plantation management, fertilization.*

(See Olympia order form.)

Threatened, Endangered, Sensitive Species

North, Malcolm P.; Franklin, Jerry F.; Carey, Andrew B. [and others]

1999. Forest stand structure of the northern spotted owl's foraging habitat. Forest Science. 45(4): 520-527.

Although the spotted owl's close association with old growth has been extensively studied, it has been more difficult to identify and quantify the abundance of particular stand structures associated with preferred owl foraging sites. Old-growth forests have a array of characteristics that distinguish them from younger forests but which also make it difficult to isolate individual structural features important to the spotted owl. This study used an analysis of use-only sites in areas where natural disturbance had created a gradient of old-growth structural characteristics. We used radiotelemetry data collected from reproducing owl pairs to locate sample stands and compute a relative measure of owl-use intensity in each stand. Snag volume and tree height class diversity (a measure of canopy layering) were the stand structures significantly associated with owl foraging intensity. Stands with 142 cubic meters per hectare of intact snags and a high diversity of tree heights had medium or high foraging use by spotted owls. In these old-growth stands, biological legacies (for example, large trees and snags) produced by past disturbance provide important forest structures associated with spotted owl foraging use.

Keywords: Old growth, stand structure, radio telemetry, canopy structure.

(See Olympia order form.)

Watershed Management

Gray, Andrew N.
2000. Adaptive ecosystem management in the Pacific Northwest: a case study from coastal Oregon. Conservation Ecology. 4(2): 6. http://www.consecol.org/vol4/iss2/art6. (27 November 2000).

The paper analyzes the primary ecological, social, and institutional issues for a single adaptive management area in the northern Oregon Coast Range. From existing knowledge, several divergent approaches are available that could meet ecological goals, but these differ greatly in social and economic implications. In particular, reliance on natural successional processes, or re-creation of historic patterns, may not meet ecosystem goals for restoration as readily as active manipulation of existing structure and composition. Although some innovative projects have been developed, adaptive management in its more rigorous definition is still in its infancy. Obstacles in this effort are similar to those found in other adaptive management efforts, but solutions may have to be local and idiosyncratic to be effective.

Keywords: Ecosystem management, adaptive management, old-growth forest, forest ecology, landscape ecology.

(See Portland order form.)

Johnson, Sherri L.; Swanson, Frederick J.; Grant, Gordon E.; Wondzell, Steven M.
2000. Riparian forest disturbances by a mountain flood–the influence of floated wood. Hydrological Processes. 14: 3031-3050.

Large floods can have major impacts on riparian forests. Here, we examine the variability and spatial distribution of riparian forest responses along eight third- to fifth-order streams following a large flood (about 100-year recurrence interval) in the Cascade Range of Oregon.

Keywords: Disturbance, flood, coarse woody debris, riparian vegetation.

(See Corvallis order form.)

Wildlife

Aubry, Keith B.
2000. Amphibians in managed, second-growth Douglas-fir forests. Journal of Wildlife Management. 64(4): 1041-1052.

The objectives of this study were to describe the community structure, relative abundances, and stand- and landscape-scale habitat relations of amphibians occurring in forests managed primarily for timber production in the Douglas-fir zone of western Washington. Although devoid of old-growth forests for many decades, these landscapes contained the same assemblage of amphibian species occurring in unmanaged Douglas-fire forests in this region. Communities were structured differently, however, which suggests that the probability of species persistence, especially for stream-associated amphibians, may be lower in managed landscapes.

Keywords: Amphibians, timber harvest, silviculture, forest management, stand structure, landscape scale, community composition, habitat relations.

(See Olympia order form.)

Wood Utilization

Parry, Dean; Cahill, Jim

2000. Retired transmission poles make good fencing products. The Forest Industry Magazine. 1(3): 20-21, 24-25.

This brief article documents a study that examined the product potential of retired cedar power transmission poles as fencing stock. Lumber recovery (overrun), lumber values, and log values are presented for 47 poles processed in a large Northwest mill. The pros and cons of using retired utility poles as a raw material source for the forest products industry also are discussed.

Keywords: Power poles, lumber recovery, lumber value, log value, forest products industry.

(See Portland order form.)

Wang, Xiping; Ross, Robert J.; McClellan, Michael [and others]

2000. Strength and stiffness of standing trees using a nondestructive stress wave technique. Res. Pap. FPL-RP-585. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 9 p.

This study investigated the usefulness of a stress wave technique for evaluating wood strength and stiffness of young-growth western hemlock and Sitka spruce in standing trees. A secondary objective was to determine if the effects of silvicultural practices on wood quality can be identified by using this technique. Results indicated that in situ stress wave measurements could provide relatively accurate and reliable information that would enable nondestructive evaluation of wood properties in standing trees.

Keywords: Nondestructive evaluation, standing trees, stress wave, wood strength, wood stiffness.

(A limited number of free copies of this publication are available by writing the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705. It is also available in electronic format at http://www.fpl.fs.fed.us/documnts/fplrp/fplrp585.pdf.)

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