United States
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Pacific Northwest
Research Station

Recent Publications of the Pacific Northwest Research Station, Third Quarter 2000

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October 2000

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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.

Bibliographies

00-131

Pacific Northwest Research Station

2000. Recent publications of the Pacific Northwest Research Station, first quarter 2000. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 18 p.

Keywords: Bibliographies (forestry).

(This publication is available to download in pdf format at www.fs.fed.us/pnw/qlist.htm.)

Economics

00-161

Warren, Debra D.

2000. Production, prices, employment, and trade in Northwest forest industries, all quarters 1998. Resour. Bull. PNW-RB-231. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 171 p.

Provides current information on lumber and plywood production and prices; employment in the forest industries; international trade in logs, lumber, and plywood; volume and average prices of stumpage sold by public agencies; and other related items.

Keywords: Forestry business economics, lumber prices, plywood prices, timber volume, stumpage prices, employment (forest products industries), marketing (forest products), imports and exports (forest products).

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

Plant Ecology

96-132

Boggs, Keith

2000. Classification of community types, successional sequences, and landscapes of the Copper River Delta, Alaska. Gen. Tech. Rep. PNW-GTR-469. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 244 p.

A classification of community types, successional sequences, and landscapes is presented for the piedmont of the Copper River Delta, Alaska. A total of 75 community types, 42 successional sequences, and six landscapes are described. Diagnostic keys, based on indicator species, are provided to aid in field identification of community types and successional sequences.

Keywords: Alaska, Copper River Delta, classification, community type, succession, landscape, outwash, flood plain, delta, dune, barrier islands.

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

99-083

Thysell, David R.; Carey, Andrew B.

2000. Effects of forest management on understory and overstory vegetation: a retrospective study. Gen. Tech. Rep. PNW-GTR-488. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 41 p.

Management for wood production through long rotations and thinning and management for biodiversity through legacy retention, protection, and no subsequent manipulation are two approaches to managing second-growth forests in

the Pacific Northwest. We describe how these two strategies have affected tree size, tree density, and native and exotic vascular plant diversity and abundance.

Keywords: Diversity, second growth, Douglas-fir, Pseudotsuga menziesii*, understory vegetation, species richness, thinning, forest development, legacies.*

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

Regional Assessments

96-075

Fluharty, David L.

2000. Characterization and assessment of economic systems in the interior Columbia basin: fisheries. Gen. Tech. Rep. PNW-GTR-451. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 114 p. (Quigley, Thomas M., ed.; Interior Columbia Basin Ecosystem Management Project: scientific assessment).

Economic value of commercial, recreational, and tribal fishing is one measure of the importance of fisheries in the interior Columbia River basin (the basin) but only part of the values associated with fish of that region. Harvest management, construction of dams and irrigation facilities, changes in habitat, and other factors have led to significant declines in some fish stocks, thereby diminishing their economic importance to the region. Future economic and societal values of fisheries can be expected to increase because of major ongoing efforts to recover stocks of anadromous salmon. Increasing human populations in the basin along with steady or increased demand for recreational fishing will continue to raise the value of both native and introduced species. Shifts in social preferences, global climate change, intermittent drought, and interdecadal shifts in ocean conditions provide additional complexity and uncertainty that will affect fish values.

Keywords: Fish, economics, native fish, resident fish, anadromous fish, recreation, tribal, warm water fish, cold water fish, Idaho, Montana, Oregon, Washington, Wyoming, Columbia River, Snake River.

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

00-001

Pacific Northwest Research Station

2000. Index to selected science publications of the interior Columbia basin ecosystem management project. Portland, OR: U.S. Department of Agriculture, Forest Service. 61 p. (Quigley, Thomas M., ed.; Interior Columbia Basin Ecosystem Management Project: scientific assessment).

This publication provides an easy-to-use, single index to the major publications of the Science Integration Team of the Interior Columbia Basin Ecosystem Management Project. The indexed publications include *A Framework for Ecosystem Management in the Interior Columbia Basin and Portions of the Klamath and Great Basins; Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin and Portions of the Klamath and Great Basins*; *An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins* (4 volumes); *Status of the Interior Columbia Basin*; *Summary of Scientific Findings*; and *Highlighted Scientific Findings of the Interior Columbia Basin Ecosystem Management Project.*

Keywords: Columbia basin, ecosystem assessment, ecosystem management, biophysical system, social system, index.

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

Resource Inventory

99-140

Caouette, John P.; Kramer, Marc G.; Nowacki, Gregory J.

2000. Deconstructing the timber volume paradigm in management of the Tongass National Forest. Gen. Tech. Rep. PNW-GTR-482. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 20 p. (Shaw, Charles G., III, tech. coord.; Conservation and resource assessments for the Tongass land management plan revision).

Timber volume maps have been widely used at the Tongass National Forest for land-use planning and timber and wildlife management. Although considerable effort has been expended to improve these maps, little has been done to evaluate the suitability of timber volume as a descriptor of forest character. In this paper, we establish a rough indicator of forest structure using trees per acre and quadratic mean diameter to examine the relations between timber volume and forest structure. Results indicate that timber volume and forest structure are not interchangeable attributes.

Keywords: Timber volume, forest structure, aerial photointerpretation, canopy texture, quadratic mean diameter, trees per acre.

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

Silviculture

98-095

Cochran, P.H.; Dahms, Walter G.

2000. Growth of lodgepole pine thinned to various densities on two sites with differing productivities in central Oregon. Res. Pap. PNW-RP-520. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 59 p.

Concave curvilinear decreases in diameter growth occurred with increasing stand densities. A convex curvilinear increase in gross growth of basal area and total cubic volume took place with increasing stand density. Maximum cumulative net cubic (total and merchantable) and board-foot yields varied curvilinearly with stand density. These yields peaked at intermediate stand densities or differed little among the four highest stand density levels.

Keywords: Growth, mortality, growing stock, thinning, lodgepole pine, stand density index, bole area.

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

00-053

Curtis, Robert O.; Clendenen, Gary W.; Henderson, Jan A.

2000. True fir-hemlock spacing trials: design and first results. Gen. Tech. Rep. PNW-GTR-492. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 35 p.

A series of 18 precommercial thinning trials was established in true fir-hemlock stands in the Olympic Mountains and west side of the Cascade Range in Washington and Oregon from 1987 through 1994. This paper documents establishment of these installations and presents some preliminary observations and results. Substantial differences in growth rate in height and diameter occurred among Pacific silver fir, western hemlock, and noble fir. Diameter growth of all species increased as spacing increased, but height growth of silver fir and noble fir decreased at wider spacings in some areas. These installations will provide a unique source of information on early development of managed stands of these species, for which little information now is available.

Keywords: Abies*, spacing, precommercial thinning, true firs.*

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

99-139

Miller, Richard E.; Obermeyer, Edmund L.; Anderson, Harry W.

1999. Comparative effects of precommercial thinning, urea fertilizer, and red alder in a site II, coast Douglas-fir plantation. Res. Pap. PNW-RP-513. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 25 p.

We varied the number of red alder retained with 300 Douglas-fir per acre on a high-quality site in coastal Oregon. Alder densities of 0, 20, 40, and 80 per acre were tested. Our fifth treatment eliminated nitrogen-fixing alder, but substituted nitrogen fertilizer. Treatment 6 had neither thinning nor alder control. Treatments were randomly assigned within each of three blocks in a 9-year-old plantation. In pure Douglas-fir plots, gross volume growth was similar for nonfertilized plots, indicating no measurable benefits of additional nitrogen. In mixed stands, red alder reduced yield of associated Douglas-fir but not yield of combined species. Similar comparisons are needed at other locations, especially those with known nitrogen deficiency.

Keywords: Mixed stands, competition (plant), Douglas-fir, Pseudotsuga menziesii*, red alder,* Alnus rubra*, thinning, nitrogen fertilization, volume growth.*

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

00-051

Owston, Peyton W.; Schlosser, William E.; Efremov, Dmitri F.; Miner, Cynthia L., tech. eds.

2000. Korean pine-broadleaved forests of the Far East: Proceedings from the international conference; 1996 September 30-October 6; Khabarovsk, Russian Federation. Gen. Tech. Rep. PNW-GTR-487. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 313 p. In Russian and English.

Korean pine-broadleaved forests are biologically diverse. In the Russian Far East, these forests are subject to a high level of use by humans and are systematically influenced by fire. Intensive exploitation in the past has led to a decrease in the resource potential. Sound decisionmaking and scientific advancement have lacked sufficient exchange of scientific information. A symposium was convened to share information through presentations of a comprehensive set of topics including forest structure, seed science, genetics, regeneration, fire, wildlife biodiversity, nontimber forest products, economics, and forest management. The main focus of the symposium was the Russian Far East with some participation from Japan and the United States. Because Siberian pine dominates in Siberia, several presentations and abstracts address this forest species.

Keywords: Korean pine-broadleaved forests, Korean pine, Pinus koraiensis*, Siberian pine*, Pinus sibirica*, biodiversity, forest structure, regeneration, nontimber forest products, genetics, Russian Far East, Siberia.*

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

Social Sciences

00-169

Burdge, Rabel; Miles, John; Alper, Donald; Kruger, Linda, comps.

2000. Book of abstracts: 8th international symposium on society and resource management; 2000 June 17-22; Bellingham, WA. Gen. Tech. Rep. PNW-GTR-497. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 354 p.

This report is a compilation of abstracts of papers presented at a symposium at Western Washington University. The abstracts explore the social dimensions of managing spatial landscapes for various purposes. The theme of the

symposium, transcending boundaries: natural resource management from summit to sea, provided participants with an opportunity to explore the challenges of working across conceptual, cultural, and physical boundaries.

Keywords: Resource management, recreation, community collaboration, comanagement, ecosystem management, landscape, protected areas.

Wood Utilization

98-118

Leavengood, Scott; Swan, Larry

1999. Western juniper drying project summaries, 1993-96. Gen. Tech. Rep. PNW-GTR-475. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 8 p.

Based on the results of tests performed during the 3-year period covered by this project, it seems that checking and splitting in juniper can be reduced by (1) carefully choosing logs to minimize large knots, spiral grain, and taper; (2) careful treatment of logs after harvest, such as end-coating and sawing logs as soon as possible after felling; (3) minimizing material with large knots (over one-half inch) and pith; (4) drying thinner, narrower, and shorter boards; (5) using moderate kiln schedules (lower initial temperatures, higher initial relative humidities, and longer times); and (6) finger-jointing and putting emphasis on products that require shorter, narrower, and thinner lumber than commonly produced in the Pacific Northwest.

Keywords: Western juniper drying, western juniper moisture loss, western juniper kiln drying, western juniper saw-dry-rip program, western juniper warping and splitting, western juniper moisture meter factors, Juniperus occidentalis.

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

Publications Available Elsewhere

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

Botany

Sorensen, F.C.

1999. Effect of dry storage on germination rate of seeds of coastal Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii*). Seed Science and Technology. 27: 91-99.

Short-term (4 to16 weeks) dry, cold storage (12 °C and 3 °C) slightly but significantly increased germination rate of seeds of coastal Douglas-fir; longer dry storage did not. Storage at 3 °C for longer than 1 year decreased germination rate, possibly due to incipient deterioration of seeds. Variation among families in germination rate was several times larger than maximum dry storage effect.

Keywords: Postripening, secondary dormancy.

(See Corvallis order form 2.)

Ecosystem Structure and Function

Daly, Christopher; Bachelet, Dominique; Lenihan, James [and others]

2000. Dynamic simulation of tree-grass interactions for global change studies. Ecological Applications. 10(2) 449-469.

The objective of this study was to determine how changes in lifeform (tree versus grass) root depth might affect ecosystem response for a historical time period (1895 to 1994) and for a general circulation model (GCM)-simulated future scenario (1995 to 2094). Results are presented from a model that estimates the distribution of vegetation to which it associates carbon and nutrient fluxes by using a modified version of the biogeochemical model CENTURY. The model includes a dynamic fire model that depends on fuel load and moisture. By manipulating the root depth of trees and grasses, we show its importance on the simulation of ecosystem processes and vegetation distribution and how they might be affected by global climate change.

Keywords: Root depth, root distribution, trees, grasses, interactions, simulation, climate change, competition.

(See Corvallis order form 1.)

Everett, Richard L.; Schellhaas, Richard; Keenum, Dave [and others]

2000. Fire history in the ponderosa pine/ Douglas-fir forests on the east slope of the Washington Cascades. Forest Ecology and Management. 129: 207-225.

We collected evidence of 490 and 233 fire scars on two ponderosa pine (*Pinus ponderosa*)/ Douglas-fir (*Pseudotsuga menziesii*)-dominated landscapes on the east slope of the Washington Cascade Range that contained a record of 3,901 and 2,309 cross-dated fire events. During the presettlement period (1700/1750 to 1860), the Weibull mean fire-free interval and the mean fire-free interval (MFFI) were 6.6 to 7 years at both sites. The MFFI during the settlement period (1860 to 1910) ranged within 3 years of the presettlement value, but increased to 38 and 43 years for a truncated fire suppression period between 1910 and 1996. Increased variation in MFFI among aspect polygons suggests fire

regimes have become more complex since Euro-settlement. In the presettlement period an area equal to about 50 to 60 percent of the study areas burned every 6 to 7 years, an amount of fire disturbance apparently in balance with landscape and stand vegetation structure. Fire disturbance rates and patterns are suggested as ecologically defensible reference points for landscape heterogeneity to reduce the potential for catastrophic fires and to establish vegetation disturbance management guidelines.

Keywords: Ecosystem integrity, fire free intervals, fire history polygons, fire regimes, landscape dynamics, natural fire rotation, patch mosaic.

(See Wenatchee order form.)

Hessburg, Paul F.; Smith, Bradley G.
1999. Management implications of recent changes in spatial patterns of interior Northwest forests. In: McCabe, Richard E.; Loos, Samantha, eds. Transactions of the 64th North American wildlife and natural resource conference; 1999 March 26-30; Burlingame, CA. Washington, DC: Wildlife Management Institute: 55-78.

We characterized recent historical and current vegetation composition and structure of a representative sample of subwatersheds on all ownerships within the interior Columbia River basin and portions of the Klamath and Great Basins. For each selected subwatershed, we constructed historical and current vegetation maps from interpretation of 1932-66 and 1981-93 aerial photos, respectively. From the remotely sensed raw vegetation attributes, we classified and attributed cover types, structural classes, and potential vegetation types to individual patches within subwatersheds; characterized change in vegetation spatial patterns, and translated change in spatial patterns of vegetation to change in spatial patterns of vulnerability to wildfires and 21 major forest pathogen and insect disturbances. In this paper, some of the most significant findings are highlighted and some potential management implications are discussed.

Keywords: Ecosystem management, vegetation spatial and temporal patterns, disturbance processes, ecosystem processes, forest health, Interior Columbia Basin Ecosystem Management Project, midscale assessment, ecological reporting units, restoration.

(See Wenatchee order form.)

Jackson, R.B.; Schenk, H.J.; Jobbágy, E.G. [and others]
2000. Belowground consequences of vegetation change and their treatment in models. Ecological Applications. 10(2): 470-483.

Vegetation change has profound consequences for the structures of plants belowground and, therefore, for biogeochemistry and ecosystem functioning. In this paper, differences in the belowground structure of plant functional types and how such differences affect soil attributes are outlined. Some ecosystem consequences of vegetation change are examined with emphasis on the role of altered root distributions. Because models are important in predicting the effects of vegetation change, different ways in which models treat belowground processes are discussed, as are the effects on outputs and predictions. Ways in which the representation of belowground processes might be improved are highlighted.

Keywords: Belowground processes, roots, root distribution, vegetation change, soil attributes, modeling.

(See Corvallis order form 1.)

Neilson, Ronald P.

1999. Landscape ecology and global change. In: Wiens, John A.; Moss, Michael R., eds. Issues in landscape ecology. Guelph, ON: International Association for Landscape Ecology: 64-69.

Dynamic global vegetation models incorporate important processes that occur at three scales: patch, landscape, and global. The key points of this discussion serve to emphasize the importance of accurate simulation of ecosystem constraints at all relevant scales. Under a rapidly changing climate and with changing physiology under elevated carbon dioxide, constraints normally assumed to be stationary must now be assumed to be dynamic and must be explicitly simulated. Heterogeneous landscapes are among the most complex yet globally among the most dominant types of ecosystems. Accurate simulation of landscape patterns and processes under global change requires attention to processes at the organism level and lower but within the constraints of biome-level dynamic biogeography.

Keywords: Landscape ecology, global change, climate change, ecosystem modeling, landscape patterns, scale, ecosystem processes.

(See Corvallis order form 2.)

Rieman, Bruce E.; Lee, Danny C.; Thurow, Russell F. [and others]

2000. Toward an integrated classification of ecosystems: defining opportunities for managing fish and forest health. Environmental Management. 25(4): 425-444.

We used recent information on the status and distribution of forest and fish communities to classify river subbasins across the Pacific Northwest and explore the potential conflict and opportunity for a more integrated view of management. Because aggressive management activities proposed for forest restoration may directly affect watershed processes and functions, the goals of aquatic and terrestrial conservation and restoration are generally viewed as conflicting. Our classification indicated that often there are common trends in terrestrial and aquatic communities that highlight areas of potential convergence in management goals.

Keywords: Ecosystem management, forest health, ecological restoration, native fishes, integrated management, disturbance.

(See Wenatchee order form.)

Spies, Thomas A.

1998. Forest structure: a key to the ecosystem. Northwest Science. 72(2): 34-39.

Forest structure is a product and a driver of ecosystem processes and biological diversity. It has become apparent in recent years that changes in forest structure as a result of management for timber production have undesirable consequences for other components of forest ecosystems. The objective of this paper is to provide an overview of what we have learned about the ecological roles of forest structure in the Pacific Northwest and how forest structure changes as a result of disturbance and succession.

Keywords: Forest structure, ecosystem structure.

(See Corvallis order form 2.)

Forest Management

Swanson, Frederick J.

2000. Rocks, paper, soils, trees: view from an experimental forest. In: Schneiderman, Jill S., ed. The Earth around us. New York: W.H. Freeman and Company: 136-143.

This essay provides an overview of how Earth sciences have been linked with ecological sciences in ecosystem research and management in the Pacific Northwest. Examples are drawn from the H.J. Andrews Experimental Forest in Oregon.

Keywords: Ecosystems, experimental forests, ecosystem management.

(See Corvallis order form 2.)

Genetics

Johnson, Randy

1999. Mating design considerations: How many crosses do we really need to test? In: Proceedings: 25th biennial Southern tree improvement conference; 1999 July 11-14; New Orleans, LA. [Place of publication unknown]: Southern Tree Improvement Committee: [Pages unknown].

The impact of increasing number of crosses per parent on the efficiency of backward selection was examined through Monte Carlo simulation. Both the efficiency of reselection and its associated variance leveled off after two to three crosses per parent. Because so few crosses seem to be needed to estimate parental GCA (general combining ability) values, a quasi-complementary mating design option was investigated where only a subset of the full-sib families were planted into replicated field trials; the remainder were established in less expensive pure-family full-sib blocks. Breeding values for families planted only in blocks were generated from the family data available from the replicated trials. Compared to using only the field-tested families, significant additional genetic gain could be made through the increased selection intensity resulting from the additional families planted only in blocks.

Keywords: Complementary mating design, GCA test, selection, testing.

(See Corvallis order form 1.)

Johnson, Randy; Temel, Fatih

1998. The genetics of Swiss needle cast intolerance. In: Filip, Greg, ed. Swiss Needle Cast Cooperative annual report 1998. Corvallis, OR: Oregon State University, College of Forestry, Forest Research Laboratory: 20-21.

Four series of progeny tests evaluated the possibility of breeding for resistance and tolerance to Swiss needle cast (SNC). The SNC traits were under moderate genetic control. Phenotypic correlations among the SNC traits over time were relatively weak. Data agreed with previous results showing that SNC impacts diameter growth much more than height growth.

Keywords: Swiss needle cast, genetics, growth.

(See Corvallis order form 1.)

Johnson, Randy; Temel, Fatih

1999. Genetics of Swiss needle cast tolerance–early screening, and field results. In: Filip, Greg, ed. Swiss Needle Cast Cooperative annual report 1999. Corvallis, OR: Oregon State University, College of Forestry, Forest Research Laboratory: 10-11.

Progress on early screening trials is reported, and results from recent field data are discussed. Foliage scores were highly correlated with subsequent basal area in areas of Swiss needle cast. There also was a weak correlation between family means of crown density and distance from the coast of the parent tree. Trees closer to the coast appear slightly more tolerant of Swiss needle cast.

Keywords: Swiss needle cast, genetics, growth.

(See Corvallis order form 1.)

Kimball, Bruce A.; Johnson, G.R.; Nolte, Dale L.; Griffin, Doreen L.

1999. An examination of the genetic control of Douglas-fir vascular tissue phytochemicals: implications for black bear foraging. Forest Ecology and Management. 123: 245-251.

Vascular tissue samples were collected from six Douglas-fir families on five sites to study the impact of genetic selection. Tree growth and the absolute concentrations of 26 terpenes and simple carbohydrates were determined. Results indicated that tree growth and some terpenes are under genetic control. The sugars present were subject to genotype-by-environment interaction.

Keywords: Douglas-fir, Pseudotsuga menziesii*, sugars, tree genetics, terpenes, black bear,* Ursus americanus*, forest management.*

(See Corvallis order form 1.)

White, T.L.; Matheson, A.C.; Cotterill, P.P. [and others]

1999. A nucleus breeding plan for radiata pine in Australia. Silvae Genetica. 48(3/4): 122-133.

The Southern Tree Breeding Association (STBA) has adopted the concept of a nucleus breeding strategy entailing a total breeding population of 300 selections subdivided into two components: a nucleus population (which receives more emphasis in terms of breeding and testing and consists of the best 10 percent or so of the population) and a main population consisting of the remainder of the breeding population. This paper describes and compares three different options for operational implementation of a nucleus breeding strategy by the STBA.

Keywords: Nucleus breeding, forest genetics, breeding plans.

(See Corvallis order form 2.)

Harvesting

Youngblood, Andrew

2000. Damage to residual trees and advance regeneration from skyline and forwarder yarding in mixed-conifer stands of northeastern Oregon. Western Journal of Applied Forestry. 15(2): 101-107.

Residual stem damage was compared after partial cutting and yarding with skyline cable or ground-based forwarder systems in mixed conifer stands of northeastern Oregon. During yarding, more damage occurred to large residual trees than to seedlings. Forwarder yarding resulted in more damage to trees than did skyline cable yarding. Wrenching was similar for seedlings and trees. Scarring occurred more frequently on residual trees than on seedlings. Slight differences occurred in stand damage, but both yarding methods met the silvicultural prescription of reducing fuel and protecting large western larch, Douglas-fir, and Engelmann spruce. This suggests that the decision by resource managers to use one method of yarding over the other probably should be based on considerations such as availability of equipment, costs, and soil damage.

Keywords: Bole damage, seedling damage, wrenching, bole scar, advance regeneration.

(See La Grande order form.)

Invasive Plants and Animals

Heckman, Charles W.

1999. The encroachment of exotic herbaceous plants into the Olympic National Forest. Northwest Science. 73(4): 264-276.

A floral survey in the Olympic National Forest and its surroundings revealed that a considerable number of introduced ruderal plant species have made deep inroads into the stands of native flora. Some of them, mainly of European and Asian origin, were planted deliberately to stabilize the soil along roadsides and after clearcutting and burning. They have now established reproductive communities that are capable of spreading rapidly without additional human help, as they already have done in almost all regions of the world having a temperate climate. Plotting data from the Geographical Information System showed that 12 percent of an area totaling 338 square kilometers, mainly in the Olympic National Forest, was occupied totally or in large part by these mainly ruderal flora; they accounted for at least 50 percent and usually nearly 100 percent of all plants within the area where they occurred. This represents a major qualitative and quantitative biogeographical alteration in the regional flora of a national forest considered to be only slightly affected by human activity.

Keywords: Exotic plants, Olympic National Forest.

(See Olympia order form.)

Landscape Ecology

Cissel, John H.; Swanson, Frederick J.; Weisberg, Peter J.

1999. Landscape management using historical fire regimes: Blue River, Oregon. Ecological Applications. 9(4): 1217-1231.

We describe a landscape management plan based in part on interpretations of historical disturbance regimes. The plan contains a reserve system and landscape areas where three distinct types of timber harvest are prescribed. This plan is compared with an alternative plan for the same area based on the reserves and prescriptions for matrix lands in the Northwest Forest Plan. The contrasting patterns of reserves and timber harvest prescriptions result in significant differences in the amount, spatial distribution, and quality of habitats.

Keywords: Landscape dynamics, landscape planning, adaptive management areas, historical range of variability, natural range of variability.

(See Corvallis order form 1.)

Garman, Steven L.; Swanson, Frederick J.; Spies, Thomas A.

1999. Past, present, and future landscape patterns in the Douglas-fir region of the Pacific Northwest. In: Rochelle, James A.; Lehmann, Leslie A.; Wisniewski, Joe, eds. Forest fragmentation: wildlife and management implications. Leiden, Germany; Boston: Brill: 61-80.

The purpose of this chapter is to provide a synopsis of historical and future landscape pattern dynamics in the western Pacific Northwest region. Specifically, we review the influence of natural disturbance, primarily wildfire, and historical timber harvesting on forest pattern development, and provide case studies of contemporary landscape conditions for western Oregon. We also provide a qualitative prognosis of future landscape conditions under current federal and state forest-management policies.

Keywords: Landscape dynamics, remote sensing, landscape planning, landscape analysis.

(Available in bookstores and libraries.)

Swanson, Fred; Jones, Julia; Wemple, Beverley; Snyder, Kai

2000. Roads in forest watersheds–assessing effects from a landscape perspective. In: Slaughter, Charles W., ed. Western watersheds: Proceedings of the 7th biennial watershed management council conference; 1998 October 19-23; Boise, ID. Wat. Resour. Cntr. Rep. 98. Riverside, CA: University of California, Centers for Water and Wildland Resources; Water Resources Center: [Pages unknown].

In this paper, we consider how landscape structure affects road influences on terrestrial and stream systems. In the realm of stream networks, we emphasize movement of water, sediment, and debris flows–all of which follow gravitational flow paths and are major issues in watershed management. Road-related movement of exotic plants into forest landscapes also is considered briefly to offer an example of transfer processes that do not follow gravitational paths. We close with some consideration of implications for assessment procedures.

Keywords: Road management, hydrology, landscape analysis, road networks.

(See Corvallis order form 2.)

Monitoring

Franklin, Jerry F.; Harmon, Mark E.; Swanson, Frederick J.

1999. Complementary roles of research and monitoring: lessons learned from the U.S. LTER program and Tierra Del Fuego. In: Celedonio, Aguirre-Bravo; Franco, Carlos Rodriguez, comps. North American science symposium: toward a unified framework for inventorying and monitoring forest ecosystem resources; 1998 November 2-6; Guadalajara, Mexico. Proceedings RMRS-P-12. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 284-290.

Some important relations between monitoring and research are outlined based on our experience at the H.J. Andrews Long-Term Ecological Research site and in development of a monitoring

plan for a sustainable forestry project in Tierra del Fuego. Our objective is to clarify the central importance of science and scientific expertise in the development and operation of environmental and natural resource monitoring programs.

Keywords: Monitoring, resource management, long-term ecological research.

(See Corvallis order form 1.)

Mycology

Colgan, Wes, III; Carey, Andrew B.; Trappe, James M. [and others]

1999. Diversity and productivity of hypogeous fungal sporocarps in a variably thinned Douglas-fir forest. Canadian Journal of Forest Research. 29: 1259-1268.

Truffle fungi are key food resources for the northern flying squirrel, which in turn is the primary prey for the northern spotted owl. To rebuild old-growth structure for the northern spotted owl, attention must be paid to the food web components of the ecosystem. This study examined the effects of variable thinning on fungal truffle productivity as part of a large, integrated ecosystem management study. Results are discussed in terms of integrating the effects of silvicultural manipulations on food web dynamics.

Keywords: Disturbance, ecosystem management, Gautieria*,* Hysterangium*,* Melanogaster*, mycophagy, mycorrhiza, northern flying squirrel, truffles.*

(See Olympia order form.)

Dahlstrom, J.L.; Smith, J.E.; Weber, N.S.

2000. Mycorrhiza-like interaction by *Morchella* with species of the Pinaceae in pure culture synthesis. Mycorrhiza. 9: 279-285.

Isolates from two species of *Morchella* were tested for ability to form mycorrhizae in pure culture synthesis with *Arbutus menziesii*, *Larix occidentalis*, *Pinus contorta*, *P. ponderosa*, and *Pseudotsuga menziesii*. Syntheses also were tested in a nonsterile growth room with *Abies concolor*, *Arbutus menziesii*, *P. menziesii*, and *Ulmus americana*. Ectomycorrhizal structures (mantle and Hartig net) formed with the four species of the Pinaceae but not with *A. menziesii* in pure culture synthesis. No mycorrhizal structures were observed in the nonsterile growth room syntheses. Results are compared to previous studies on morel mycorrhizae and discussed in an ecological context.

Keywords: Morel, Morchella, Pinus, Pseudotsuga, Larix*.*

(See Corvallis order form 1.)

Massicotte, H.B.; Molina, R.; Tackaberry, L.E. [and others]

1999. Diversity and host specificity of ectomycorrhizal fungi retrieved from three adjacent forest sites by five host species. Canadian Journal of Botany. 77: 1053-1076.

This study examined the ability of diverse ectomycorrhizal host trees from southwest Oregon to develop mycorrhizae when grown in various combinations in soils from different forest types in a greenhouse seedling bioassay. Tree genera included *Pinus*, *Pseudotsuga*, *Abies*, *Lithocarpus*, and *Arbutus*. Overall, 18 different types formed on all tree species combined, 14 types with *Pinus* and *Pseudotsuga*, 10 with *Lithocarpus* and *Abies*, and 7 with *Arbutus*. Only five types were found on all tree species, and only *Pinus* and *Pseudotsuga* had types unique to them. These tree species occur in different seral positions in the succession of southwest Oregon forests. Given the overlap in compatibility for shared mycorrhizal fungi, these results illustrate the importance of different host species in maintaining the ectomycorrhizal fungus diversity, especially fungi with restricted host range, and the strong potential for fungal links between trees in forest ecosystems.

Keywords: Mycorrhizae, host specificity, forest succession, fungal communities.

(See Corvallis order form 1.)

Molina, R.; Trappe, J.M.; Grubisha, L.C.; Spatafora, J.W.

1999. *Rhizopogon*. In: Cairney, John W.G.; Chambers, Susan M., eds. Ectomycorrhizal fungi key genera in profile. Berlin: Springer-Verlag: 129-161. Chapter 5.

Several *Rhizopogon* species are important members of ectomycorrhizal fungal communities. They occur in young and old forest stands alike and in a diverse array of habitats. The ease of isolation from sporocarps and manipulation of pure cultures of *Rhizopogon* and practical use of spore inoculation has made *Rhizopogon* a model genus to explore morphological, physiological, ecological, and symbiotic mutualism of ectomycorrhizae. This paper reviews the nearly 200 papers published on *Rhizopogon*.

Keywords: Fungi, mycorrhizae, mycophagy, seedling growth, forest ecology.

(Available in bookstores and libraries.)

Molina, Randy; O'Dell, Thomas; Dunham, Susie; Pilz, David

1999. Biological diversity and ecosystem functions of forest soil fungi: management implications. In: Meurisse, Robert T.; Ypsilantis, William G.; Seybold, Cathy, tech. eds. Proceedings: Pacific Northwest forest and rangeland soil organism symposium; 1998 March 17-19; Corvallis, OR. Gen. Tech. Rep. PNW-GTR-461. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 45-58.

This paper provides a brief overview on the ecosystem function and biodiversity of forest fungi, which are critical to the health and sustainability of forest ecosystems. Recent efforts to conserve rare fungi and sustainably manage the commercial harvest of edible forest mushrooms provide examples of integrating fungi into ecosystem management schemes.

Keywords: Mycorrhiza, special forest products, nontimber forest products, conservation biology, survey and manage, mushrooms.

(See Corvallis order form 2 for this article. If you would like the complete General Technical Report PNW-GTR-461, circle 99-065 on the last page and mail the form to the address indicated.)

Pilz, David; Molina, Randy

2000. Wild edible mushroom research and monitoring in the Pacific Northwest United States. In: Fortin, J.A.; Piché, Y., eds. Les champignons forestiers: récolte, commercialization et conservation de la resource; 1999 February 22-23; Sainte-Foy, PQ. [Place of publication unknown]: [Publisher unknown]: 7-11.

The harvest of wild edible mushrooms from Pacific Northwest forests is regulated to conserve the fungi and their habitats, ensure equitable access to harvesting opportunities, and keep conflicts among forest users to a minimum. Questions remain, however, about how forest management activities influence mushroom productivity and whether long-term, large-scale, intensive commercial harvesting is sustainable. We discuss research on these topics by the Pacific Northwest Research Station and the Department of Forest Science, Oregon State University. We outline a proposed program of cooperative, long-term monitoring to verify harvest sustainability.

Keywords: Edible mushrooms, special forest products, ecosystem management, adaptive management, research, monitoring.

(See Corvallis order form 2.)

Natural Resource Policy

Mills, Thomas

2000. Position advocacy by scientists at best risks science credibility and at worst is unethical. In: Reflections: newsletter of the program for ethics, science, and environment. Corvallis, OR: Oregon State University, Department of Philosophy. Special Issue 4: 10-11.

Public research scientists are increasingly asked to provide science information during debates about natural resource management. They can contribute valuable information and play an important role if they avoid advocacy for particular solutions. Position advocacy risks the credibility of the science role and the scientist.

Keywords: Advocacy, ethics, natural resource management.

(To order this publication, circle 00-099 on the last page and mail the form to the address indicated.)

Plant Ecology

Pabst, Robert J.; Spies, Thomas A.

1999. Structure and composition of unmanaged riparian forests in the coastal mountains of Oregon, U.S.A. Canadian Journal of Forest Research. 29: 1557-1573.

The structure and composition of unmanaged riparian forests were characterized in three river basins in Oregon's Coast Range. The objective was to evaluate stand attributes at three spatial scales: streamside (site), drainage network (stream order), and basin (subregion). Data on basal area, species composition, snag density, canopy cover, and tree regeneration were collected along transects at 124 sites. The unmanaged forests were characterized by a patchy mosaic of structure and composition. Hardwoods and shrubs were major components of the near-stream environment in these forests, whereas dominance of conifers was limited to hillslopes. It appears that fine-scale patterns associated with proximity to the stream are influenced by coarser scale factors such as valley floor width and climate.

Keywords: Community structure, forest composition and structure, riparian vegetation.

(See Corvallis order form 2.)

Sawyer, John O.; Gray, Jane; West, G. James [and others]

2000. History of redwood and redwood forests. In: Noss, Reed F., ed. The redwood forest: history, ecology, and conservation of the coast redwoods. Washington, DC: Island Press: 7-38. Chapter 2.

The history of any taxon, community, or ecosystem provides a context for interpreting its current distribution and status. Narrowly distributed species have always interested naturalists. One pattern that begs explanation is the restriction of redwood to a relatively narrow coastal strip from central California to extreme southwestern Oregon. In the case of the redwood and its close relatives, the present range is a tiny remnant of a much broader distribution in the past. This chapter reviews the history of redwood and closely related species, from their antecedents more than 100 million years ago to their restricted status today.

Keywords: Redwood forest, paleoecology, logging, history.

(Available in bookstores and libraries.)

Wilson, M.V.; Ingersoll, C.A.; Thies, W.G.

1999. Testing for effects of stump fumigation with chloropicrin on vegetation in an early seral Douglas-fir stand. Canadian Journal of Forest Research. 29: 1254-1258.

The biocide chloropicrin has been suggested for the control of laminated root rot (caused by *Phellinus weirii* (Murr.) Gilb.), an important disease of Douglas-fir. This study investigated

the effects of chloropicrin use on nontargeted vegetation. Following the harvest of a 65-year-old stand in northwest Washington by clearcutting in 1988, a study was installed that involved treating stumps with chloropicrin. Individual plots received 3.0 and 18.3 kilograms per 0.04 hectare. Multiple regression analysis was used to investigate the effect of chloropicrin on the abundance of nontarget vegetation, accounting for pretreatment plot differences. Five years after harvest and fumigation, no significant differences in vegetation composition or cover were found.

Keywords: Chloropicrin, fumigation, Douglas-fir.

(See Corvallis order form 2.)

Youngblood, A.; Newton, M.; Cole, E.C.
1999. Adaptability of spruce seedlings for forest restoration in interior and south central Alaska. In: Alden, John, tech. ed. Stocking standards and restoration methods for Alaska: Proceedings of the Alaska Reforestation Council; 1999 April 29; Anchorage, AK. Fairbanks, AK: University of Alaska, Agricultural and Forestry Experiment Station: 51-56.

There is a critical need for site-specific prescriptions for restoration of white spruce ecosystems. In 1995, we began work to better link the role of past disturbance, competing vegetation, site preparation, container seedling production, and seedling physiology for an enhanced understanding of white spruce reforestation option. Five field installations were established in the Tanana River uplands west of Fairbanks, the Matanuska-Susitna Valley, the Copper River basin, and two locations on the Kenai Peninsula. At each location, sites representing relatively old harvesting activity and more recent clearing were selected, and combinations of three site preparation treatments and five stock types are being tested for seedling survival and growth. Preliminary results are confined to initial seedling mortality and growth during the first 2 years.

Keywords: Reforestation, container seedling, Alaska.

(See La Grande order form.)

Youngblood, Andrew; Riegel, Gregg
1999. Reintroducing fire in eastside ponderosa pine forests: long-term silvicultural practices. In: Proceedings of the Society of American Foresters 1999 convention; 1999 September 11-15; Portland, OR. Bethesda, MD: Society of American Foresters: 291-298.

We describe a long-term study designed to develop a better understanding of reintroducing fire to fire-dependent ecosystems, which features repeated burns at 4-, 10-, and 20-year intervals. Our work is focused on stands within the 581-hectare Metolius Research Natural Area in central Oregon. Initial results compare horizontal and vertical structure components of trees in late-successional/old-growth forests and how these components are modified by periodic fire, how underburns affect understory plant species diversity, and the relation between overstory canopy cover and understory species composition and cover. We believe this study will increase our understanding of how natural disturbances and human-caused manipulations can affect forest health over a long time and lead to new options for protecting old-growth structural characteristics.

Keywords: Research natural areas, prescribed fire, fire restoration, fuel reduction, long-term study.

(See La Grande order form.)

Plant Pathology

Maguire, Doug; Kanaskie, Alan; Voelker, Bill [and others]

1999. Growth impact study: phase III progress report. In: Filip, Greg, ed. Swiss Needle Cast Cooperative annual report 1999. Corvallis, OR: Oregon State University, College of Forestry, Forest Research Laboratory: 44-49.

Seventy-six one-fifth-acre plots in young (10- to 30-year-old), intensively managed plantations of Douglas-fir were established in spring 1998. Swiss needle cast severity was assessed annually, and growth measurement was planned for spring 2000. Data analysis will extend through the summer. This paper describes the range in initial plot and tree conditions.

Keywords: Swiss needle cast, genetics, growth.

(See Corvallis order form 1.)

Regional Assessments

Anderson, David R.; Burnham, Kenneth P.; Franklin, Alan B. [and others]

1999. A protocol for conflict resolution in analyzing empirical data related to natural resource controversies. Wildlife Society Bulletin. 27(3): 1050-1058.

Controversy surrounds many natural resource management issues, and most often these issues are resolved by a largely political process. In addition, interpretation of scientific results that could influence management policies, economics, or legislation is often controversial. Indeed, controversial scientific issues as diverse as the effect of low-level lead exposure on IQ, the effect of dietary salt on human health, and the influence of predators on prey populations have their roots in the analysis and interpretation of large amounts of data. We believe such controversies will continue to exist when alternative economic, social, or legal outcomes depend on scientific results.

Keywords: Analysis strategy, conflict resolution, controversy, data analysis, northern spotted owl, protocol.

(See Corvallis order form 1.)

Remote Sensing

Lefsky, M.A.; Cohen, W.B.; Acker, S.A. [and others]

1999. Lidar remote sensing of the canopy structure and biophysical properties of Douglas-fir western hemlock forests. Remote Sensing of Environment. 70: 339-361.

A novel three-dimensional analysis of lidar waveforms was developed to characterize the total volume and spatial organization of vegetation material and empty space within the forest canopy. We applied this analysis, and two earlier methods of canopy description, to 22 plots in Douglas-fir/western hemlock stands on the west slope of the Cascade Range in Oregon. By using the indices of canopy structure from all three methods of descriptions as independent variables in a stepwise multiple regression, we were able to make nonasymptotic predictions of biomass and leaf area index (LAI) over a wide range, up to1200 megagrams per hectare of biomass and an LAI of 12, with 90 percent and 75 percent of variance explained, respectively.

Keywords: Biomass, trees, remote sensing.

(See Corvallis order form 1.)

Milne, Bruce T.; Cohen, Warren B.

1999. Multiscale assessment of binary and continuous landcover variables for MODIS validation, mapping, and modeling applications. Remote Sensing of Environment. 70: 82-98.

Validation, mapping, and modeling efforts require accurate methods to transform process rates and ecosystem attributes estimated from small field plots to the 240- to 1,000-meter-wide cells used by a new generation of land cover mapping sensors. We provided alternative scale transformations, each with attendant assumptions and limitations.

Keywords: Landscape pattern.

(See Corvallis order form 1.)

Turner, David P.; Cohen, Warren B.; Kennedy, Robert E. [and others]

1999. Relationships between leaf area index and Landsat TM spectral vegetation indices across three temperate zone sites. Remote Sensing of Environment. 70: 52-68.

Mapping and monitoring of leaf area index (LAI) is important for spatially distributed modeling of vegetation productivity, evapotranspiration, and surface energy balance. Global LAI surfaces will be an early product of the MODIS land science team, and the requirements for LAI validation at selected sites has prompted interest in accurate LAI mapping at a more local scale. In the interest of a preliminary assessment of the variability in LAI-SVI relations across vegetation types, we compared Landsat 5 Thematic Mapper imagery from three temperate zone sites with onsite LAI measurements.

Keywords: Leaf area index, Landsat Thematic Mapper.

(See Corvallis order form 2.)

Silviculture

Emmingham, Bill; Chan, Sam; Mikowski, Dan [and others]

2000. Silvicultural practices for riparian forests in the Oregon Coast Range. Res. Contrib. 24. Corvallis, OR: Oregon State University. 34 p.

This publication contains information on the ecology of riparian forests and a checklist of recommended practices and common mistakes made in restoring conifers to hardwood-dominated riparian forests. Our recommendations are based on (1) an evaluation of 34 riparian restoration projects spanning the Coast Range of Oregon, (2) three case studies of riparian restoration projects, and (3) ongoing research projects aimed at learning how to establish or release conifers in riparian forests. We found that project managers were choosing appropriate conifer species and stock types for planting, but the survival and growth of conifers in the understory were poor because managers were underestimating the competitive power of shrub- and hardwood-dominated communities. In some cases, conflicting objectives and lack of priority setting led to the failure of expensive projects. We hope this publication will assist managers in efforts to restore healthy riparian forests and dwindling fish stocks.

Keywords: Riparian ecology, watershed restoration, regeneration, vegetation management, riparian silviculture.

(Copies of this publication are available from Forestry Publications Office, Oregon State University, 256 Peavy Hall, Corvallis, OR 97331 or http://webdata.for.orst.edu/forestry/pubs/frl.)

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.

Old-growth forests have an array of characteristics distinguishing them from younger forests but that make it difficult to isolate individual structural features important to the northern 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 radio-telemetry 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 143 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 (e.g., large trees and snags) produced by past disturbance provide important forest structures associated with spotted owl foraging use.

Keywords: Old growth, stand structure, northern spotted owl, Strix occidentalis*, radio telemetry, canopy structure, biological legacies.*

(See Olympia order form.)

Reid, Janice A.; Horn, Robert B.; Forsman, Eric D.

1999. Detection rates of spotted owls based on acoustic-lure and live-lure surveys. Wildlife Society Bulletin. 27(4): 986-990.

We documented response rates of northern spotted owls to calling surveys and live-lure surveys. Most owls were detected within three visits when we used the acoustic-lure and live-lure methods in combination. Some females did not respond to the acoustic lure but were detected by following males when they delivered prey to the nest. Our surveys suggest that a three-visit survey protocol is adequate to detect about 94 percent of the resident owls.

Keywords: Northern spotted owl, surveys, acoustic lure, live lure.

(See Corvallis order form 2.)

Wildlife

Buchanan, Joseph B.; Lewis, Jeffrey C.; Pierce, John [and others]

1999. Characteristics of young forests used by spotted owls on the western Olympic Peninsula, Washington. Northwest Science. 73(4): 255-263.

Although the dependence of spotted owls on older forests has been well documented, the specific attributes of comparatively younger forests used by owls have not been described in some regions. We collected habitat data at locations used by spotted owls in forests on the western Olympic Peninsula, Washington. We collected data at 16 telemetry locations that could be clearly associated with non-old-growth habitat, and at 16 random locations. Owl locations were divided into two groups to reflect single-use and multiple-use sites within home ranges. Vegetation data collected in three arrays of variably sized plots included measures of stem and snag density, canopy cover, and cover of downed wood and shrubs. Our analyses indicated that single-visit and random locations did not differ with respect to the variables we recorded. Both differed, however, from multiple-use locations in abundance of large snags and amount of canopy closure.

Keywords: Spotted owl, Olympic Peninsula, Washington, young forests.

(See Corvallis order form 1.)

Carey, A.B.
1999. Red tree vole/*Arborimus longicaudus*. In: Wilson, D.E.; Ruff, S., eds. The Smithsonian book of North American mammals. Washington, DC: Smithsonian Institution Press: 620-622.

The red tree vole is the least studied and most specialized vole in North America. It is found only in western Oregon where it is adapted to living in the tops of Douglas-fir trees, eating Douglas-fir needles, and drinking dew, rain, and condensed fog from needles. The vole's low reproductive potential reflects its adaptation to eating a low quality food. The red tree vole is most abundant in old-growth forests. Its numbers have declined owing to logging. Its poor ability to disperse makes it sensitive to forest fragmentation.

Keywords: Red tree vole, Phenacomys longicaudus*,* Arborimus longicaudus*.*

(See Olympia order form.)

Carey, Andrew B.
1999. Land mammals of Oregon [Book review]. The Quarterly Review of Biology. 74(4): 480.

This is a book review of *Land Mammals of Oregon* by B.J. Verts and Leslie Carraway, published in 1998 by the University of California Press in Berkeley.

Keywords: Mammals, Oregon.

(See Olympia order form.)

Carey, Andrew B.
2000. Effects of new forest management strategies on squirrel populations. Ecological Applications. 10(1): 248-257.

Two strategies for managing forests for multiple values have achieved prominence in debates in the Pacific Northwest: (1) legacy retention with passive management and long rotations, and (2) intensive management for timber with commercial thinnings and long rotations. Northern flying squirrels, Townsend's chipmunks, and Douglas' squirrels were studied retrospectively in Douglas-fir forests managed under these strategies in the Puget Trough of Washington. Flying squirrels were twice as abundant under legacy retention as under intensive management for timber, almost as abundant as in old-growth western hemlock forests on the Olympic Peninsula of Washington, but 50 percent as abundant as old-growth Douglas-fir forests in western Oregon. Chipmunks were four times as abundant under intensive timber management as under legacy retention, but less abundant than in old-growth forests. Abundance of Douglas' squirrels did not differ between strategies. Neither strategy produced the increased abundance of all three species that is an emergent property of late-seral forests. A third strategy holds promise: active, intentional ecosystem management that incorporates legacy retention, variable-density thinning, and management for decadence.

Keywords: Biodiversity, Douglas-fir, ecosystem management, forest ecology, forest management, Glaucomys sabrinus*, managed forest, Pacific Northwest, silviculture, squirrels,* Tamias townsendii*,* Tamiasciurus douglasii*, thinning, old-growth restoration.*

(See Olympia order form.)

Cooperrider, Allen; Noss, Reed F.; Welsh, Hartwell H., Jr. [and others]
2000. Terrestrial fauna of redwood forests. In: Noss, Reed F., ed. The redwood forest: history, ecology, and conservation of the coast redwoods. Washington, DC: Island Press: 119-163. Chapter 5.

The redwood forests support an unknown but large number of invertebrate species and, over all seasons, more than 200 species of vertebrates. Beyond this, knowledge of redwoods fauna is surprisingly limited. Few animal species are endemic to the redwood region and no known species is restricted to redwood stands. Most of this chapter focuses on vertebrates because

information on the invertebrates in redwood forests is extremely limited. This chapter reviews the biogeographic history and current biogeography of terrestrial vertebrates in the redwoods.

Keywords: Redwood forest, wildlife species, paleoecology.

(Available in bookstores and libraries.)

Gurung, Janita; Adams, A.B.; Raphael, Martin G. 1999. Use of Pacific madrone by cavity-nesting birds [Use of *Arbutus menziesii* by cavity-nesting birds]. In: The decline of Pacific madrone (*Arbutus menziesii* Pursh): current theory and research directions: Proceedings of a symposium held at the Center for Urban Horticulture; 1995 April 28; Seattle, WA. [Place of publication unknown]: Ecosystems Database Development and Research: 17-24.

This paper reviews ecological interactions of birds with Pacific madrone. Results from a tree inventory in the Magnolia area, Seattle, Washington, during 1994-95 and a literature search are summarized. We surveyed 126 trees and found 2 northern flicker cavity nests and 35 cup nests. American crows occupied the cup nests. Madrone is a substrate for nesting and is a nutrient resource. Birds provide pollination service to the plant and disperse seeds. Madrone berries are consumed by numerous bird species. The role of frugivores as a mechanism for flower pollination and seed dispersal is discussed. Knowledge of the nutrient content of madrone berries may be useful for managing madrone-dependent frugivores. The presence of antifungal chemicals in madrone berries may be a factor in understanding the spread and control of madrone diseases. Successful management of the Pacific madrone entails protecting not only the trees but also the wildlife that use them.

Keywords: Foraging, Pacific madrone, cavity-nesting.

(See Olympia order form.)

Hanley, Thomas A.; Barnard, Jeffrey C. 1999. Food resources and diet composition in riparian and upland habitats for Sitka mice, *Peromyscus keeni sitkensis*. The Canadian Field-Naturalist. 113: 401-407.

Food resources and diet composition for Sitka mice were studied over a 4-year period in four flood plain and upland forest habitats in southeastern Alaska: old-growth Sitka spruce flood plain, red alder flood plain, beaver pond flood plain, and nearby old-growth Sitka spruce-western hemlock upland forest. Food resources in each habitat were quantified by understory biomass and species richness, fruit production, tree seedfall, and relative abundance of arthropods. Diet composition was analyzed from stomach contents. Among-year differences in the availability of food resources were substantial, but among-habitat differences were minor. Diet composition differed among years and among months but did not differ between habitat type or age and sex class of mice. We concluded that flood plain habitats do not provide unique food resources for Sitka mice in comparison to upland old-growth forests. However, spatial and temporal complexity within habitats is an important feature of habitat quality in flood plain forests for *Peromyscus* mice.

Keywords: Sitka mouse, riparian forest, river, flood plain, southeastern Alaska, wildlife habitat.

(See Juneau order form.)

Hanley, Thomas A.; Barnard, Jeffrey C. 1999. Spatial variation in population dynamics of Sitka mice in flood plain forests. Journal of Mammalogy. 80(3): 866-879.

Population dynamics and demography of the Sitka mouse, *Peromyscus keeni sitkensis*, were studied by mark and recapture live trapping over a 4-year period in four flood plain and upland habitats in southeastern Alaska: old-growth Sitka spruce flood plain, red alder flood plain, beaver pond flood plain, and nearby old-growth Sitka

spruce-western hemlock upland forest. We did not find the expected source-sink population dynamics resulting from flood disturbance or among-habitat variation in food resources. We found significant among-year differences in population densities, age and sex ratios, survival rates, growth rates, and movements. Within-year differences in all demographic variables were consistently greater among replicate trapping grids within habitat types than among habitat types, and there was no year-to-year consistency in any demographic difference among replicates or habitat types. We concluded that flood plain forests, per se, do not provide unique habitat for Sitka mice in either a strongly positive or negative sense compared with upland old-growth forests.

Keywords: Riparian forest, habitat heterogeneity, Sitka mouse, population dynamics, source-sink, southeastern Alaska, wildlife habitat.

(See Juneau order form.)

Hilderbrand, G.V.; Schwartz, C.C.; Robbins, C.T. [and others]

1999. The importance of meat, particularly salmon, to body size, population productivity, and conservation of North American brown bears. Canadian Journal of Zoology. 77: 132-138.

We hypothesized that relative availability of meat, reflected in dietary contribution, would be positively related to body size and population productivity in North American brown bears. Dietary contribution of plant matter and meat derived from both terrestrial and marine sources was quantified by stable-isotope analysis of hair samples from 14 brown bear populations. The proportion of meat in the diet was significantly and positively correlated with mean adult female body mass, mean litter size, and mean population density. Salmon was an especially important source of meat for the largest bodied bears and the most carnivorous, most productive populations. We concluded that dietary meat is of fundamental importance to habitat quality of brown bears at both the level of the individual animal and the population.

Keywords: Brown bear, grizzly bear, diet composition, population productivity, stable isotopes, salmon, wildlife habitat, Alaska.

(See Juneau order form.)

Hilderbrand, Grant V.; Hanley, Thomas A.; Robbins, Charles T.; Schwartz, Charles C.

1999. Role of brown bears (*Ursus arctos*) in the flow of marine nitrogen into a terrestrial ecosystem. Oecologia. 121: 546-550.

We quantified the amount and spatial distribution of salmon-derived nitrogen (N) by brown bears on the Kenai Peninsula, Alaska. We tested the hypothesis that the stable-isotope signature of N in foliage of white spruce was inversely proportional to the distance from salmon-spawning streams, which indeed it was ($P<0.05$ in two separate watersheds). Locations of radio-collared brown bears, in relation to distance from stream, were highly negatively correlated with 15N depletion of foliage across the same gradient. Mean rates of redistribution of salmon-derived N by adult female brown bears were 37.2 kilograms per hectare per year, of which 96 percent was excreted in urine. On an area basis, salmon N-redistribution rates were as high as 5.12 milligrams per square meter per year per bear within the first 500 meters from the stream but dropped off greatly with increasing distance. We estimated that 1.5 percent to 17.8 percent of the total N in the spruce foliage within the first 500 meters from the stream was derived from

salmon. Thus, brown bears can be an important vector of salmon-derived N into riparian ecosystems, but their effects are highly variable spatially and in relation to bear density.

Keywords: Brown bear, nitrogen, salmon, stable isotopes, white spruce, Alaska, wildlife habitat.

(See Juneau order form.)

Hilderbrand, Grant V.; Jenkins, Steven G.; Schwartz, Charles C. [and others]
1999. Effect of seasonal differences in dietary meat intake on changes in body mass and composition in wild and captive bears. Canadian Journal of Zoology. 77: 1623-1630.

The influence of seasonal dietary meat on changes in the body mass and composition of wild and captive brown bears was investigated. Adult female brown bears on the Kenai Peninsula, Alaska, used meat heavily in both spring and fall. Meat accounted for 76 percent of the assimilated carbon and nitrogen in the spring (primarily moose carrion and calves) and 80 percent in the fall (primarily salmon). Mass increases in the spring were mostly lean body mass, but fall increases were primarily fat. Daily intake by captive brown bears fed meat ad libitum during 12-day trials was positively related to body mass. Mass change was positively related to intake in both seasons, but the composition of the gain varied by season with spring gains primarily in lean body mass and fall gains mostly lipid. Absolute rates of gain by wild bears occasionally equaled but were usually much less than those of captive bears. Management strategies for areas with brown bears that consume significant amounts of meat must address the perpetuation and availability of those meat resources.

Keywords: Brown bear, salmon, nutrition, growth rate, body composition, fat, moose, Alaska, wildlife habitat.

(See Juneau order form.)

Hilderbrand, Grant V.; Schwartz, Charles C.; Robbins, Charles T.; Hanley, Thomas A.
2000. Effect of hibernation and reproductive status on body mass and condition of coastal brown bears. Journal of Wildlife Management. 64(1): 178-183.

We investigated the effect of hibernation and reproductive status on changes in body mass and composition of female brown bears on the Kenai Peninsula, Alaska. Six adult females handled in fall and following spring (paired samples) lost an average of 73 kilograms (32 percent of fall body mass) over 208 days. Of this mass loss, 56 percent (55 kilograms) was lipid and 44 percent (43 kilograms) was lean body mass. Lone females had greater body masses, lipid contents, and lean body masses than females with cubs of the year or yearlings in the spring; and body mass and lipid content were greatest in lone females in the fall. Studies using body mass and composition as indices of population health must ensure that these values are not skewed by season or reproductive class. Additionally, the costs of hibernation and reproduction should be components of resource management strategies, particularly in ecosystems in which nutritional resources are limited.

Keywords: Brown bear, Alaska, wildlife habitat, body composition, hibernation.

(See Juneau order form.)

Singleton, Peter H.; Lehmkuhl, John F.
1999. Assessing wildlife habitat connectivity in the Interstate 90 Snoqualmie Pass corridor, Washington. In: Evink, G.L.; Garrett, P.; Zeigler, David, eds. Proceedings of the 3rd international conference on wildlife ecology and transportation; 1999 September 13-16; Missoula, MT. FL-ER-73-99. Tallahassee, FL: Florida Department of Transportation: 75-83.

An assessment of wildlife habitat connectivity and the barrier effects of Interstate 90 from Snoqualmie Pass to Cle Elum, Washington, began in January 1998 under a cooperative

agreement between the Washington State Department of Transportation and the USDA Forest Service. The assessment has five components: (1) geographic information system (GIS) "least-cost path" modeling of landscape patterns to identify potential linkage areas for sensitive species, (2) GIS analysis of ungulate road-kill distribution, (3) monitoring of existing highway structures that may provide crossing opportunities for wildlife, (4) automatic camera station documentation of species found near the highway, and (5) winter snow tracking transects to document highway crossings and animal distribution along the highway. The methodology developed for this assessment will apply to landscapes where the combined effects of forest management and highway corridors may be impacting habitat connectivity.

Keywords: Connectivity, wildlife habitat, barriers, landscape patterns.

(See Wenatchee order form.)

Wisdom, Michael J.; Cook, John G.
2000. North American elk. In: Demaris, Stephen; Krausman, Paul R. Ecology and management of large mammals in North America. Upper Saddle River, NJ: Prentice-Hall, Inc.: 694-735.

Elk was one of the most common and widely distributed of the wild ungulates in North America before European settlement. Declines in elk numbers, subsequent reductions in their distribution, and ultimately the extirpation of populations and entire subspecies occurred across large expanses of North America as European settlers moved west in the 17th, 18th, and 19th centuries. Although elk populations have recovered in large areas of the United States, distribution remains fragmented, especially in eastern North America. Although the future of elk seems secure, managers of this important resource will be faced with several controversial issues, such as density dependence, competition with livestock, and management of elk on private lands. Our chapter addresses these issues and describes holistic ways to manage elk to meet diverse management interests.

Keywords: Elk, Cervus*, elk habitat, elk ecology, elk management.*

(Available in bookstores and libraries.)

Lyon, L. Jack; Brown, James K.; Huff, Mark H.; Smith, Jane Kapler
2000. Chapter 1: Introduction: 1-7.

Lyon, L. Jack; Huff, Mark H.; Telfer, Edmund S. [and others]
2000. Chapter 4: Fire effects on animal populations: 25-34.

Huff, Mark H.; Smith, Jane Kapler
2000. Chapter 5: Fire effects on animal communities: 35-42.

Lyon, L. Jack; Huff, Mark H.; Smith, Jane Kapler
2000. Chapter 6: Fire effects on fauna at landscape scales: 43-49.

The above papers were coauthored by scientists from PNW and are from:

Smith, Jane Kapler, ed. 2000. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep. RMRS-GTR-42-Vol. 1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 83 p. Vol. 1.

Fires affect animals mainly through effects on their habitat. Animal species are adapted to survive the pattern of fire frequency, season, size, severity, and uniformity that characterized their habitat in presettlement times. When fire frequency increases or decreases substantially or fire severity changes from presettlement patterns, habitat for many animal species declines.

Keywords: Fire effects, fire management, fire regime, habitat, succession, wildfire.

(Available from Publications Distribution, Rocky Mountain Research Station, 240 W. Prospect Road, Fort Collins, CO 80526 or via email to rschneider@fs.fed.us.)

Ruggiero, Leonard F.; Schwartz, Michael K.; Aubry, Keith B. [and others]
1999. Species conservation and natural variation among populations: 101-116. Chapter 5.

McKelvey, Kevin S.; Aubry, Keith B.; Ortega, Yvette K.
1999. History and distribution of lynx in the contiguous United States: 207-264. Chapter 8.

McKelvey, Kevin S.; Ortega, Yvette K.; Koehler, Gary M. [and others]
1999. Canada lynx habitat and topographic use patterns: 307-336. Chapter 10.

Aubry, Keith B.; Koehler, Gary M.; Squires, John R.
1999. Ecology of Canada lynx in the southern Canadian Rocky Mountains: a study: 373-396. Chapter 13.

Buskirk, Steven W.; Ruggiero, Leonard F.; Aubry, Keith B. [and others]
1999. Comparative ecology of lynx in North America: 397-418. Chapter 14.

McKelvey, Kevin S.; Aubry, Keith B.; Agee, James K. [and others]
1999. Lynx conservation in an ecosystem management context: 419-442. Chapter 15.

Ruggiero, Leonard F.; Aubry, Keith B.; Buskirk, Steven W. [and others]
1999. The scientific basis for lynx conservation: qualified insights: 443-454. Chapter 16.

Aubry, Keith B.; Ruggiero, Leonard F.; Squires, John R. [and others]
1999. Conservation of lynx in the United States: a systematic approach to closing critical knowledge gaps: 455-470. Chapter 17.

Ruggiero, Leonard F.; Aubry, Keith B.; Buskirk, Steven W. [and others]
1999. Epilogue: the scientific basis for lynx conservation: Can we get there from here? 471-474. Chapter 18.

The above papers were coauthored by scientists from PNW and are from:

Ruggiero, Leonard F.; Aubry, Keith B.; Buskirk, Steven W. [and others]. 1999. Ecology and conservation of lynx in the United States. Gen. Tech. Rep. RMRS-GTR-30WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 480 p.

Once found throughout the Rocky Mountains and forests of the northern states, the lynx is now found only in pockets of its former habitat. In Colorado, a reintroduction project has been criticized, while at the same time the U.S. Fish and Wildlife Service is preparing to make a final decision about listing the lynx as a threatened species under the Endangered Species Act. This publication reviews the newest scientific knowledge of this unique cat's history, distribution, and ecology.

Keywords: Lynx, Endangered Species Act, wildlife conservation.

(This publication is available at http://www.fs.fed.us/rm/pubs/rmrs_gtr30.html. Paper copies are being distributed by the University of Oklahoma Press [in partnership with the University of Colorado]. Hard cover copies are $59.95 and soft cover copies are $29.95; they may be ordered by calling 1-800-627-7377.)

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