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Department of
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Forest Service

Pacific Northwest
Research Station



Recent Publications of the Pacific Northwest Research Station, Fourth Quarter 2005



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Pacific Northwest Research Station

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Aquatic/Riparian Systems

05-170

Gallo, K.; Lanigan, S.H.; Eldred, P.; Gordon, S.N.; Moyer, C.

2005. Northwest Forest Plan—the first 10 years (1994–2003): preliminary assessment of the condition of watersheds. Gen. Tech. Rep. PNW-GTR-647. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 133 p.

We aggregated road, vegetation, and inchannel data to assess the condition of sixth-field watersheds and describe the distribution of the condition of watersheds in the Northwest Forest Plan (the Plan) area. The assessment is based on 250 watersheds selected at random within the Plan area. The distributions of conditions are presented for watersheds and for many of the attributes that contribute to the condition of watersheds by land use allocation. Under the Plan, management activities were implemented in a way to promote positive changes in the condition of watersheds. This assessment revealed that the growth rate of trees (2 to 4 percent) exceeded losses (1.6 percent owing to stand-replacing fire and harvest), and nine times more roads were decommissioned than were constructed. Fifty-seven percent of the watersheds had higher condition scores in time 2 (1998–2003) than in time 1 (1990–96) across the entire Plan area. Only 3 percent of the watersheds had lower condition scores in time 2, and the scores did not change in the remainder of the watersheds. More key watersheds, which were given the highest priority for restoration activities, increased in condition than non-key watersheds. The greatest positive change in watershed condition occurred in late-successional reserves.

Keywords: Effectiveness monitoring, aquatic ecosystems, riparian ecosystems, watersheds, decision-support models, Northwest Forest Plan, aquatic conservation strategy, Pacific Northwest.

Economics

05-424

Fight, R.D.; Barbour, R.J.

2005. Financial analysis of fuel treatments. Gen. Tech. Rep. PNW-GTR-662. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 20 p.

This paper provides information and discussion that will be helpful in promoting thoughtful design of fire hazard reduction treatments to meet the full range of management objectives. Thoughtful design requires an understanding of the costs and potential revenues of applying variations of fire hazard reduction treatments in a wide range of stand conditions. This paper draws extensively on the My Fuel Treatment Planner (MyFTP) software to highlight and illustrate the effect of treatment variables on the cost and net revenue from fire hazard reduction treatments in dry forest types of the Western United States. Treatments covered are thinning with or without utilization, prescribed fire, and mastication. For thinning with removal to a landing, costs can be estimated for four ground-based systems, four cable systems, and two helicopter systems.

Keywords: Financial analysis, silviculture, fire, prescriptions, economics, fuel treatments.

05-210

Fight, R.D.; Blatner, K.A.; Chapman, R.C.; Schlosser, W.E.

2005. Users guide for noble fir bough cruiser. Gen. Tech. Rep. PNW-GTR-644. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 8 p.

The bough cruiser spreadsheet was developed to provide a method for cruising noble fir (*Abies procera* Rehd.) stands to estimate the weight of boughs that might be harvested. No boughs are cut as part of the cruise process. The approach is based on a two-stage sample. The first stage consists of fixed-radius plots that are used to estimate the number of merchantable noble fir trees per acre.

The second stage consists of sample trees that are used to estimate the weight of boughs per tree. The software produces a report with the estimated weight of boughs per tree and per acre.

Keywords: Noble fir, boughs, cruise, sampling, inventory, software.

05-241

Loomis, J.

2005. Updated outdoor recreation use values on national forests and other public lands. Gen. Tech. Rep. PNW-GTR-658. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 26 p.

This report summarizes more than 30 years of the literature on net economic value of outdoor recreation on public lands. The report provides average net willingness to pay or consumer surplus per day for 30 recreation activities at the national level. Values per day by recreation activity are also presented by census region of the United States. Detailed tables provide the average value per day as well as the standard error for calculating confidence intervals. Guidance for using these values in performing benefit transfer to unstudied sites is also provided. The report provides a link to a Web site where the spreadsheet that underlies the averages calculated in this report is available.

Keywords: Benefit transfer, consumer surplus, recreation use values, willingness to pay.

Fire

05-242

Thompson, J.

2005. Climate change and California: potential implications for vegetation, carbon, and fire. Science Findings 75. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 11 p.

To quantify the range of the possible effects of climate change on California's environment and economy over the next century, researchers used state-of-the-art climate change simulations coupled with a dynamic vegetation model to gauge sensitivity of natural ecosystems in California under several climate scenarios. The results suggest that climate change would have a more pervasive

impact on the vegetation community diversity than would urbanization. Vegetation is estimated to migrate to higher elevations, which would result in reductions in the area covered by alpine meadows and subalpine forests. The area of commercially important softwood tree species and the state's signature woodlands and shrublands are predicted to decline with warming. Climate change could also affect fire frequency and the area burned annually, with most of the scenarios resulting in increased fire. Finally, the simulations showed that reducing emissions of carbon dioxide over the next several decades could buffer the longer term impacts of global warming.

Keywords: climate change, vegetation, fire frequency.

Forest Management

05-261

Bevers, M.; Barrett, T., tech. comps.

2005. System analysis in forest resources: proceedings of the 2003 symposium. Gen. Tech. Rep. PNW-GTR-656. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 366 p.

The 2003 symposium of systems analysis in forest resources brought together researchers and practitioners who apply methods of optimization, simulation, management science, and systems analysis to forestry problems. This was the 10th symposium in the series, with previous conferences held in 1975, 1985, 1988, 1991, 1993, 1994, 1997, 2000, and 2002. The forty-two papers in these proceedings are organized into five application areas: (1) sustainability, criteria and indicators, and assessment; (2) techniques and decision support for forest planning; (3) forest assessment and planning case studies; (4) fire suppression, fire planning, and fuels management; (5) harvest scheduling; and (6) mill supply and forest product markets.

Keywords: Forest planning, forest management, forest modeling, operations research.

05-255

Rapp, V.A.

2005. Monitoring forests at the speed of light. Science Update 12. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 11 p.

Airborne laser scanning, commonly referred to as light detection and ranging, or LIDAR, can provide

high-resolution digital data of landforms and topography, even through forest cover. LIDAR can characterize the forest along with land contours, providing accurate data on forest characteristics such as canopy height, stand structure, growing stock estimates, wildlife habitat, and biomass. LIDAR is rapidly emerging as a useful, effective source of high-resolution data and has strong potential to be used in forest inventory and silvicultural work, fire and fuels management, and other resource management work. However, some essential steps, including the development of standards and specifications, must be taken for LIDAR to be used fully in forestry.

Keywords: LIDAR, airborne laser scanning, forest inventory, mapping, Capital State Forest.

05-414

Thompson, J.

2005. Acting on uncertainty in landscape management—options forestry. Science Findings 78. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 11 p.

In response to the highly uncertain outcomes inherent in forest management, “options forestry” has been introduced as a novel approach that includes an honest appraisal of uncertainties and learning as a specific objective. The strategy uses a variety of management pathways, all designed to reach the same goal, and structures them in a rigorous statistical design to reduce and spread the risks associated with failure. In the first application of options forestry, the objective of the Five Rivers Landscape Management Project was to convert thousands of acres of young productive plantations into old-growth forests—something that had never been tried at a landscape scale. Three approaches—passive management, pulsed thinning, and continuous access thinning—are now being applied simultaneously in a replicated design distributed across the 32,000-acre watershed in coastal Oregon. By implementing a variety of legitimate approaches, managers may discover more than one way to achieve their goal. Furthermore, by using strategies that appeal to multiple stakeholders, options forestry allows groups to see their ideas in practice, at least in part of the landscape.

Keywords: Options forestry, passive management, pulsed thinning, continuous access thinning.

05-356

Thompson, J.

2005. Forest biodiversity policies: where are they leading us? Are we going where we expected to go? Science Findings 76. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 11 p.

Conserving biodiversity in the Oregon Coast Range requires tradeoffs. Policymakers must consider both the costs and benefits of new conservation programs. During this appraisal process, the costs, in terms of economic activity forgone, are often easier to quantify than the benefits. How does the value of biodiversity compare to other important resources and services? Thousands of surveys were mailed out to measure the public’s willingness to pay for conservation in the Oregon Coast Range. They investigated popular attitudes toward increasing endangered species habitat, salmon and aquatic habitat protection, old-growth forest conservation, and large-scale nature reserves. Respondents generally showed a preference for the status quo and did not support any reductions in the current level of protection. They were willing to pay for increasing biodiversity conservation but only to an intermediate level, beyond which regulations were seen as burdensome. Of the programs considered, old-growth conservation had the highest level of support. These findings will be useful to policymakers who, until now, had few ways of gauging the public’s preferences.

Keywords: Biodiversity, conservation willingness to pay.

Invertebrates

05-098

Wickman, B.E.

2005. Harry E. Burke and John M. Miller, pioneers in Western forest entomology. Gen. Tech. Rep. PNW-GTR-638. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 163 p.

This history was compiled from the memoirs, diaries, and other personal documents of the two forest entomologists in charge of the first forest insect laboratories on the west coast. It traces the lives of the two pioneers from 1902 to 1952 as they pursued their careers in the USDA Bureau of Entomology, Division of Forest Insect Investigations. Cooperative bark beetle control projects with the USDA Forest Service, Park Service, and private timber owners guided much of their early activities. Later,

when the laboratories were located on university campuses, cooperative research was undertaken with Forest Service Research Stations. The focus shifted to more basic research and, particularly, studies on the silvicultural management of bark beetle populations.

Keywords: History, forest entomology, bark beetles, Forest Service, Bureau of Entomology, National Parks, insect control projects, cone and seed insects, forest fire and insects, ponderosa pine, Jeffrey pine, sugar pine, lodgepole pine, Sitka spruce.

Monitoring

05-169

Moeur, M.; Spies, T.A.; Hemstrom, M.; Martin, J.R.; Alegria, J.; Browning, J.; Cissel, J.; Cohen, W.B.; Demeo, T.E.; Healey, S.; Warbington, R.

2005. Northwest Forest Plan—the first 10 years (1994–2003): status and trend of late-successional and old-growth forest. Gen. Tech. Rep. PNW-GTR-646. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 142 p.

This report summarizes monitoring of the status and trend of late-successional and old-growth forest on 24 million acres of land managed by the Forest Service, Bureau of Land Management (BLM), and National Park Service in the Northwest Forest Plan (the Plan) area between 1994 and 2003. Baseline maps from satellite imagery of older forest conditions at the start of the Plan were developed, remotely sensed change detection was used to track losses of older forests on federally managed lands to stand-replacing harvest and wildfire, and statistical analysis on inventory plot information collected on Forest Service and BLM lands was performed. These analyses provided statistically rigorous estimates of older forest acres bracketed by confidence intervals.

The initial amount, distribution, and arrangement of older forest on federally managed land appears to have met or exceeded Plan expectations. But the large amount of older forest susceptible to catastrophic wildfire may be a concern for managers. Losses to wildfire in the first decade were in line with assumptions for the Plan area, but rates of loss were highly variable among provinces, with the highest rates of loss occurring in the dry provinces. Loss of older forest to harvest was a fraction of the

approximately 230,000 ac of older forest expected to have been harvested. Overall gain was about twice the 600,000 ac expected during the first decade of the Plan.

Keywords: Northwest Forest Plan, effectiveness monitoring, late-successional and old-growth forests, remote sensing, existing vegetation, change detection, Pacific Northwest, Forest Service, Bureau of Land Management, land use allocations, late-successional reserves, physiographic provinces.

Natural Resources Policy

05-207

Stankey, G.H.; Clark, R.N.; Bormann, B.T.

2005. Adaptive management of natural resources: theory, concepts, and management institutions. Gen. Tech. Rep. PNW-GTR-654. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 73 p.

This report reviews the extensive and growing literature on the concept and application of adaptive management. Adaptive management is a central element of the Northwest Forest Plan and there is a need for an informed understanding of the key theories, concepts, and frameworks upon which it is founded. Literature from a diverse range of fields including social learning, risk and uncertainty, and institutional analysis was reviewed, particularly as it related to application in an adaptive management context. The review identifies opportunities as well as barriers that adaptive management faces. It concludes by describing steps that must be taken to implement adaptive management.

Keywords: Adaptive management, social learning, public policy, research design, risk and uncertainty, natural resource management.

Plant Pathology

05-234

Hennon, P.E.; D'Amore, D.; Zeglen, S.; Grainger, M.

2005. Yellow-cedar decline in the North Coast Forest District of British Columbia. Res. Note PNW-RN-549. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 16 p.

The distribution of a forest decline of yellow-cedar (*Callitropsis nootkatensis* (D. Don) Örsted) has been documented in southeast Alaska, but its occurrence in

British Columbia was previously unknown. We conducted an aerial survey in the Prince Rupert area in September 2004 to determine if yellow-cedar forests in the North Coast Forest District of British Columbia were experiencing a similar fate as in nearby Alaska. Numerous large areas of concentrated yellow-cedar mortality were found, extending the known distribution of the decline problem 150 km south of the Alaska–British Columbia border. The forests with the most concentrated tree death occurred at 300 to 400 m elevation, frequently on south aspects. The appearance of these forests including proximity to bogs; mixtures of dying, recently killed, and long-dead trees; and crown and bole symptoms of dying trees were all consistent with the phenomenon in southeast Alaska.

Keywords: Yellow-cedar, Alaska-cedar, forest decline.

Range Management

05-129

Johnson, C.G., Jr.; Swanson, D.K.

2005. Bunchgrass plant communities of the Blue and Ochoco Mountains: a guide for managers. Gen. Tech. Rep. PNW-GTR-641. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 119 p.

A classification of bunchgrass vegetation is presented for the Malheur, Ochoco, Umatilla, and part of the Wallowa-Whitman National Forests. It includes grassland vegetation as well as shrubland and forest land where the herbaceous layer is dominated by bunchgrasses. It is based on potential vegetation, with the plant association as the basic unit. Diagnostic keys and descriptions are presented for each type. Descriptions include information about plant species occurrence, environment and soils, states and transitions, forage productivity, management considerations, and relations to other classifications.

Keywords: Blue Mountains, Ochoco Mountains, plant association, plant ecology, range management, steppe.

Recreation

04-403

Garber-Yonts, B.E.

2005. Conceptualizing and measuring demand for recreation on national forests: a review and synthesis. Gen. Tech. Rep. PNW-GTR-645. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 40 p.

This analysis examines the problem of measuring demand for recreation on national forests and other public lands. Current measures of recreation demand in Forest Service resource assessments and planning emphasize population-level participation rates and activity-based economic values for visitor days. Alternative measures and definitions of recreation demand are presented, including formal economic demand and multiattribute preferences. Recreation assessments from national-level Renewable Resources Planning Act Assessments to site-level demand studies are reviewed to identify methods used for demand analysis at different spatial scales. A finding throughout the multiple scales of analysis, with the exception of site-level studies, is that demand measures are not integrated with supply measures. Supply analyses, in the context of resource assessments, have taken the form of mapped spatial inventories of recreation resources on the national forests, based on the classification of recreational settings according to the opportunities they produce (e.g., the Recreation Opportunity Spectrum). As such, integration of demand analysis with these measures of supply requires measuring the demand for recreational settings.

Keywords: Recreation, presentation, supply and demand, national forests.

Resource Inventory

05-249

Azuma, D.L.; Hiserote, B.A.; Dunham, P.A.

2005. The western juniper resource of eastern Oregon, 1999. Resour. Bull. PNW-RB-249. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 18 p.

This report summarizes resource statistics for eastern Oregon's juniper forests, which are in Baker, Crook, Deschutes, Gilliam, Grant, Harney, Jefferson, Klamath, Lake, Malheur, Morrow, Sherman, Umatilla, Union,

Wallowa, Wasco, and Wheeler Counties. We sampled all ownerships outside of the National Forest System; we report the statistics on juniper forest on national forest lands by using data from the national forest, Pacific Northwest Region inventory. Statistical tables summarize the area covered by juniper trees and juniper forest, wood volume, and numbers of trees, by ownership and juniper type. We found juniper on an estimated 6.5 million acres, a little more than half that was considered forest land. Evidence suggests that amount of forest land will continue to increase.

Keywords: Forest inventory, western juniper, resource statistics, eastern Oregon.

05-206

Campbell, S.; van Hees, W.W.S.; Mead, B.

2005. South-central Alaska forests: inventory highlights. Gen. Tech. Rep. PNW-GTR-652. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 28 p.

This publication presents highlights of a recent south-central Alaska inventory conducted by the Pacific Northwest Research Station Forest Inventory and Analysis Program. South-central Alaska has about 18.5 million acres, of which one-fifth (4 million acres) is forested. Species diversity is greatest in closed and open Sitka spruce forests, spruce woodlands, closed tall alder shrub type, and low shrub willow type. Of the forest land, 1.9 million acres are classified as timberland (unreserved productive forest land). About 1.3 million acres of forest land are reserved from harvest; these reserved forest acres are primarily on the Kenai National Wildlife Refuge, national parks, and the Chugach National Forest. The volume of timber on timberland was estimated at 5,087 million cubic feet; the plurality of volume—44 percent—is on state and local government lands with the remaining volume primarily on private lands (28 percent) and national forests (23 percent). Fifty-seven percent of timberland acres and 93 percent of the growing-stock volume is in sawtimber stands, with Sitka spruce forest type predominating. Most timberland in south-central Alaska is of relatively low productivity, producing less than 50 cubic feet per acre per year. For timberland acres on state and private lands, average annual mortality and harvest exceeded average annual growth.

Keywords: Inventory, south-central Alaska, Kenai Peninsula, timberland, forest land.

Social Sciences

05-283

Farnum, J.; Hall, T.; Kruger, L.E.

2005. Sense of place in natural resource recreation and tourism: an evaluation and assessment of research findings. Gen. Tech. Rep. PNW-GTR-660. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 59 p.

Understanding sense of place and related concepts often presents challenges for both managers and researchers. Inconsistent application of terms, questions regarding their origin, and a lack of awareness of research findings contribute to the ambiguity of these concepts. This integrative review of research provides relevant, current information on the role of sense of place in natural-resource-based recreation and tourism. Special focus is given to the foundations of place attachment, how place attachment may differ among user types, and the relation of place attachment to other psychological phenomena such as attitudes. The role of theory in place attachment also is addressed, and gaps in theoretical and empirical work are identified. This review provides specific recommendations for managers and others wanting to better understand the dynamics of sense of place.

Keywords: Sense of place, place attachment, synthesis, recreation, tourism, review.

Special Forest Products

05-208

McLain, R.J.; Jones, E.T.

2005. Nontimber forest products management on national forests in the United States. Gen. Tech. Rep. PNW-GTR-655. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 85 p.

This study provides an overview of nontimber forest products (NTFP) programs on national forests in the United States. We conducted an email survey in 2003 to obtain data on NTFP management activities on national forests across the country. Program characteristics examined in the study included important NTFPs managed on national forests, presence of NTFP coordinators and law enforcement programs on ranger districts, incorporation of NTFPs into forest planning

documents, presence of NTFP inventory and monitoring programs, managers' views on barriers to and opportunities for including NTFP harvesters in NTFP inventory and monitoring efforts, and managers' perceptions of barriers to expanding commercial NTFP harvesting. The data indicate that the agency is constructing a foundation for scientific NTFP management. The study identifies lack of funding and internal administrative capacity as key barriers to adequate incorporation of NTFPs in Forest Service planning, inventory, and monitoring.

Keywords: Nontimber forest products, forest planning, inventory and monitoring, biodiversity conservation, special forest products.

Threatened, Endangered, Sensitive Species

05-171

Lint, J.

2005. Northwest Forest Plan—the first 10 years (1994–2003): status and trends of northern spotted owl populations and habitat. Gen. Tech. Rep. PNW-GTR-648. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 176 p.

This report presents results from monitoring spotted owl (*Strix occidentalis caurina*) populations and habitat during the first 10 years of implementation of the Northwest Forest Plan. Estimated population decline ranged from 0 to 10 percent across study areas (weighted average of 3.4 percent) annually. The average annual rate of decline for the four demographic areas in Washington was 7.1 percent. Presence of barred owls (*Strix varia*), weather, past and present harvest of habitat, and wildfire and insect infestations that alter habitat are all possible contributors to the noted decline.

Rangewide, about 74 percent of the federal land area was habitat-capable. Fifty-seven percent of the habitat-capable area was in a forest condition similar to the conditions where territorial owls were known to be present on the landscape. Fifty-one percent of the habitat-capable area fell in large, reserved blocks intended, under the plan, to support clusters of reproducing owls. About 62 percent of the habitat-capable area inside the reserved blocks was in a forest condition similar to the conditions where owls were known to be present.

Owl movement was assessed in selected provinces by using data from banded owls. Movements with resighting

locations inside reserved blocks accounted for 51 percent of juvenile movement records. Over 30 percent of the juvenile movements were into reserved blocks from outside points.

The barred owl has expanded its range in past decades and currently is present throughout the range of the spotted owl. The likelihood of competitive interaction between spotted owls and barred owls raises concern on the future of spotted owl populations.

Keywords: Northwest Forest Plan, effectiveness monitoring, northern spotted owl, geographic information system, owl habitat, habitat suitability, demographic study, remote sensing, predictive model, habitat model.

Wildlife

06-057

Thompson, J.

2005. Rocky to Bullwinkle: understanding flying squirrels helps us restore dry forest ecosystems. Science Findings 80. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 11 p.

A century of effective fire suppression has radically transformed many forested landscapes on the east side of the Cascades. Managers of dry forests critically need information to help plan for and implement forest restoration. Management priorities include the stabilization of fire regimes and the maintenance of habitat for the northern spotted owl and other old-forest associates. The northern flying squirrel is the primary prey of northern spotted owls and is a key species in a complex ecological web with important influences on forest productivity and biodiversity. For 4 years and across several forest types, flying squirrels on the Wenatchee National Forest were live-trapped and radio collared; squirrel habitat was evaluated for food and denning resources. Results suggest that sufficient canopy cover, not forest age, is the single best indicator of good flying squirrel habitat. Other important habitat components include large trees with abundant forage lichen growth, down logs to promote abundant truffle foods, and diverse understory plant communities with rich fruit and seed food resources. Flying squirrel habitat could be conserved in dry forest landscapes through patchy or variable retention thinning, which emulates mixed-severity fires.

Keywords: Northern flying squirrel, habitat, truffles, canopy cover.

Publications Available Elsewhere

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Aquatic/Riparian Systems

Bisson, P.A.

2004. Review of "Restoration of Puget Sound Rivers."
Seattle, WA: University of Washington Press. Transactions of the American Fisheries Society. 133: 1290–1293.

Restoration of Puget Sound Rivers presents an excellent case study of the approaches being used to bring salmon back to the Northwest's most heavily developed area. While its direct relevance is regional, the book examines restoration processes that should be of general interest to scientists and managers seeking to reconcile fish habitat protection and rehabilitation with the myriad of competing land and water interests. Because the challenge of restoring Puget Sound's salmon rivals that of California's Central Valley, the Columbia River basin, and British Columbia's Fraser River basin, readers from outside Puget Sound will have little difficulty finding useful material in many of the chapters.

Keywords: Watershed managers, fish habitat specialists.
(see Olympia order form.)

Biometrics

Anderson, H.-E.; McGaughey, R.J.; Carson, W.W.; Reutebuch, S.E.; Mercer, B.; Allan, J.

2004. A comparison of forest canopy models derived from LIDAR and InSAR data in a Pacific Northwest conifer forest. Dresden, Germany: International Archives of Photogrammetry and Remote Sensing. XXXIV, Part 3/W13: 211–217.

To assess the capabilities of interferometric radar (InSAR) and airborne laser scanning (LIDAR) for characterizing the forest canopy dimensions, canopy- and terrain-level elevation models derived from multifrequency InSAR and high-density LIDAR data were compared to photogrammetric forest canopy measurements acquired within a Douglas-fir forest near Olympia, Washington. Canopy and terrain surface elevations were measured on large-scale photographs along two representative profiles

within a forested area located on Capitol State Forest in western Washington. Results generally indicate that both technologies can provide valuable measurements of gross canopy dimensions.

Keywords: Forestry, LIDAR, SAR, photogrammetry, comparison, digital elevation model, digital terrain model.
(see Pacific Wildland Fire Sciences order form.)

Anderson, H.-E.; McGaughey, R.J.; Reutebuch, S.E.

2004. Estimating forest canopy fuel parameters using LIDAR data. *Remote Sensing of the Environment*. 94: 441–449.

Reliable estimates of critical canopy structure characteristics including canopy bulk density, canopy height, canopy base height, and canopy fuel weight are required to accurately map fuel loading and model fire behavior over the landscape. The use of polarimetric interferometric synthetic aperture radar (IFSAR), a high-resolution active remote sensing technology, provides for accurate and efficient estimation of crown fire behavior variables over extensive areas of forest. In this study, estimates of crown fuel variables were developed from the polarimetric backscatter and interferometric information (elevation, coherence, and phase) for an IFSAR data set acquired within a coniferous forest in western Washington.

Keywords: Forest fire, mapping, radar, SAR, interferometer.

(see Pacific Wildland Fire Sciences order form.)

Anderson, H.-E.; McGaughey, R.J.; Reutebuch, S.E.; Carson, W.W.; Schreuder, G.F.

2004. Estimating forest crown fuel variables using LIDAR data. *Remote Sensing of Environment*. 94(4): 441–449.

Reliable estimates of critical forest canopy structure characteristics, including canopy bulk density, stand height, canopy fuel weight, and canopy base height, are required to accurately map fuel loading and model fire behavior over the landscape. The use of airborne laser scanning

(LIDAR), a high-resolution active remote sensing technology, provides for accurate and efficient estimation of crown fire behavior variables over extensive areas of forest. In this study, estimates of crown fire behavior variables were developed from the spatial distribution of the small-footprint, discrete-return LIDAR data acquired over stands of varying condition within Capital State Forest in western Washington.

Keywords: LIDAR, laser scanning, fuels, canopy structure.

(see Pacific Wildland Fire Sciences order form.)

Ecosystem Structure and Function

Lehmkuhl, J.F.; Gould, L.; Cazares, E.; Hosford, D.R.

2004. Truffle abundance and mycophagy by northern flying squirrels in eastern Washington forests. *Forest Ecology and Management*. 200: 49–65.

We quantified the abundance and diversity of ectomycorrhizal fungal sporocarps in the soil and diets of northern flying squirrels in low-elevation forests of the eastern Washington Cascade Range. Spring sporocarp biomass was 1.7 kg/ha in open ponderosa pine forest, 3.6 kg/ha in young mixed-conifer forest, and 4.1 kg/ha in mature mixed-conifer forest. Twenty-two species were collected, but four species accounted for 70 percent of truffle biomass. Truffle communities and biomass were similar in mature and young mixed-conifer forest, which differed from open pine. Fall squirrel diets had 23 fungal groups and 22 percent plant material. Diet composition did not differ among forest cover types.

Keywords: Fungi, flying squirrels, eastern Washington, truffles.

(See Wenatchee order form.)

Youngblood, A.; Max, T.; Coe, K.

2004. Stand structure in eastside old-growth ponderosa pine forests of Oregon and northern California. *Forest Ecology and Management*. 199: 191–217.

Quantitative metrics of horizontal and vertical structure old-growth ponderosa pine forests were measured at three protected study areas in central Oregon and northern California. These attributes may guide the design of restoration prescriptions. Stands were multi-aged, with the oldest trees 618 years. Density of live pine in the upper canopy averaged 50 ± 3.5 trees per hectare; density of large snags averaged 9.0 ± 0.97 trees per hect-

are. Ripley's K(d) analysis of the spatial relations revealed a common clumped distribution. These results are discussed in the context of reference conditions for restoration of ecosystem processes.

Keywords: Stand structure, old-growth forests, ponderosa pine, spatial point patterns.

(see La Grande order form.)

Fire

Gedalof, Z.; Peterson, D.L.; Mantua, N.J.

2005. Atmospheric, climatic, and ecological controls on extreme wildfire years in the northwestern United States. *Ecological Applications*. 15(1): 154–174.

Wildland fire is an important disturbance agent in forests of the American Northwest. Here we investigate the extent to which atmospheric and climatic variability may contribute to variability in annual area burned on 20 national forests in Oregon, Washington, and Idaho. Empirical orthogonal function analysis was used to identify coherent patterns in areas burned by wildfire in the Pacific Northwest. Four distinct patterns in area burned were identified, each associated with distinct climatic processes. The results suggest that fuels treatments alone may not be effective at reducing area burned under extreme climatic conditions, and furthermore that global climate change may have important implications for forest management.

Keywords: Wildfire, Pacific Northwest, climatic variability, Pacific Decadal Oscillation.

(see Pacific Wildland Fire Sciences order form.)

Hessburg, P.F.; Agee, J.K.; Franklin, J.F.

2005. Dry forests and wildland fires of the inland Northwest USA: contrasting the landscape ecology of the presettlement and modern eras. *Forest Ecology and Management*. 211: 117–139.

Inland Northwest dry forests no longer appear or function as they once did. Large landscapes are homogenous in their composition and structure, and the regional landscape is set up for severe, large fire events. We describe key landscape pattern and process changes wrought by settlement and management influences, and point to an uncertain future for ecosystem management. Uncertainty is based on the lack of current and improbable future

social consensus concerning desired outcomes for public forest land, the need for significant financial investment in ecosystem restoration, a lack of integrated planning tools, and mismatches among the existing planning process, congressional appropriations, and complex restoration problems.

Keywords: *Mixed-conifer forests, fire ecology, European settlement, historical range of variability.*

(See Wenatchee order form.)

Smith, J.E.; McKay, D.; Brenner, G.; McIver, J.; Spatafora, J.W.

2005. Early impacts of forest restoration treatments on the ectomycorrhizal fungal community and fine root biomass in a mixed conifer forest. *Journal of Applied Ecology*. 42: 526–535.

Knowledge of how the ectomycorrhizal fungi (EMF) community responds to prescribed fire and thinning may provide insight into stand recovery after fuel-reducing restoration treatments. The response of EMF species richness, live fine root biomass, and duff levels to thinned-only, prescribed burned only, thinned and prescribed burned (both restoration treatments), and non-thinned and nonburned control stands was investigated in mixed ponderosa pine and Douglas-fir stands in the Blue Mountains of Oregon. Ectomycorrhizal fungi species richness, live root biomass, and duff levels were significantly reduced by prescribed fire treatments compared to the non-burned treatments. Ectomycorrhizal fungi mortality and complete duff reduction after fire have been implicated with poor tree survival and slow stand recovery in forest ecosystems worldwide. The initial reduction of EMF species richness, fine root biomass, and duff levels after prescribed fire has important implications on whether managers can achieve the desired future condition of stands with large-tree retention and low fuel loads. These results, along with the recovery potential of a site, and the impending risk of stand-replacing wildfire in stands differing in structure from historic conditions, bear consideration when reintroducing fire.

Keywords: *Prescribed thinning and fire, Pinus ponderosa, ectomycorrhizal community, fine root biomass, ecological restoration.*

(See Corvallis order form.)

Thies, W.G.; Westlind, D.J.; Loewen, M.

2005. Season of prescribed burn in ponderosa pine forests in eastern Oregon: impact on pine mortality. *International Journal of Wildland Fire*. 14: 223–231.

Managers are concerned about the effects of seasonal timing of prescribed burns on ponderosa pine ecosystems. Six ponderosa pine stands near Burns, Oregon, were each subdivided into three units. Each unit was randomly assigned a prescribed burn treatment: fall, spring, or control. For four seasons following the burns, 5,321 ponderosa pines were observed for damage, mortality, and occurrence of black stain root disease (BSRD). The percentage of ponderosa pine dying was higher following fall burns than following spring burns. We suggest that fire severity rather than phenology is responsible for observed patterns. The lion's tail appearance, thought to be a symptom of BSRD, was found to be an unreliable indicator of BSRD in the six test stands.

Keywords: *Blue Mountains, black stain root disease, Leptographium wageneri, fire.*

(See Corvallis order form.)

Fish and Wildlife

Forsman, E.D.; Anthony, R.G.; Zabel, C.

2004. Regional, local, and annual variation in diets of spotted owls in Oregon. *Journal of Raptor Research*. 38(3): 214–230.

We described local, regional, and annual variation in diets of spotted owls in Oregon based on a sample of 23,847 prey collected at 1,102 owl territories from 1970 to 2001. The total sample included 91.6 percent mammals, 4.3 percent birds, 4.0 percent insects, and 0.1 percent other prey. The diet included more than 130 species, including 47 mammals, 41 birds, 3 reptiles, 1 frog, 1 crayfish, 1 scorpion, 2 snails, and 33 species of insects. Of 22,370 prey that could be identified to species or family, 91.7 percent were primarily nocturnal, 3.5 percent were primarily diurnal, and 4.8 percent were animals that were active both day and night. Of 21,177 mammalian prey that could be assigned to a life zone, 54.4 percent were arboreal, 17.0 percent were scansorial, 0.3 percent were aerial, and 28.3 percent were terrestrial. Mean mass of prey averaged 121.4 g. Diets varied among owl territories, geographic

regions, and years, but were generally dominated by four to six species of nocturnal mammals, including northern flying squirrels (*Glaucomys sabrinus*), woodrats (*Neotoma fuscipes* and *N. cinerea*), red tree voles (*Arborimus longicaudus*), western red-backed voles (*Clethrionomys californicus*), deer mice (*Peromyscus maniculatus*), or gophers (*Thomomys* spp.). Estimates of dietary diversity were low, indicating diets dominated by a few species of mammals. Forest management practices that produce healthy populations of arboreal and scansorial mammals such as flying squirrels, woodrats, and red tree voles should benefit spotted owls.

Keywords: Northern spotted owl, northern flying squirrel, red tree vole.

(See Corvallis order form.)

Forest Management

Adams, D.M.; Mills, J.R.; Alig, R.J.; Haynes, R.W.

2005. SOFRA and RPA: two views of the future of Southern timber supply. *Southern Journal of Applied Forestry*. 29(3): 123–134.

Two recent studies provide alternative views of the current state and future prospects of Southern forests and timber supply: the Southern Forest Resource Assessment (SOFRA) and the Fifth Resources Planning Act Timber Assessment (RPA). Using apparently comparable data but different models and methods, the studies portray futures that in some aspects are quite similar and in others markedly different. This article focuses on what the differences and commonalities between the reports suggest about the key factors that help shape our views of the future of southern timber supply. What inputs and assumptions make important differences in projections of the South's timber supply future: We find that there are five major areas to watch: (1) gross land area shifts from forest to urban and from agriculture to forest (not just net timberland area change); (2) the sensitivity of pine plantation investments to expected timber prices; (3) the responsiveness of southern timber demand to prices; (4) age or date of the starting inventory and the definition of timber harvest (what products are included); and (5) the basic yield assumptions and the timing of the yield impacts from improved management and timberland area change.

Keywords: Harvest, removals, demand, models.

(see Portland order form.)

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

2005. Estimation and application of a growth and yield model for uneven-aged mixed-conifer stands in California. *International Forestry Review*. 7(2): 101–112.

A growth model for uneven-aged mixed-conifer stands in California was developed with data from 205 permanent plots. The model predicts the number of softwood and hardwood trees in 19 diameter classes, based on equations for diameter growth rates, mortality, and recruitment. The model gave unbiased predictions of the expected number of trees by diameter class and species group over 8 to 12 years on 28 validation plots that were not used in model estimation. The results of predictions of undisturbed growth over more than a century were consistent with previous knowledge about succession and productivity in this forest type. The growth model, embedded in the CalPro simulator, was applied to project the effects of managing stands to maintain the current average stand state over the observed plots, with cutting cycles of 10 or 20 years. The results suggested that uneven-age management could match the productivity of even-age systems. The 10-year cutting cycle led to higher productivity, higher present value of harvests, and higher tree species diversity, but lower tree size diversity than the 20-year cycle.

Keywords: Mixed species, growth, mortality, recruitment, uneven-aged.

(See Portland order form.)

Reynolds, K.M.; Hessburg, P.F.

2005. Decision support for integrated landscape evaluation and restoration planning. *Forest Ecology and Management*. 207: 263–278.

The historical patterns of Inland Northwest U.S. forests have been dramatically altered by two centuries of human settlement and land use. Spatial patterns of forest structural conditions, tree species composition, snags and down wood, and temporal variation in these patterns, have been altered to such an extent that the natural ebb and flow of terrestrial habitats and their linkages has been disrupted. Closely coupled with these changes, fire and other disturbance processes in most dry and many mesic forest types have also shifted, with a bias for increased severity and extent. In the context of planning restoration

of some semblance of historical vegetation pattern–disturbance process interactions, we revisit why it is theoretically sound to estimate the range and variation in historical forest spatial patterns. We call these estimates of range and variation, reference conditions or reference variation, and discuss how forest managers might use them when evaluating current landscape patterns to identify changes that may have important ecological implications. We term such evaluations as departure analyses and describe how departure analysis is implemented in a decision support system for integrated landscape evaluation and restoration planning.

Keywords: Landscape, evaluation, planning, decision support, ecology, pattern, process, logic, decision.
(See Corvallis order form.)

Talbert, C.; Marshall, D.D.

2005. Plantation productivity in the Douglas-fir region under intensive silvicultural practices: results from research and operations. *Journal of Forestry*. 103(2): 65–70.

This paper reviews the major silvicultural practices in the west-side Douglas-fir region of Oregon and Washington: origin, growth and yield impacts, and the region's global competitive status for productivity, tree-growing costs, and returns. The main messages emerge: (1) there has been great progress in the region to increase wood yield and to shorten rotations; (2) the Pacific Northwest remains at a competitive disadvantage globally; and (3) opportunity remains strong for this region to become competitive, although it will require challenging current beliefs and norms, and an increased collective will and focused sense of urgency.

Keywords: Douglas-fir, productivity, management, thinning, fertilization, vegetation management.
(See Olympia order form.)

Genetics

Alvarez, I.; Cronn, R.C.; Wendel, J.F.

2005. Phylogeny of the New World diploid cottons (*Gossypium* L., Malvaceae) based on sequences of three low-copy nuclear genes. *Plant Systematics and Evolution*. 252: 199–214.

American diploid cottons (*Gossypium* L., subgenus *Houzingenia* Fryxell) form a monophyletic group of 13 species distributed mainly in western Mexico, extending

into Arizona, Baja California, and with one disjunct species each in the Galapagos Islands and Peru. Prior phylogenetic analysis based on an alcohol dehydrogenase gene (*AdhA*) and nuclear ribosomal DNA indicated the need for additional data from other molecular markers to resolve phylogenetic relationships with this subgenus. Toward this end, we sequence three nuclear genes, the anonymous locus *A1341*, an alcohol dehydrogenase gene (*AdhC*), and a cellulose synthase gene (*CesAlb*). Independent and combined analyses resolved clades that are congruent with current taxonomy and previous phylogenies. Our analyses diagnose at least two long-distance dispersal events from the Mexican mainland to Baja California, following a rapid radiation of the primary linkages early in the diversification of the subgenus. Molecular data support the proposed recognition of a new species closely related to *Gossypium laxum* that was recently collected in Mexico.

Keywords: *Gossypium*, *Houzingenia*, cotton, phylogeny, low-copy nuclear genes, alcohol dehydrogenase, cellulose synthase.

(see Corvallis order form.)

Geomorphology and Hydrology

Beebe, R.A.; O'Connor, J.E.; Grant, G.E.

2002. Geology and geomorphology of the lower Deschutes River Canyon, Oregon. In: Moore, G.W., ed. Field guide to geologic processes in Cascadia: field trips to accompany the 98th annual meeting of the Cordilleran Section of the Geological Society of America. Corvallis, OR. Special Paper 36. Portland, OR: The Oregon Department of Geology and Mineral Industries: 91–108.

This field guide is designed for geologists floating the approximately 80 km of the Deschutes River from the Pelton–Round Butte Dam Complex west of Madras to Maupin, Oregon. The first section of the guide is a geological timeline tracing the formation of the units that compose the canyon walls and the incision of the present canyon. The second section discusses the hydrology, morphology, and formation of the present river channel. The third section is a river log, describing sights and stops for a 3-day floating excursion.

Keywords: Channel geomorphology, hydrologic processes, landslides, floods.

(see Corvallis order form.)

Tague, C.; Grant, G.E.

2004. A geological framework for interpreting the low-flow regimes of Cascade streams, Willamette River Basin, Oregon. *Water Resources Research*. 40(W04303).

In ungauged basins, predicting streamflows is a major challenge for hydrologists and water managers, with approaches needed to systematically generalize hydro-metric properties from limited stream gauge data. Here we illustrate how a geologic/geomorphic framework can provide a basis for describing summer base flow and recession behavior at multiple scales for tributaries of the Willamette River in Oregon. We classified the basin into High Cascade and Western Cascade provinces based on the age of the underlying volcanic bedrock. Using long-term U.S. Geological Survey stream gauge records, we show that summer streamflow volumes, recession characteristics, and timing of response to winter recharge are all linearly related to the percentage of High Cascade geology in the contributing area. This analysis illustrates how geology exerts a dominant control on flow regimes in this region and suggests that a geological framework provides a useful basis for interpreting and extrapolating hydrologic behavior.

Keywords: Lowflows, geology, recession analysis, water supply.

(See Corvallis order form.)

Harvest

Adams, D.M.; Latta, G.S.

2005. Timber harvest potential from private lands in the Pacific Northwest: biological, investment, and policy issues. In: *Understanding key issues of sustainable wood production in the Pacific Northwest*. Gen. Tech. Rep. PNW-GTR-626. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 4–12.

A review of recent studies suggests that private lands in the Pacific Northwest should be able to maintain at least recent historical harvest levels over the next 50 or more years given unchanged policies and anticipated levels of private management investment. These results could be realized with stable-to-rising inventories and nearly stable real prices. Concentration of lands in younger age and size classes will continue in some cases for industrial owners and to a lesser extent on nonindustrial private forest lands. Shifts toward more intensive management

will be measured, gradual, and relatively limited and will have a modest impact on harvest over the next 50 years. New policies that act to reduce the operable land base of private owners should lead to roughly proportional reductions in private timber harvest. Withdrawals that focus on larger and older stands will have a much larger proportional near-term impact, given the general dearth of older timber in the private forest base.

Keywords: Timber supply, forest practice regulation, timber inventory.

(See Portland order form.)

Invasive Plants and Animals

Gray, A.N.

2005. Nonnative plants in western Oregon forests: associations with environment and management. *Environmental Monitoring and Assessment*. 100: 109–127.

Nonnative plants have tremendous ecological and economic impacts on plant communities globally, but comprehensive data on the distribution and ecological relationships of individual species are often scarce or nonexistent. The objective of this study was to assess the influence of vegetation type, climate, topography, and management history on the distribution and abundance of eight selected nonnative plant taxa in forests in western Oregon. These eight taxa were selected as being reliably detected by a multiresource inventory of 1,127 systematically placed plots on nonfederal forest lands from 1995 to 1997 by the USDA Forest Service Forest Inventory and Analysis Program. One or more of the eight nonnative taxa studies were found on 20 percent of the sampled subplots in the study area, but relatively few stands were dominated by them. Overall abundance of nonnative taxa was likely much greater, because few composites and graminoids were identified to species in this general-purpose inventory. Distribution of most taxa was more closely associated with low density of overstory trees than with climate. Nonnative taxa were significantly more abundant in stands that had been recently clearcut or thinned than in stands that had not. Frequencies of several taxa decreased with elevation, which may reflect proximity to source populations and intensive land use rather than any climatic constraints.

Keywords: Autoecology, conifer forest, invasive plants, management, monitoring.

(See Corvallis order form.)

Radosevich, S.R.; Endress, B.A.; Parks, C.G.

2005. Defining a regional approach for invasive plant research and management. In: Inderjit, S., ed. *Invasive plants: ecological and agricultural aspects*. Basel, Switzerland: Birkhäuser Verlag. 141–165.

Research at multiple scales is needed to comprehensively examine regional invasive plant problems, but it is difficult to define and implement, especially at the landscape level. Understanding the basic biology and demography of non-native invasive plants is also critical to develop effective management techniques. A regional research program that integrates experiments and informs managers and researchers within an adaptive management philosophy is an effective way to implement such a research effort. We present a framework for regional research on nonnative invasive plants by using an ongoing research program as an example. This program is focused on the invasive plant *Potentilla recta* in the interior Pacific Northwest.

Keywords: *Potentilla recta*, *weed research*, *rangelands*, *grasslands*, *Blue Mountains*, *Oregon*.

(See La Grande order form.)

Invertebrates

Niwa, C.G.; Peck, R.W.

2002. Influence of prescribed fire on carabid beetle (Carabidae) and spider (Araneae) assemblages in forest litter in southeastern Oregon. *Environmental Entomology*. 31(5): 785–796.

The objective of this study was to determine if prescribed fire affects spider and carabid beetle abundance, and whether the magnitude of this effect varies with time since fire. Within mixed-conifer stands, nine understory fuels-reduction burns ranging from <1 to 15 years old were compared to adjacent unburned sites. Pitfall traps were used to compare macroarthropod abundance over 5 months. In total, 3,441 spiders in 24 families and >120 species, and 14,793 carabid beetles from 17 species, were identified from the samples. Seven spider families and five species of carabid beetles were abundant enough to be analyzed statistically. Four spider families were more abundant in unburned sites.

Keywords: *Prescribed fire*, *forest litter arthropods*, *spiders*, *Carabidae*, *Oregon*, *pitfall traps*.

(See Corvallis order form.)

Landscape Ecology

Bettinger, P.; Lennette, M.; Johnson, K.N.; Spies, T.A.

2005. A hierarchical spatial framework for forest landscape planning. *Ecological Modeling*. 182: 2–48.

A hierarchical spatial framework for large-scale, long-term forest landscape planning is presented along with example policy analyses for a 560,000 ha area of the Oregon Coast Range. The modeling framework suggests utilizing the detail provided by satellite imagery to track forest vegetation condition and representation of fine-scale features, such as riparian areas. Spatial data are then aggregated up to management units, where forest management decisions are simulated. Simulations indicated that the minimum harvest age constraint has a stronger influence on even-flow harvest levels than do maximum clearcut size or interior habitat area constraints. Even-flow timber harvest level objectives, however, also have an effect on the results: time periods beyond the constraining time period show a buildup of timber inventory, which suggests that a possible relaxation or modification of the objective in order to achieve average harvest ages that are closer to the minimum harvest age.

Keywords: *Forest management*, *forest planning*.

(see Corvallis order form.)

Hessburg, P.F.; Kuhlmann, E.E.; Swetnam, T.W.

Wimberly, M.C.; Ohmann, J.L.

2004. A multi-scale assessment of human and environmental constraints on forest land cover on the Oregon (USA) Coast Range. *Landscape Ecology*. 19: 631–646.

Human modification of forest habitats is a major component of global environmental change. Even areas that remain predominantly forested may be changed considerably by human alteration of historical disturbance regimes. To better understand human influences on the abundance and pattern of forest habitats, we studied forest land cover change from 1936 to 1996 in a 25 000 km² landscape in the Oregon Coast Range. We integrated historical forest survey data and maps from 1936 with satellite imagery and geographic information system data from 1996 to quantify changes in major forest cover types. Change in the total area of closed-canopy forests was relatively minor, decreasing from 68 percent of the landscape in 1936 to 65 percent in 1996. In contrast, large-conifer

forests decreased from 42 percent in 1936 to 17 percent in 1996, whereas small-conifer forests increased from 21 percent of the landscape in 1936 to 39 percent in 1996. Linear regression models were used to predict changes in the proportion of large conifer forest as a function of socioeconomic and environmental variables at scales of subbasins, watersheds, and subwatersheds. The proportion of land in private ownership was the strongest predictor at all three spatial scales. The amounts of variation explained by other independent variables were comparatively minor. Results corroborate the hypothesis that differing landowner goals and regulatory constraints on private and public ownerships have led to distinctive types of forest management. These human disturbance regimes, constrained by the spatial pattern of ownership, have replaced wildfire as the primary driver of forest structure dynamics in the Oregon Coast Range.

Keywords: Disturbance, environmental heterogeneity, forest fragmentation, forest management, habitat loss, human impacts, land ownership, watersheds.

(See Corvallis order form.)

Land Use

Alig, R.J.; Adams, D.M., Joyce, L.; Sohngen, B.

2004. Climate change impacts and adaptation in forestry: responses by trees and markets. Choices Magazine (Fall 2004). Ames, IA: American Agricultural Economics Association. 7–11.

Potential consequences of climate variability and change on U.S. forests were assessed with climate models, ecological process models, and an economic model of land use and management. With enhanced forest growth overall from climate change U.S. timber harvests rise over the next 100 years, lowering timber prices and reducing costs of wood and paper products, with higher total economic welfare. Differences may occur by region, as potential habitats for trees favored by cool environments are very likely to shift to the north, such that eastern land area associated with aspen, sugar maple, and birch, for example, is likely to decline, whereas oak/hickory and oak/pine forests could possibly expand. Among choices by the millions of private landowners affecting adaptation are options to shift land uses, interregional migration

of timber production, substitution in timber consumption, altered forest stand management, salvage of dead or dying trees, shifts in planting stock, and changes in fertilization and thinning regimes.

Keywords: Forest growth, environmental services, land use decisions.

(see Corvallis order form.)

Alig, R.J.; Plantinga, A.J.

2004. Future forestland area: impacts from population growth and other factors that affect land values. Journal of Forestry. 102(8): 19–24.

Shifting patterns of land use in the United States are associated with many of today's environmental concerns. Land use shifts occur because of relative changes in land rents, which are determined in part by financial returns in commodity markets. In recent decades, more than 3 million acres shifted annually in or out of U.S. forest use. Gross amounts of land use change are on an order of magnitude larger than net changes. Between 1982 and 1997, a **net** amount of 3.6 million acres was added to the U.S. forest land base. Area of developed uses is projected to increase by about 70 million acres by 2030, with the largest percentage diverted from forests. All regions show substantial increases in developed area, with increases in population and personal income as key drivers.

Keywords: Projections, land use, land markets.

(See Corvallis order form.)

Beuter, J.H.; Alig, R.J.

2004. Forestland values. Journal of Forestry. 102(8): 4–8.

This article serves as the introduction to this issue of the Journal of Forestry, which is devoted to six articles about forest-land values and the influences of such values on policy deliberations and their implications for future use of forest land.

Keywords: forest-use valuation.

(See Corvallis order form.)

Mycology

Antoine, M.E.; McCune, B.

2004. Contrasting fundamental and realized ecological niches with epiphytic lichen transplants in an old-growth *Pseudotsuga* forest. *The Bryologist*. 107(2): 163–173.

Three lichen transplant experiments examined the effect of height in the canopy on the growth rates of four lichen species, using the Wind River Canopy Crane in an old-growth *Pseudotsuga-Tsuga* forest in the Cascade Range of southern Washington. A total of 40 to 100 transplants were used for each species, and growth was measured over a 1-year period. We then compared the vertical profiles of growth rates to the vertical profiles of natural abundance. The vertical pattern of abundance of *Letharia vulpina* more or less corresponded with the vertical pattern in growth rates. The other two species for which we had vertical profiles in both abundance (realized niche) and growth of transplants (fundamental niche) showed some potentially important discrepancies between the two niche species. *Usnea* peaked in abundance at the highest levels in the canopy, but appeared to reach a maximum growth rate at about 30 m. The treetop environment is evidently ideal for *Usnea*, and its capacity for rapid growth suggests that it is a vigorous competitor. *Lobaria oregana* peaked in abundance at 25–30 m, while its growth rates were maximal considerably higher in the canopy, at 4045 m. We must conclude that some aspect of establishment or competition has a pronounced negative effect on *L. oregana* above about 35 m in the 65-m-high canopy. Further experiments are needed to test the hypothesis that these cyanolichens fail in the upper canopy because of competition or that they fail by an inability to tolerate rare microclimatic extremes, such as low temperatures.

Keywords: Competition, epiphytes, fundamental niche, *Letharia*, lichen, *Lobaria*, old-growth forests, transplants, *Usnea*.

(See Corvallis order form.)

Plant Ecology

Andrade, J.L.; Meinzer, F.C.; Goldstein, G.; Schnitzer, S.A.

2005. Water uptake and transport in lianas and co-occurring trees of a seasonally dry tropical forest. *Trees*. 19: 282–289.

Water uptake and transport were studied in eight liana species in a seasonally dry tropical forest on Barro Colorado Island, Panama. Our observations that lianas tap shallow sources of soil water at the beginning of the dry season and that sap flow is similar in lianas and trees of equivalent stem diameter do not support the common assumptions that lianas rely primarily on deep soil water and that they have higher rates of sap flow than do co-occurring trees of similar stem size.

Keywords: Panama, sap flow, soil volumetric water content; stable hydrogen isotope ratio.

(See Corvallis order form.)

Kerns, B.K.; Alexander, S.J.; Bailey, J.D.

2004. Huckleberry abundance, stand conditions, and use in western Oregon: evaluating the role of forest management. *Economic Botany*. 58(4): 668–678.

Huckleberries are major components of the understory vegetation in Oregon and are also important nontimber forest products (NTFP). However, little research has been done regarding how they respond to common forest management techniques. We examined differences in *Vaccinium ovatum*, *V. parvifolium*, and *V. membranaceum* frequency and abundance by using data from old-growth and young thinned and unthinned Douglas-fir stands in western Oregon. Our objective was to evaluate how forest management could potentially affect species abundance and product supply. We also spoke with NTFP harvesters, buyers, business owners, and managers to gain an understanding of local knowledge, present-day use, and markets for these species. Results were variable and site-specific, but several trends emerged: *V. ovatum* was more abundant in old-growth and unthinned stands; *V. parvifolium* was more abundant in thinned stands, particularly in the Cascade Range, with abundance related to time elapsed and intensity of thinning; and *V. membranaceum* was more abundant in old-growth stands. However, to fully assess the effects of forest management on these species, better linkages between biological abundance and commercial productivity are needed.

Keywords: Nontimber forest products, understory, overstory, *Vaccinium*.

(see Corvallis order form.)

Range Management

Vavra, M.

2005. Livestock grazing and wildlife: developing compatibilities. *Journal of Range Management*. 58(2): 128–134.

Livestock grazing has long been considered detrimental to wildlife habitat. However, managed grazing programs have the potential to maintain habitat diversity and quality. Managed livestock grazing can have four general impacts on vegetation: (1) alter the composition of the plant community, (2) increase the productivity of selected species, (3) increase the nutritive quality of the forage, and (4) increase the diversity of the habitat by altering its structure. Implementation of a grazing management plan to enhance wildlife habitat requires an interdisciplinary approach. Knowledge of plant community dynamics, wildlife habitat requirements of affected species, and potential impacts on the livestock used are basic to successful system design.

Keywords: Cattle, facilitation, herbivory, deer, elk.

(See La Grande order form.)

Silviculture

Andrews, L.S.; Perkins, J.P.; Thraillkill, J.A.; Poage, N.J.; Tappeiner, J.C., II

2004. Silvicultural approaches to develop northern spotted owl nesting sites, central Coast Ranges, Oregon. *Western Journal of Applied Forestry*. 20(1): 13–27.

We used an individual-tree, distance-independent growth model to explore a range of management scenarios for young Douglas-fir stands (age class 50 years with 170 to 247 trees/acre) and estimated which scenarios promoted the development of forest patches that emulate the species mix and diameter distributions at known spotted owl nest sites in the central Coast Ranges of Oregon. Silvicultural simulations that modeled heavy thinnings at ages 50 and 80 years, followed by tree planting and additional thinnings, developed forest patches by stand age 160 most structurally similar to our sample of spotted owl nest sites.

Keywords: Forest thinning, old growth, stand structure, northern spotted owl, wildlife habitat.

(see Portland order form.)

Beggs, L.R.

2004. Vegetation response following thinning in young Douglas-fir forests of western Oregon: Can thinning accelerate development of late-successional structure and composition? Corvallis, OR: Oregon State University. 95 p. M.S. thesis.

The Young Stand Thinning and Diversity Study was developed to test if thinning could accelerate development of late-successional habitat in young managed Douglas-fir forests. Results for overstory vegetation indicate that heavy thinning may accelerate development of large trees, one important component of old-growth structure. It is expected that, eventually, similarities and differences in overstory structure among thinned treatments will be reflected in the understory. Finally, the effect of canopy gaps on the understory was more apparent at a within-stand scale rather than at a stand scale.

Keywords: Silviculture, thinning, plantations, old growth.

(see Corvallis order form.)

Elman, E.; Peterson, D.L.

2005. Effects of post-harvest treatments on high-elevation forests in the North Cascade Range, Washington. *BC Journal of Ecosystems and Management*. 6(1): 33–50.

We studied the effects of postharvest treatments on regeneration and forest composition 13 to 27 years following harvest in high-elevation forests of the North Cascade Range, USA. Treatments included sites broadcast burned and planted, unburned sites seeded, and unburned sites mostly planted. Overstory and understory composition was determined and compared with agency records of mature forest stands in the area. Burned/planted sites contained a smaller proportion of *Abies amabilis* than did unburned sites, and burned sites also contained less advance regeneration than did unburned sites. Advance regeneration in these sites will be enhanced by careful logging operations and not by using fire to treat slash.

Keywords: Abies amabilis, Cascade Range, high-elevation forest, Tsuga heterophylla, understory.

(See Pacific Wildland Fire Sciences order form.)

Social Sciences

Becker, D.R.; Harris, C.C.; Nielson, E.A.; McLaughlin, W.J.

2004. A comparison of a technical and a participatory application of social impact assessment. *Impact Assessment and Project Appraisal*. 22(3): 177–189.

The results of independent applications of a technical and a participatory approach to social impact assessment are compared for impacts of the proposed removal of hydro-electric dams to recover threatened and endangered salmon in the Pacific Northwest. The analysis focuses on differences and similarities found between the technical Social Analysis Report (SAR) and the participatory Interactive Community Forum (ICF) report in terms of indicators used, the manner in which impacts were projected, and the types of social impacts identified. The SAR assessment was found to use a more homogenous set of social structures and indicators to make expert-based projections of impacts. The ICF did not limit indicators to those aggregated across the region, but revealed resident's perceptions of impacts to their communities. By combining approaches, a greater range of impacts was identified. Key impacts were also verified from which strategic mitigation plans could be developed.

Keywords: Social impact assessment, technical, participatory, social indicators, impact projection.

(see Portland order form.)

Bigler-Cole, H.

2005. A historical forest management conundrum: do social and biophysical science mix? In: *Proceedings of the 6th national conference of the Australian Forest History Society*. Rotterdam, Netherlands: Millpress Science Publishers: 35–46.

Over the past several decades, forest managers have watched management plans disintegrate. The controversies surrounding the disintegration have a common denominator: they involve conflicting human values, attitudes, and behaviors. With this realization, several forest management efforts have attempted to incorporate social analyses into their scientific base, with limited success. This paper explores three models of social and biophysical scientific integration from Australia and the United States. It then turns to three philosophers who considered the benefits of and barriers to integration.

Keywords: Scientific integration, Wendell Barry, E.O. Wilson, Thomas Gieryn.

(see La Grande order form.)

Wildlife

Ager, A.A.; Johnson, B.K.; Coe, P.K.; Wisdom, M.J.

2004. Landscape simulation of foraging by elk, mule deer, and cattle on summer range. In: *Transactions of the 69th North American wildlife and natural resources conference*. Washington, DC: Wildlife Management Institute: 687–707.

Cattle, mule deer (*Odocoileus hemionus*), and Rocky Mountain elk (*Cervus elaphus*) share more area of spring, summer, and fall range than any other combination of wild and domestic ungulates in western North America. Not surprisingly, conflicts over perceived competition for forage have a long history, yet knowledge about actual competition is limited. One of the first studies of the Starkey Project was designed to address the issue of whether mule deer and elk compete with cattle for available forage on summer range. For this study, we developed a model to simulate how elk, mule deer, and cattle would respond to altered population levels and forage availability on typical summer range conditions found in the Blue Mountains of northeastern Oregon. Our model has four primary components that simulate animal distributions, vegetation growth, diet selection, and animal energetics. Animal distributions were simulated using resource selection functions during peak foraging periods developed from Starkey telemetry data. The vegetation submodel considered daily increments in forage biomass as a function of habitat type with adjustments for tree canopy closure and summer precipitation.

Keywords: Elk, mule deer, cattle, summer range, forage, populations, Blue Mountains, Starkey Project.

(see La Grande order form.)

Ager, A.A.; Preisler, H.K.; Johnson, B.K.; Kie, J.G.

2004. Movements and habitat use of Rocky Mountain elk and mule deer. In: *Transactions of the 69th North American wildlife and natural resources conference*. Washington, DC: Wildlife Management Institute. 641–655.

We examined fine-scale movements and habitat use by female Rocky Mountain elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*) in northeastern Oregon by using telemetry data collected over 6 years at the Starkey Experimental Forest and Range. Data from female elk and mule deer were analyzed for 30-day intervals from April 15 to November 14, 1991–96, and

tested for daily cycles of use in habitat variables and movements. Both elk and deer exhibited strong daily and seasonal patterns of movements and habitat use, although patterns were weaker for deer. Daily cycles of habitat use were most pronounced during spring and fall, and were composed of both crepuscular and daytime habitat transitions.

Keywords: Elk, mule deer, habitat, movement, patterns, Starkey Project, Starkey Experimental Forest and Range. (see La Grande order form.)

Aubry, K.B.; Wisely, S.M.; Raley, C.M.; Buskirk, S.W.

2004. Zoogeography, spacing patterns, and dispersal in fishers: insights gained from combining field and genetic data. In: Martens and fishers (*Martes*) in human-altered environments: an international perspective. New York: Springer Science+Business Media: 201–220.

We describe procedures used in genetic analyses of fishers (*Martes pennanti*) studied with radio-telemetry in south-western Oregon, and discuss how genetic information can facilitate the interpretation of field data and provide insights into such aspects of population ecology as phylogeography, spacing patterns, and dispersal. We screened microsatellite DNA for polymorphic loci using 18 primers developed for other carnivore species, 7 of which were polymorphic among our sample. We used data on variation among alleles to calculate observed and expected heterozygosity, coefficients of inbreeding and relatedness, and to exclude parent-offspring and mother-father combinations. Our analyses showed that fishers in the southern Oregon Cascade Range are genetically isolated from populations in the northern Siskiyou Mountains, and we have provided the first empirical evidence that male territorial behavior during the breeding season is flexible and determined primarily by the distribution of receptive females, and that juvenile dispersal in fishers is male-biased, resulting in greater philopatry among females. Combining field and genetic data can substantially improve the quality of field studies and enables researchers to study aspects of population ecology that would not otherwise be possible.

Keywords: Genetics, relatedness, inbreeding, microsatellite DNA, primers, radio-telemetry, home range, philopatry. (See Olympia order form.)

Bate, L.J.; Torgersen, T.R.; Wisdom, M.J.; Garton, E.O.

2004. Performance of sampling methods to estimate log characteristics for wildlife. *Forest Ecology and Management*. 199: 83–102.

We evaluated the empirical performance of line-intersect (LIM) and strip plot (SPM) methods for sampling logs in forests of Oregon and Montana. In unharvested stands, the precision and efficiency of LIM and SPM were similar for all variables except log density, for which SPM performed better. In harvested stands, precision and efficiency of LIM and SPM varied widely for several estimates. Strip plot method was more precise and efficient than LIM as an estimator of density and volume. Moreover, SPM required less time to sample large logs. Our results provide the first empirical validation of these methods and offer useful context for design of log inventories for research and management.

Keywords: Coarse woody debris, down wood, fixed-area sampling, line-intersect sampling, logs, log sampling, wildlife.

(see La Grande order form.)

Bellinger, M.R.; Haig, S.M.; Forsman, E.D.; Mullins, T.D.

2005. Taxonomic relationships among *Phenacomys* voles as inferred by cytochrome *b*. *Journal of Mammalogy*. 86(1): 201–210.

Taxonomic relationships among red tree voles (*Phenacomys longicaudus longicaudus*, *P. l. silvicola*), the Sonoma tree vole (*P. pomo*), the white-footed vole (*P. albipes*), and the heather vole (*P. intermedius*) were examined by using 664 base pairs of the mitochondrial cytochrome *b* gene. Results indicate specific differences among red tree voles, Sonoma tree voles, white-footed voles, and heather voles, but no clear difference between the two Oregon subspecies of red tree voles (*P. l. longicaudus* and *P. l. silvicola*). Our data further indicated a close relationship between tree voles and *albipes*, validating inclusion of *albipes* in the subgenus *Arborimus*. These three congeners shared a closer relationship to *P. intermedius* than to other arvicolid. A moderate association between *pomo* and *albipes* was indicated by maximum parsimony and neighbor-joining phylogenetic analyses. Molecular clock estimates suggest a Pleistocene radiation of the *Arborimus*

clade, which is concordant with pulses of diversification observed in other murid rodents. The generic rank of *Arborimus* is subject to interpretation of data.

Keywords: *Arborimus*, *cytochrome b*, *mitochondrial DNA*, *molecular systematics*, *Phenacomys*, *voles*, *taxonomy*.

(See Corvallis order form.)

Quigley, T.; Wisdom, M.J.

2004. The Starkey Project: long-term research for long-term management solutions. In: Transactions, 69th North American wildlife and natural resources Conference. Wildlife Management Institute, Washington, DC: 443–454.

The Starkey Project is a unique, long-term research program originally designed to study the effects of key resource uses of national forests on mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) habitats and populations. The original studies were completed in the 1990s, but research on understanding the effects of new and ongoing resources uses on deer and elk continues today. In addition, a myriad of new studies are underway to understand the role of these ungulates as disturbance agents that can dramatically alter the ecological patterns and processes in forest ecosystems.

Keywords: *Research*, *elk*, *mule deer*, *Starkey Project*, *Starkey Experimental Forest and Range*.

(see La Grande order form.)

Smith, W.P.; Zollner, P.A.

2005. Sustainable management of wildlife habitat and risk of extinction. *Biological Conservation*. 125: 287–295.

Whether land management planning provides for sufficient habitat to sustain viable populations of indigenous wildlife ranks high among issues challenging management of natural resources. Effects analyses of land management alternatives mostly have relied on qualitative assessments that select single species to reflect the risk of wildlife extinction across a planning area. We propose a conceptual framework for sustainable management of wildlife habitat that acknowledges the greater risk of an extinction event when considering the viability of multiple species, i.e., an indigenous vertebrate fauna. This concept is based on the principle that the likelihood of at least one event (i.e., species extinction) is the joint probability of

the extinction probabilities of individual species, assuming independence of species' response to disturbance. We use simulation of a simple hypothetical scenario to illustrate the influence of covariance among species' responses on the probability of any extinction, and to illustrate the effect of number of indicator species incorporated in the effects analysis on the difference between the probability of any species going extinct and the probability of the single most sensitive species going extinct. We conclude that risk assessments that select the most sensitive single species may substantially underestimate the risk of wildlife extinction across a planning area.

Keywords: *Conservation assessments*, *extinction risk*, *indigenous wildlife*, *planning*, *population viability*, *sustainable management*, *wildlife habitat*.

(See Juneau order form.)

Wood Utilization

Johnson, G.R.; Grotta, A.T.; Gartner, B.L.; Downes, G.

2005. Impact of the foliar pathogen Swiss needle cast on wood quality of Douglas-fir. *Canadian Journal of Forest Research*. 35: 331–339.

Many stands of Douglas-fir near coastal areas of Oregon and Washington are heavily infected with the foliar pathogen causing Swiss needle cast (SNC) disease, yet there is very little research on resulting wood quality. Modulus of elasticity (MOE) modulus of rupture, microfibril angle, wood density, latewood proportion, and sapwood moisture content were examined in 20- to 28-year-old trees from 15 stands that were infected with varying intensities of SNC. Severity of SNC was quantified by measuring needle retention, the number of needle cohorts retained at three crown levels. Correlations between disease severity and wood properties were examined at both the stand and within-stand levels. When analysis was limited to unhealthy stands (<2.5 years of foliage), the more heavily infected stands (lower needle retention) had higher MOE and latewood proportion and higher sapwood moisture content than did trees from less affected stands.

Keywords: *Swiss needle cast*, *modulus of elasticity*, *modulus of rupture*, *wood quality*.

(see Corvallis order form.)

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— **Bate, L.J.; Torgersen, T.R.; Wisdom, M.J.; Garton, E.O.**

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