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Recent Publications of the Pacific Northwest Research Station, First Quarter, 2006

The **Forest Service** of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the national forests and national grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.

ERRATA

In the previous issue of this publication (*Recent Publications of the Pacific Northwest Research Station, Fourth Quarter, 2005*), the authors of a journal article were incorrectly cited.

On page 14 of the "Publications Available Elsewhere" section, under the heading "Landscape Ecology," a study by M.C. Wimberly and J.L. Ohmann titled "A multi-scale assessment of human and environmental constraints on forest land cover on the Oregon (USA) Coast Range" was misidentified as having been authored by "Hessburg, P.F.; Kuhlmann, E.E.; Swetnam, T.W.; Wimberly, M.C.; and Ohmann, J.L."

For clarity, the corrected citation and abstract for this paper appear on page 24 of this issue.

Pacific Northwest Research Station

Web site	http://www.fs.fed.us/pnw/
Telephone	(503) 808-2592
Publication requests	(503) 808-2138
FAX	(503) 808-2130
E-mail	pnw_pnwpubs@fs.fed.us
Mailing address	Publications Distribution Pacific Northwest Research Station P.O. Box 3890 Portland, OR 97208-3890

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Corvallis, OR 97331-4401

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Bibliographies

06-183

Pacific Northwest Research Station.

2006. Recent Publications of the Pacific Northwest Research Station, Fourth Quarter 2005.

Keywords: *Bibliographies (forestry).*

Economics

05-209

Richards, R.T.; Alexander, S.J.

2006. A social history of wild huckleberry harvesting in the Pacific Northwest. Gen. Tech. Rep. PNW-GTR-657. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 113 p.

Once gathered only for subsistence and cultural purposes, wild huckleberries are now also harvested commercially. Drawing on archival research as well as harvester and producer interview and survey data, an inventory of North American wild huckleberry plant genera is presented, and the wild huckleberry harvesting patterns of early Native Americans and nonindigenous settlers are described. The social, technological, and environmental changes that gave rise to the commercial industry in the Pacific Northwest by the 1920s and the industry's demise after World War II are explained. The resurgence of the commercial wild huckleberry industry in the mid-1980s and national forest management issues related to the industry are presented as are possible strategies that land managers could develop to ensure wild huckleberry, wildlife, and cultural sustainability.

Keywords: Northwest Forest Plan, huckleberry, Vaccinium*, berry picking, Pacific Northwest.*

05-299

Adams, D.M.; Haynes, R.W.; Daigneault, A.J.

2006. Estimated timber harvest by U.S. region and ownership, 1950–2002. Gen. Tech. Rep. PNW-GTR-659. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 64 p.

This publication provides estimates of total softwood and hardwood harvests by region and owner for the United States from 1950 to 2002. These data are generally not available in a consistent fashion and have to be estimated from state-level data, forest resource inventory statistics, and production of forest products. This publication describes the estimation process and documents the various assumptions. These estimates have been used for the past three decades in the periodic USDA Forest Service timber assessments.

Keywords: Timber harvest, forest products, timber supply, forest products trade.

06-020

Biesecker, R.L.; Fight, R.D.

2006. My fuel treatment planner: a user guide. Gen. Tech. Rep. PNW-GTR-663. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 31 p.

My Fuel Treatment Planner (MyFTP) is an MS-Excel®-based tool for calculating and displaying the financial costs and potential revenues associated with forest fuel reduction treatments. It was designed for fuel treatment planners including those with little or no background in economics, forest management, or timber sales. This guide provides the information needed to acquire, load, and begin to use MyFTP.

Keywords: Financial analysis, silviculture, fire, prescriptions, economics, treatment cost, software.

06-058

Fight, RD.; Hartsough, B.R.; Noordijk, P.

2006. Users guide for FRCS: fuel reduction cost simulator software. Gen. Tech. Rep. PNW-GTR-668. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 23 p.

The Fuel Reduction Cost Simulator (FRCS) spreadsheet application is public-domain software used to estimate costs for fuel reduction treatments involving removal of trees of mixed sizes in the form of whole trees, logs, or chips from a forest. Equipment production rates were developed from existing studies. Equipment operating cost rates are from December 2002 prices for new equipment and wage rates for the Pacific Northwest. These cost assumptions can be modified by the user. There are four ground-based systems, four cable systems, and two helicopter systems. Cost estimates are in U.S. dollars per 100 cubic feet, per green ton, and per acre.

Keywords: Cost (fuel treatment), harvesting economics, fuel treatment planning, software, simulation.

Fire

06-092

Thompson, J.

2006. Prescribed fires are not created equal: fire season and severity effects in ponderosa pine forests of the southern Blue Mountains. Science Findings 81. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 6 p.

In the mid-1990s, forest managers on the Malheur National Forest were concerned that spring-season prescribed burning might be exacerbating black stain root disease and having negative effects on understory plants. Working with forest managers, PNW Research Station scientists designed an experiment tailored to the problem. Prescribed fires were set in the fall and spring. The stands were then monitored for several years to determine the response of understory plants, black stain root disease development, and ponderosa pine tree mortality. Although more trees died in fires set in the fall, the season of burn did not really matter. What did matter was the severity of fire and the amount of damage to the trees. There was also no evidence that burn season influenced the understory native perennial (long-lived) grasses and forbs. However, exotic and native short-lived species were more abundant in the areas burned in the fall. As with tree mortality patterns, fire severity is probably driving this pattern. Short-lived native plants showed postfire invasion and spread patterns similar to exotics, but exotics were more abundant than natives.

Keywords: Fire, prescribed burning, black stain root disease, ponderosa pine, burn season, Blue Mountains.

Forest Management

05-254

Rapp, V.; Sands, Y.

2006. 2005 Science Accomplishments of the Pacific Northwest Research Station. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 78 p.

The Pacific Northwest Research Station conducts research at 11 laboratories and centers in Alaska, Oregon, and Washington, and at many sites throughout the three states. This publication summarizes research findings, products, accomplishments, and outcomes for fiscal year 2005. All research is organized under the Station's four goals: (1) develop a fundamental understanding of ecological, social, and economic systems and their interactions; (2) assess the status and trends of ecosystems and natural resources and their uses; (3) develop science-based options for informed management; and (4) communicate science findings and enhance their application. The report also includes information on finances, workforce, and honors and awards.

Keywords: PNW Research Station, accomplishments, 2005, science findings, outcomes, science-based options.

06-078

Nelson, P.; White, R.; Molina, R..

2006. The Pacific Northwest Research Station's Biodiversity Initiative: collaborating for biodiversity management. Gen. Tech. Rep. PNW-GTR-670. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 32 p.

The Pacific Northwest Research Station launched a Biodiversity Initiative to assist natural resource professionals in integrating complex biodiversity concepts into natural resource management processes. We canvassed clients from various affiliations to determine the main challenges they face in biodiversity management, to define their information needs, and to understand how best to deliver biodiversity information within a collaborative framework. The biodiversity management challenges that emerged included (1) the lack of well-defined biodiversity management policies, (2) understanding and quantifying the interaction effects between a number of factors (e.g., disturbance types, management practices) and biodiversity, (3) the lack of applied biodiversity monitoring strategies, (4) difficulty in locating and accessing biodiversity information, and (5) balancing conflicting

values relating to biodiversity. We also list the biodiversity information product needs of clients, as well as preferred technology transfer methods, and we discuss the future direction of the Biodiversity Initiative.

Keywords: Biological diversity, natural resource management, biodiversity information, information needs assessment, resource managers, Pacific Northwest.

06-223

Deal, R.L.; Harrington, C.A., tech. eds.

2006. Red alder: a state of knowledge. Gen. Tech. Rep. PNW-GTR-669. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 150 p.

In March 2005 an international symposium on red alder was held at the University of Washington in Seattle, WA. The symposium brought together regional experts to critically examine the economic, ecological, and social values of red alder; its primary goal was to discuss new advances in the understanding of red alder biology and silviculture, changing market and nonmarket values, and the current regulatory climate for management of alder. This proceedings includes 14 papers based on oral presentations given at the symposium. These papers highlight some of the key findings from the history, ecology, biology, silviculture, and economics sessions presented at the red alder symposium.

Keywords: Red alder, Alnus rubra*, history, biology and ecology, mixed-species stands, silviculture, pruning, plantation establishment, economics, inventory, supply.*

Silviculture

06-121

Harrington, Constance A.; Devine, Warren D.

2006. A practical guide to oak release. Gen. Tech. Rep. PNW-GTR-666. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 24 p.

Oregon white oak savannas and woodlands represent a biological and cultural legacy in the Pacific Northwest. Many Oregon white oak stands are deteriorating owing to invasion and eventual overtopping by Douglas-fir or other conifers. Releasing the shade-intolerant oak trees from overtopping conifers can often restore these oak stands. When planning a release operation, there are many factors to consider such as timing and intensity of release, which trees to select for release, and management of the understory. A carefully executed oak release can minimize damage to oak trees, and followup treatments may reduce the spread of invasive plants. This guide answers the most commonly asked questions related to oak release.

Keywords: Oregon white oak, Garry oak, Quercus garryana*, release, restoration, competition, savanna.*

Social Science

05-232

Moseley, C.

2006. Procurement contracting in the affected counties of the Northwest Forest Plan: 12 years of change. Gen. Tech. Rep. PNW-GTR-661. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 36 p.

As part of the 10-year socioeconomic monitoring of the Northwest Forest Plan, this report evaluates changes in Forest Service and Bureau of Land Management (BLM) procurement contracting between 1990 and 2002 by asking, (1) How much and what kind of work did the Forest Service and BLM contract during this period, and (2) who received economic benefits from this procurement contracting? Procurement contracting is a particular focus of the socioeconomic monitoring because one expectation of the Northwest Forest Plan was that the Forest Service and BLM would create high-skill, high-wage private sector jobs in public land restoration through contracting to partially offset job losses in timber production, harvesting, and processing. This report finds that, to the contrary, the Forest Service reduced its contracting of land management activities on national forests in the Northwest Forest Plan area from a high of $103 million in 1991 to a low of $33 million in 2002. By contrast, BLM spending was fairly constant at just under $20 million annually. Both the Forest Service and the BLM changed the type of activities that they contracted, shifting from activities associated with intensive forest management such as tree planting in clearcuts to activities associated with ecosystem management. Contractors located near national forests and BLM lands and rural communities captured a similar proportion of contracts in both the earlier and later parts of the study period. However, the significant decline in Forest Service contract spending resulted in considerable decline in the amount of money flowing to rural communities through contracting. Thus, it is unlikely that federal land management contracting created a net increase in jobs to replace jobs lost in mills and logging operations in public lands communities.

Keywords: Northwest Forest Plan, monitoring, procurement contracting, U.S. Forest Service, Bureau of Land Management, ecosystem management, restoration, rural communities.

Wildlife

06-056

Thompson, J.

2006. Highways and habitat: managing habitat connectivity and landscape permeability for wildlife. Science Findings 79. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 6 p.

Highways fragment the landscape, affecting the distribution of animal populations and limiting the ability of individuals to disperse between those populations. Moreover, animal-vehicle collisions are a serious hazard to both wildlife and people. Researchers at the PNW Research Station in Wenatchee, Washington, have developed methods to evaluate landscape permeability—the ability of animals to move across the landscape. Using a geographic information system, in conjunction with snow tracking, automatic cameras, and road-kill surveys, they can now identify areas where animals are most likely to cross major highways. These techniques have been adopted by the Washington State Department of Transportation in a massive reconstruction project on Interstate 90 at Snoqualmie Pass. The new stretch of highway is slated to include several wildlife crossing structures. In addition, the researchers have conducted a regional-scale evaluation of landscape permeability for grizzly bears, wolverines, grey wolves, and lynx in the Pacific Northwest. The analysis identifies highways and other landscape barriers that may fragment populations and limit dispersal opportunities. Their work provides tools that can be used to develop conservation strategies and help identify management priorities for these focal species.

Keywords: wildlife habitat, fragmentation, connectivity, landscape permeability, landscape barriers.

06-057

Thompson, J.

2006. 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. 6 p.

A century of fire suppression has radically transformed many forested landscapes on the east side of the Cascades. Managers of dry forests need information to help plan for and implement forest restoration, including 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. In an extensive 4-year study of flying squirrel ecology on the Wenatchee National Forest, squirrels were live-trapped and radio collared, and 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, northern spotted owl, habitat, canopy cover, fire suppression.

06-140

Rapp, V.

2006. Elk, deer, and cattle: the Starkey Project. Science Update 13. Portland, OR: U.S. Department of Agriculture,Forest Service, Pacific Northwest Research Station. 11 p.

Definitive results from the Starkey Project's first decade (1989–99) have given managers defensible options for managing roads, timber production, and range allotments in relation to elk, deer, and cattle. Study results have prompted changes in policies, management standards and guidelines, hunting regulations, and timber sale planning throughout western North America. In the 1970s and 1980s, wildlife managers, hunters, and forest managers had intense debates about how elk, mule deer, and cattle should be managed on public lands. In response, scientists from the Pacific Northwest (PNW) Research Station and the Oregon Department of Fish and Wildlife (ODFW), in collaboration with over 40 partners, initiated the Starkey Project in the Blue Mountains of northeastern Oregon. Starkey is a controlled, landscape-scale study at the Starkey Experimental Forest and Range and the primary field location for research on mule deer, elk, and cattle in managed ecosystems of the Pacific Northwest. Four major themes were identified for the Starkey Project's first decade of research: (1) roads and traffic, (2) timber production and thermal cover, (3) competition with cattle, and (4) breeding efficiency of male elk. The result of the research was a set of compelling findings about elk, deer, and cattle responses to a variety of forest and rangeland activities at scales compatible with management.

Keywords: Starkey, elk, mule deer, cattle, ungulates.

Wood Utilization

06-019

Roos, J.; Nicholls, D.L.

2006. Domestic market opportunities for Alaska lumber-species preferences by secondary wood products manufacturers in the continental United States. Res. Note PNW-RN-550. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 13 p.

New equipment, technology, and marketing efforts have allowed Alaska's wood products producers to consider opportunities previously unavailable to them. Until recently, the primary product produced by Alaska firms was rough, unseasoned lumber sold primarily within local markets. Given the purchase and installation of new drying and planing equipment, Alaska producers can now enter domestic and export markets for a variety of secondary wood products. Previously underutilized species, such as red alder (*Alnus rubra* Bong.), paper birch (*Betula papyrifera* Marsh.), and Alaska yellow-cedar (*Chamaecyparis nootkatensis* (D. Don) Spach) are also gaining in popularity and market potential. A detailed knowledge of species preferences for Alaska lumber, across business types and geographic regions, will be essential if Alaska producers are to be competitive. Information for this paper was obtained from producers attending national and regional woodworking shows. Research objectives were to identify which Alaska species are preferred by selected wood products manufacturers in the continental United States. Manufacturing sectors investigated include cabinet, furniture, door and window, and moulding and millwork. A second objective was to determine which geographic regions of the United States have the greatest potential to purchase lumber produced from various Alaska species. Furniture and cabinet manufacturers were the most common business types among survey responses, representing more than 80 percent of respondents. Overall, Alaska yellow-cedar was the most popular Alaska species, followed by Sitka spruce (*Picea sitchensis* (Bong.) Carr.) and western redcedar (*Thuja plicata* Donn ex D. Donn). Of the four business types represented, door/window manufacturers showed preferences for western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), whereas moulding/millwork producers preferred Sitka spruce, Alaska yellow-cedar, and western redcedar. Both western hemlock and Alaska yellow-cedar were generally preferred by respondents from the Northwest region. However, the overall popularity of Alaska species was relatively low, with the most popular species (Alaska yellow-cedar) being used by only about 7 percent of all respondents. Results of this study indicate a strong potential for development of niche markets by using Alaska species, in particular, use of Alaska yellow-cedar by Pacific Northwest producers. Further opportunities could include substitution of Alaska species such as red alder and western hemlock within established markets in the continental United States. The high costs of producing lumber in Alaska (including transportation, labor, and equipment costs) will need to be considered in developing successful export programs.

Keywords: Wood products, Alaska, export, lumber, underutilized species, furniture.

06-142

Brackley, A.M.; Nicholls, D.L.; Stiefel, M.C.

2006. Alaska Wood Tides [Newsletter]. Sitka, AK: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Alaska Wood Utilization Research and Development Center. 4 p.

Issue No. 4 of the newsletter of the Wood Utilization Center in Sitka features an article by Allen Brackley on methods for simulating mill production overruns. This issue also provides research updates, an events calendar, and lists of current and upcoming publications.

Keywords: Bioenergy, sawmill overrun, species preferences.

Publications Available Elsewhere

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Aquatic and Riparian Systems

Bull, E.L.; Snook, M.

2005. Rocky Mountain tailed frog, *Ascaphus montanus*. In: Jones, L.L.C.; Leonard, W.P.; Olson, E.H., eds. Amphibians of the Pacific Northwest. Seattle, WA: Seattle Audubon Society. [Page range unknown.]

This species account of the Rocky Mountain tailed frog, *Ascaphus montanus*, provides information on its physical description, distribution, life history, natural history, and habitat.

Keywords: Rocky Mountain tailed frog, Ascaphus montanus*, species account.*

(see La Grande Lab order form.)

Elliot, S.R.; Naiman, R.J.; Bisson, P.A.

2004. Riparian influences on the biophysical characteristics of seston in headwater streams. Northwest Science. 78(2): 150–157.

Suspended particles (seston) in streams are an important source of nutrition for many invertebrates, forming a strong trophic link between plant and animal production. In forested regions the management of riparian corridors may alter allochthonous and autochthonous contributions to streams, ultimately changing the biophysical characteristics of seston. This article examines the effects of riparian condition on the biophysical parameters of seston at summer base-flow from 19 small, headwater streams (first to third order) on the Olympic Peninsula of Washington. Consistent with other studies, seston concentrations and percentage of organic matter were not correlated with any single or combination of riparian characteristics. Nevertheless, there are several riparian effects on the biotic characteristics of seston. Chlorophyll-*a* concentrations correlated significantly with canopy closure, particularly for streams of first and second order. C:N ratios at coniferous sites were significantly higher than those at alder-dominated deciduous sites or at sites with no appreciable riparian cover. Particle diversity showed that diatoms were a significant proportion of total seston diversity, although significantly higher concentrations of diatoms were found in sites lacking canopy cover. Surprisingly, wood particles were not well represented and wood concentration did not vary by riparian cover type or by any other measured parameter. We conclude that riparian condition affects summer food quality, but not the amount of suspended organic matter.

Keywords: Seston, riparian management, watershed condition.

(see Olympia Lab order form.)

Merriam, J.L.; McDowell, W.H.; Tank, J.L.; Wollheim, W.M.; Crenshaw, C.L.; Johnson, S.L.

2002. Characterizing nitrogen dynamics, retention and transport in a tropical rainforest stream using an in situ ^{15}N addition. Freshwater Biology. 47: 143–160.

Using ^{15}N ammonium released into a Puerto Rican stream, after 42 days, we found that only about 20 percent remained or was taken up by biota in the reach and about 60 percent was transported downstream as nitrate after transformation by the microbial community.

Keywords: Aquatic ecosystems, nutrients, nitrogen cycling, foodweb, ammonium uptake.

(see Corvallis Lab order form.)

Atmosphere

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

2004. Columbia River flow and drought since 1750. Journal of the American Water Resources Association. 40(6): 1579–1592.

A network of 32 drought-sensitive tree-ring chronologies is used to reconstruct mean water year flow on the Columbia River at The Dalles, Oregon, since 1750. The reconstruction explains 30 percent of the variability in mean water year (October to September) flow, with a large portion of unexplained variance caused by underestimates of the most severe low-flow events. Residual statistics from the tree-ring reconstruction, as well as an identically specified instrumental reconstruction, exhibit positive trends over time. This finding suggests that the relationship between drought and streamflow has changed over time, supporting

results from hydrologic models, which suggest that changes in land cover over the 20th century have had measurable impacts on runoff production. Low pass filtering the flow record suggests that persistent low flows during the 1840s were probably the most severe of the past 250 years, but that flows during the 1930s were nearly as extreme. The period from 1950 to 1987 is anomalous in the context of this record for having no notable multiyear drought events. A comparison of the flow reconstruction to paleorecords of the Pacific Decadal Oscillation (PDO) and El Niño/ Southern Oscillation (ENSO) support a strong 20th century link between large-scale circulation and streamflow, but suggests that this link is very weak prior to 1900.

Keywords: Drought, climate change, dendrochronology, Columbia River, Pacific decadal oscillation, tree rings paleohydrology.

(see Pacific Wildland Fire Sciences Lab order form.)

Hoadley, J.L.; Westrick, K.; Ferguson, S.A.; Goodrick, S.L.; Bradshaw, L.; Werth, P.

2004. The effect of model resolution in predicting meteorological parameters used in fire danger rating. Journal of Applied Meteorology. 43: 1333–1347.

Previous studies of model performance at varying resolutions have focused on winter storms or isolated convective events. This study focuses on static high-pressure situations that may lead to severe wildfire so as to evaluate the value of increased model resolution for prediction of fire danger. The results are intended to lay the groundwork for using the fifth-generation Pennsylvania State University–National Center for Atmospheric Research Mesoscale Model (MM5) as input to the National Fire Danger Rating System to provide gridded predictions of fire danger indices. Predicted weather parameters were derived from MM5 and evaluated at three resolutions (36, 12, and 4 km). Model output was compared with observations during the 2000 fire season in western Montana and northern Idaho to examine the model's ability to predict fire danger. Little significant improvement was found with increased model resolution when using standard forecast verification techniques. Diurnal bias of modeled temperature and relative humidity resulted in errors larger than the differences between resolutions. Significant timing and magnitude errors at all resolutions could jeopardize accurate prediction of fire danger.

Keywords: Fire weather, MM5, NFDRS, Bitterroot Valley.

(see Pacific Wildland Fire Sciences Lab order form.)

Kittel, T.G.F.; Rosenbloom, N.A.; Royle, J.A.; Daly, C.; Gibson, W.P.; Fisher, H.H.; Thornton, P.; Yates, D.N.; Aulenbach, S.; Kaufman, C.; McKeown, R.; Bachelet, D.; Schimel, D.S.; VEMAP participants.

2004. VEMAP phase 2 bioclimatic database. I. Gridded historical (20th century) climate for modeling ecosystem dynamics across the conterminous USA. Climate Research. 27: 151–170.

Analysis and simulation of biospheric responses to historical forcing require surface climate data that capture those aspects of climate that control ecological processes, including key spatial gradients and modes of temporal variability. We developed a multivariate, gridded historical climate dataset for the conterminous United States as a common input database for the Vegetation/Ecosystem Modeling and Analysis Project (VEMAP), a biogeochemical and dynamic vegetation model intercomparison. The dataset covers the period 1895–1993 on a 0.5° latitude/longitude grid. Climate is represented at both monthly and daily timesteps. Variables are precipitation, minimum and maximum temperature, total incident solar radiation, daylight-period irradiance, vapor pressure, and daylight-period relative humidity.

Keywords: Climate data, climate change, ecosystem dynamics, vegetation dynamics, ecological modeling.

(see Corvallis Lab order form.)

Ecosystem Structure and Function

Manter, D.K.; Kavanagh, K.L.; Rose, C.L.

2005. Growth response of Douglas-fir seedlings to nitrogen fertilization: importance of rubisco activation state and respiration rates. Tree Physiology. 25: 1015–1021.

Growth and needle physiology responses to nitrogen (N) fertilization were investigated in 1-year-old Douglas-fir seedlings. After 1 year of fertilization, total seeding biomass increased with each successive level of N fertilization treatment, except at the highest N treatment. Of the many physiological responses that were analyzed, only photosynthetic capacity, respiration rates, and leaf specific conductance (KL) values significantly differed between N treatments. Photosynthetic capacity (i.e., Vcmax) showed a curvilinear relation with foliar N, reaching an apparent maximum rate in needles when N contents exceeded about 12 milligrams per gram. In vitro measurements of rubisco activity suggest that photosynthetic capacity was best related to activated, not total, rubisco contents. Rubisco activation state declined as foliar N increased, and based on its significant correlation with foliar Mn:Mg ratios, may be related to Mn inactivation of rubisco.

Keywords: Photosynthesis, Vcmax, rubisco, growth, nitrogen fertilization.

(see Corvallis Lab order form.)

Monserud, R.A.; Huang, S.; Yang, Y.

2004. Estimating and mapping biomass of lodgepole pine stands in Alberta. In: Hasenauer, H.; Makela, A., eds. Modeling forest production. Proceedings of the conference. Vienna, Austria: BOKU University of Natural Resources and Applied Life Sciences, Department of Forest and Soil Sciences: 288–302.

We demonstrated methods and results for broad-scale estimation and mapping of forest biomass for the Canadian province of Alberta. Over 1,500 permanent sample plots (PSP) range from stand initiation through 150 years. Biomass components measured for live trees were stem, bark, branches, foliage, and roots; components for standing dead trees excluded foliage. Total tree biomass was dominated by stem biomass, which is an order of magnitude greater than the estimates for bark, branch, and foliage components. Total tree biomass was strongly related to stand stem volume. The heart of the lodgepole pine distribution (primarily the foothills subregions) showed an increase in biomass from the 1980s decade to the 1990s; isolated pockets of lodgepole pine in the boreal northern subregion showed a decline in biomass.

Keywords: Mapping, biomass, lodgepole pine, Alberta.

(see Portland Lab order form.)

Monserud, R.A.; Ledermann, T.; Sterba, H.

2003. Are self-thinning constraints needed in a tree-specific mortality model? Forest Science. 59(6): 848–858.

Can a tree-specific mortality model elicit expected forest stand density dynamics without imposing stand-level constraints such as Reineke's maximum stand density index (SDI_{max}) or the -3/2 power law of self-thinning? We examine this emergent properties question by using the Austrian stand simulator PROGNAUS. This simulator was chosen specifically because it does not use stand density constraints to determine individual tree mortality rates. In addition, it is based on a probability sample of the population that includes the span of the data being used to test the hypothesis. Initial conditions were obtained from 27 permanent research plots that were established in young pure stands of Norway spruce (*Picea abies* L. Karst.) and Scots pine (*Pinus sylvestris* L.) in Austria. A growth period of 250 years was simulated. From the results for Norway spruce, we concluded that stand-level density constraints are not necessary to obtain Reineke's maximum size-density relations. Norway spruce results confirm that the maximum size-density relationship reflects reasonable and stable stand dynamics and conforms to that expected by Reineke's theory. Results from simulation of Scots pine also display reasonable and stable stand dynamics, except that they greatly exceed Reineke's maximum stand density index determined empirically from the literature. This Scots pine result argues for stand-level constraints (such as specifying SDI_{max}) to ensure that the appropriate intercept for the maximum density line is used. Our second test revealed that the estimated maximum stand density index according to Sterba's theory was too high for both species, but that the relative rankings across plots were correct. Thus, we are left with ambiguous results. First, that a density-dependent individual-tree mortality model, developed on an adequate data set, is sufficient for the desired stand-level behavior of Reineke to emerge. Second, that stand-level constraints on SDI_{max} need to be imposed if the underlying mortality modeling database is not adequate.

Keywords: Self-thinning, maximum size-density relationship, mortality model, stand simulation, PROGNAUS, Reineke.

(see Portland Lab order form.)

Warren, J.M.; Meinzer, F.C.; Brooks, J.R.; Domec, J.C.

2005. Vertical stratification of soil water storage and release dynamics in Pacific Northwest coniferous forests. Agricultural and Forest Meteorology. 130: 39–58.

We characterized vertical variation in the seasonal depletion of soil moisture in contrasting coniferous forests. Soil water potential and water content were measured concurrently to 1 m depth to create in situ nonlinear soil water retention curves. We quantified root biomass and soil texture. Water retention curves were dependent on soil texture. Water use from the upper 2 m peaked in July at 1.5 to 2.5 mm/day. Most fine roots were in the upper 20 cm; however, this layer only accounted for 20 percent of peak water depletion, illustrating the contribution of deeper roots. Even so, total water uptake was dependent on soil water potential at 20 cm, indicating that upper fine roots may play a role in regulating water uptake.

Keywords: Hydraulic redistribution, root water uptake, soil water modeling, retention curve, Douglas-fir, ponderosa pine.

(see Corvallis Lab 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 in east-side 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 multiaged with the oldest trees 618 years. Density of live pine in the upper canopy averaged 50 ±3.5 trees per ha; density of large snags averaged 9.0 ±0.97 trees per ha. Ripley's K(d) analysis of spatial point patterns revealed significant departure from randomness in 24 of the 27 plots. Functional data 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, reference conditions, Ripley's K(d).

(see La Grande Lab order form.)

Economics

Donovan, G.H.; Brown, T.C.

2005. An alternative incentive structure for wildfire management on national forest land. Forest Science. 51(5): 387–395.

Wildfire suppression expenditures on national forest land have increased over the last 35 years, exceeding $1 billion in 2000 and 2002. These increases in expenditure have been attributed in part to a century of aggressive wildfire suppression, resulting in a buildup of fuel on the Nation's forests. The current incentive structure faced by Forest Service fire managers is analyzed to determine if it contributes to the excess fuel problem. Two problems are identified. First, fire managers are not allowed to consider the beneficial effects of wildfire when making suppression decisions. Second, they are not required to consider the marginal tradeoff between suppression expenditures and resource damages. Both problems encourage inefficiently high levels of suppression expenditure. An alternative incentive structure is proposed in which a fire manager's suppression budget is dependent on the number of acres burned.

Keywords: Forest Service, incentives, prescribed fire, suppression, wildfire.

(see Portland Lab order form.)

Donovan, G.H.; Hesseln, H.; Garth, J.

2005. Credit availability: a possible barrier to growth for the Alaska forest products industry? Forest Science. 20(3): 177–183.

Historically, the Alaska forest products industry has been driven by pulp production and the export of logs and cants primarily to Japan. Economic stagnation in Japan, the closure of Alaska's two pulp mills, harvest restrictions, and increased competition have severely impacted the industry. To survive, the industry must make significant investments in capital equipment, which requires adequate access to business credit. This article examines whether credit availability is a barrier to the future growth of the industry. Data were collected through a mail survey in spring 2002. Our results show that credit rationing is prevalent throughout the industry. Lack of experience and low collateral are identified as the two main causes. An educational program and loan guarantees are offered as policy prescriptions to help alleviate credit rationing.

Keywords: Alaska forest products industry, credit rationing, economics, policy, environmental management, forest, forest management, forest resources, forestry, forestry research, forestry science, natural resources, natural resource management.

(see Portland Lab order form.)

Donovan, G.H.; Nicholls, D.L.; Roos, J.

2004. Sources of product information used by consumers when purchasing kitchen cabinets. Forest Products Journal. 54(12): 77–79.

Survey data from home shows in Seattle, Washington, and Anchorage, Alaska, were used to determine the sources of product information used by consumers when buying kitchen cabinets. Results show that in-store sales staff are the most common source of product information, and that consumers' favorite wood species, age, and gender can influence the source of product information chosen. It was concluded that wood products manufacturers should consider customer demographics in their marketing efforts.

Keywords: Product information, consumer preferences, marketing, secondary products, kitchen cabinets.

(see Portland Lab order form.)

Skog, K.; Haynes, R.W.

2001. Projections of shifts in U.S. forest products produced, imported, and exported and sources of roundwood and other fiber used to make them. In: Forestry at the great divide: Proceedings, Society of American Foresters 2001 national convention. Denver, CO: Society of American Foresters: 270–283.

U.S. consumption of wood, paper, and paperboard products is projected to increase from 223 to 310 million tons, or 39 percent over the next 50 years (annual rate about half that of the last 33 years). U.S. production currently provides for 78 percent of consumption. This declines to 73 percent by 2050. U.S. roundwood harvest to meet domestic and export demands is projected to increase from 18.2 to 22.4 billion cubic feet, or 23 percent over the next 50 years (annual rate of less than one-third that of the last 44 years). All of the projected increase in roundwood harvest comes from nonsawtimber, most is from nonindustrial land, and most is from the South. To offset current net imports of forest products would require that 14 percent more than current harvest be provided for domestic use by redirecting harvest used for exports or by increasing harvest. This increases to 36 percent of roundwood harvest by 2050.

Keywords: Projections, United States, forest products, roundwood requirements, trade.

(see Portland Lab order form.)

Fire

Costa, F.; Sandberg, D.

2004. Mathematical model of a smoldering log. Combustion and Flame. 139: 227–238.

A mathematical model is developed describing the natural smoldering of logs. It is considered the steady one-dimensional propagation of infinitesimally thin fronts of drying, pyrolysis, and char oxidation in a horizontal semi-infinite log. Expressions for the burn rates, distribution profiles of temperature, and positions of the drying, pyrolysis, and smoldering fronts are obtained in terms of the smolder temperatures. An appropriate smolder transfer number is defined. Heat transfer by conduction, convection, and radiation inside the porous matrix of the log is considered, as are convection and radiation around the log and inside the boundary layer adjacent to the smoldering end. Solutions for the problem without circumferential heat losses and for a single front of drying and pyrolysis are also presented. The effects of variations of several parameters, such as moisture content, log diameter, pyrolysis temperature, heat of char oxidation, heat of pyrolysis, porosity, fuel density, and char density, are evaluated. The theoretical burning rates are in good agreement with available experimental data.

Keywords: Smoldering, log, mathematical model, wood, char.

(see Corvallis Lab order form.)

Donovan, G.H.

2005. Comparison of the costs of Forest Service and contract fire crews in the Pacific Northwest. Western Journal of Applied Forestry. 20(4): 233–239.

Rising wildfire suppression expenditures on public land in the United States have led to increased scrutiny of wildfire management practices. One area that has received particular attention is the Forest Service's increasing reliance on contract fire crews. Because a contract crew rate includes several costs that are not included in the wage costs of a Forest Service crew, it is difficult to determine if this increasing reliance on contract fire crews increases or decreases wildfire suppression costs. The full cost of 33 Forest Service type II fire crews dispatched during the 2003 fire season from five national forests in Oregon and Washington are estimated and compared with the cost of contract crews dispatched in the same region. Results suggest that if sufficient work is available to keep a Forest Service crew productively employed throughout a fire season, then the daily cost of a Forest Service type II crew is lower than the daily cost of a contract crew.

Keywords: Type II fire crew, wildfire suppression, Oregon, Washington, Region 6, Forest Service, contract fire crews, environmental management.

(see Portland Lab order form.)

Donovan, G.H.; Brown, T.C.

2005. Wildfire management in the U.S. Forest Service: a brief history. Natural Hazards Observer. 29(6): 1–3.

Wildfire management in the United States has evolved from a policy of fire exclusion to a recognition of the essential role that fire plays in many forest ecosystems. A brief history of this policy evolution is provided and possible future policy options are explored.

Keywords: wildfire management.

(see Portland Lab order form.)

Harden, J.W.; Neff, J.C.; Sandberg, D.V.; Turetsky, M.R.; Ottmar, R.; Gleixner, G.; Fries, T.L.; Manies, K.L.

2004. Chemistry of burning the forest floor during the FROSTFIRE experimental burn, interior Alaska, 1999. Global Biogeochemical Cycles. 18(3): GB3014, 10.1029/2003GB002194.

Wildfires represent one of the most common disturbances in boreal regions, and have the potential to reduce carbon (C), nitrogen (N), and mercury (Hg) stocks in soils while contributing to atmospheric emissions. Organic soil layers of the forest floor were sampled before and after the FROSTFIRE experimental burn in interior Alaska, and were analyzed for bulk density, major and trace elements, and organic compounds. Concentrations of carbon, nutrients, and several major and trace elements were significantly altered by the burn. Emissions of C, N, and Hg estimated from chemical mass balance equations using iron, aluminum, and silicon as stable constituents, indicated that 500 to 900 g C and up to 4×10^{-4} g Hg/m^2 were lost from the site. Calculations of nitrogen loss range from -4 to +6 g/m^2 but were highly variable (standard deviation 19), with some samples showing increased N concentrations post-burn potentially from canopy ash. Noncombustible major nutrients such as calcium and potassium also were inherited from canopy ash. Thermogravimetry indicates a loss of thermally labile C and increase of lignin-like C in char and ash relative to unburned counterparts. Overall, atmospheric impacts of boreal fires include large emissions of C, N, and Hg that vary greatly as a function of severe fire weather and its access to deep organic layers rich in C, N, and Hg. In terrestrial systems, burning rearranges the vertical distribution of nutrients in fuels and soils, the proximity of nutrients and permafrost to surface biota, and the chemical composition of soil including its nutrient and organic constituents, all of which impact C cycling.

Keywords: Combustion, experimental burn, boreal forest, black spruce, feathermoss, mercury.

(see Corvallis Lab 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 pre-settlement 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 homogeneous 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 social consensus and improbable future consensus concerning desired outcomes for public forest lands, the need for significant financial investment in ecosystem restoration, a lack of integrated planning tools, and mismatches between the existing planning process, congressional appropriations, and complex restoration problems.

Keywords: mixed-conifer forests, fire ecology, fire history, European settlement, historical range of variability.

(see Wenatchee Lab order form.)

McKenzie, D.

2004. La historia del fuego y su relación con el clima. In: Ruiz, L.V.; Blanco, J.L., eds. Incendios forestales in Mexico. [Place of publication unknown]. Universidad Nacional Autonoma de México: 13–28. In Spanish.

To understand the relation of fire to climate, it is necessary to examine both historical patterns and recent instrumental records. This paper reviews two methods for identifying historical fire-climate associations. Fire-history studies demonstrate coherent relations between spatial and temporal patterns of fires and climatic variability, drought, and quasi-periodic patterns. Studies of fire-scarred trees suggest that climate controls fire frequency and area burned at annual to decadal scales. A task for the future is to understand broad-scale spatial patterns to anticipate new fire regimes in diverse ecosystems and their implications for management and conservation.

Keywords: Fire, fire history, climate, fire regimes, charcoal, fire-scarred trees.

(see Pacific Wildland Fire Sciences Lab order form.)

Ottmar, R.D.; Alvarado, E.

2004. Linking vegetation patterns to potential smoke production and fire hazard. In: Murphy, D.D.; Stime, P.A., eds. Proceedings of the Sierra Nevada science symposium. Gen. Tech. Rep. PSW-GTR-193. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station: 93–96.

Assessment of potential smoke production and tradeoffs in air quality and fire hazard relative to managed fire and wildfire during large landscape assessments are essential to inform stakeholders involved in landscape-level decisionmaking. We developed a general method to compare fuel loading, modeled fuel consumption, smoke production, fire behavior, and susceptibility to crown fire in recent historical versus current periods. Individual subwatersheds generally displayed much greater changes than were apparent at the much larger ecological reporting units. Our general landscape pattern analysis indicated increase in the size and continuity of areas with high fuel

loading, fireline intensity, crown fire susceptibility, rate of spread, and flame length, indicating a higher potential on current landscapes for large, continuous wildfires that produce substantial smoke.

Keywords: Sierra Nevada, climate change, landscape change, fire, biodiversity, watersheds, conservation, resource management policy.

(see Pacific Wildland Fire Sciences Lab order form.)

Raymond, C.; Peterson, D.L.

2005. How did prefire treatments affect the Biscuit Fire? Fire Management Today. 65(2): 18–22.

The effects of fuel treatments on wildfire behavior and fire effects were studied on the Biscuit Fire, which burned nearly 500,000 acres in Oregon and northern California in 2002. The fire burned through a previously established experiment, which provided the opportunity to evaluate the effects of thinning and prescribed burning on mortality of overstory Douglas-fir. Damage on the thinned (unburned) plots was likely caused by higher accumulations of fine woody fuel and dense hardwood sprouts. Thinning treatments targeted at reducing overstory damage from fire in this forest type would be more effective if fine fuel and subcanopy hardwoods were treated as well.

Keywords: Fire effects, Biscuit Fire, fuel treatment, forest thinning.

(see Pacific Wildland Fire Sciences Lab order form.)

Smith, J.E.; McKay, D.; Niwa, C.G.; Thies, W.G.; Brenner, G.; Spatafora, J.W.

2004. Short-term effects of seasonal prescribed burning on the ectomycorrhizal fungal community and fine root biomass in ponderosa pine stands in the Blue Mountains of Oregon. Canadian Journal of Forest Research. 34: 2477–2491.

The effects of seasonal prescribed fire on the belowground ectomycorrhizal community and live fine root biomass were investigated before, 1 year after, and 2 years after prescribed underburning. Ectomycorrhizas were sampled from four replications of three treatments (fall burn, spring burn, and a nonburned control) in a randomized complete block design. Samples were separated into two subsamples representing the upper 5 cm and lower 5 cm of a soil core. Molecular tools were used to distinguish 140 fungi directly from the ectomycorrhizas. Before underburning, the number of species and live root biomass were similar among treatment units and between upper and lower core samples. Fall underburning largely removed live root biomass to a depth of 10 cm, and significantly reduced ectomycorrhizal species richness compared to spring underburning and the nonburned control for at least 2 years. Effects of spring underburning were generally similar to the nonburned treatment. The successful reintroduction of fire to the ecosystem to achieve the desired future condition of large-tree pine retention with low fuel loads may require more than burning in a single season.

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

(see Corvallis Lab 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 responses of EMF species richness, live fine root biomass, and duff levels to thinned only, prescribed burned only, thinned and prescribed burned, and control stands were investigated in mixed ponderosa pine and Douglas-fir stands in the Blue Mountains of Oregon. EMF species richness, live root biomass, and duff levels were significantly reduced by prescribed fire treatments compared to the nonburned treatments. EMF 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 historical conditions bear consideration when reintroducing fire.

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

(see Corvallis Lab order form.)

Tollefson, J.E.; Swanson, F.J.; Cissel, J.H.

2004. Fire severity in intermittent stream drainages, western Cascade Range, Oregon. Northwest Science. 78(3): 186–191.

We quantified fire severity patterns within intermittent stream drainages in a recently burned area of the central western Cascade Range, Oregon. Aerial photographs were used to estimate postfire live canopy cover within streamside and upland zones on the southeast- and southwest-facing slopes of 33 watersheds. Fire severity data obtained from aerial photographs were highly correlated with fire severity data obtained in the field in six of the watersheds, confirming that aerial photograph estimates of live canopy cover reflected actual conditions on the ground. Whereas previous studies indicate that fire severity may be lower along perennial streams, the results of this study suggest that fire severity in intense events may be similar between intermittent stream channels and adjacent upland areas. At the landscape scale, differences in fire severity along streams of different sizes may influence the mosaic of postfire vegetation and contribute to overall structural diversity in forests of mountainous landscapes. Fire regime information obtained in this and related studies may be used to guide forest management activities that are modeled after natural disturbance processes and seek to balance commodity production and ecosystem protection.

Keywords: Fire effects, riparian zones, landscape patterns, disturbance.

(see Corvallis Lab order form.)

Forest Management

Deal, R.

2004. The Sustainable Wood Production Initiative. Western Forester. 49(5): 4–6.

To address concerns about sustainable forestry in the region, the Focused Science Delivery Program of the Pacific Northwest Research Station sponsored a 3-year Sustainable Wood Production Initiative. The Pacific Northwest is one of the world's major timber-producing regions, and the ability of this region to produce wood on a sustained yield basis is widely recognized. Concerns relating to the ecological, social, and economic contributions of sustainable forestry, however, will play a major role in future wood production of the region.

Keywords: Sustainability, wood production, timber harvest, land use changes, Pacific Northwest.

(see Portland Lab order form.)

Deal, R.L.; White, S.M.

2005. Sustainable wood production: What are the issues for the Pacific Northwest? In: Deal, R.L.; White, S.M., eds. 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: 1–2.

Researchers involved with the Pacific Northwest Research Station Sustainable Wood Production Initiative have outlined some of the barriers and opportunities for sustainable wood production in the region. Sustainable wood production is defined as the capacity of forests to produce wood, products, and services on a long-term basis and in the context of human activity and use. The collective findings of these papers suggest that, in the future, the region's wood supply will primarily come from private land, and the barriers and opportunities related to sustainable wood production will have more to do with future markets, harvest potential, land use changes, and sustainable forestry options than with traditional sustained yield outputs. Private lands in the Pacific Northwest should be able to sustain recent historical harvest levels over the next 50 years, but regional changes in sawmilling capacity and uncertain market conditions may affect wood production in the region. Public perceptions of forestry, land use changes, and alternative forestry options are also discussed. These papers present preliminary findings and proposals for future work designed to help us understand the key issues related to sustainable wood production.

Keywords: Pacific Northwest, sustainable forestry, wood production, timber harvest, land use changes, economics.

(see Portland Lab order form.)

Fried, J.S.; Christensen, G.

2004. FIA BioSum: a tool for evaluating the financial costs, opportunities and effectiveness of fuel treatments. Western Forester. 49(5): 12–13.

FIA BioSum, a tool developed by the USDA Forest Service Forest Inventory and Analysis (FIA) Program, generates reliable cost estimates, identifies opportunities, and evaluates the effectiveness of fuel treatments in forested landscapes. BioSum is an analytic framework that integrates a suite of widely used computer models with a foundation of attribute-rich, statistically representative sample data for forested landscapes. The framework builds the analysis by using comprehensive forest condition data collected by the FIA Program and geographic information system transportation layers that represent the costs of

moving harvested material to processing sites. The analysis predicts gross revenues for delivered merchantable wood based on current product prices and "dirty chips" derived by chipping whole-tree-harvested small trees and the tops and limbs of larger trees. The dirty chips are suitable as feedstock for wood-fired electrical generating facilities, with an assumed value of $18 per green ton. FIA BioSum also predicts harvest costs, hauling costs, and the amount of wood and dirty chips that could be accumulated at each processing site.

Keywords: Thinning, biomass assessment, fire hazard reduction.

(see Portland Lab order form.)

Forsman, E.D.

2002. Lessons learned in 30 years of research and management on the northern spotted owl. In: Newton, I.; Kavanagh, R.; Olsen, J.; Taylor, I., eds. Ecology and Conservation of Owls. Collingswood, Australia: Csiro Publishing: 277–285.

I describe the profound changes that have taken place in management philosophy on federal lands during the last 30 years. Agency actions, lawsuits, environmental activists, and management plans are discussed.

Keywords: Northern spotted owl, species management.

(see Corvallis Lab order form.)

Halpern, C.B.; McKenzie, D.; Evans, S.A.; Maguire, D.A.

2005. Initial responses of forest understories to varying levels and patterns of green-tree retention. Ecological Applications. 15(1): 175–195.

Timber harvest with "green-tree" retention has been adopted in many temperate and boreal forest ecosystems, reflecting growing appreciation for the ecological values of managed forests. On federal forest lands in the Pacific Northwest, standards and guidelines for green-tree retention have been adopted, but systematic assessments of ecosystem response have not been undertaken. We studied initial (1–2 year) responses of vascular understory communities to green-tree retention at six locations (blocks) in western Oregon and Washington by using a factorial design with retention at contrasting levels (15 percent vs. 40 percent of initial basal area) and spatial patterns (trees dispersed vs. aggregated in 1-ha patches). Direction of compositional change (expressed in ordination space) was similar among treatments within each block, but the magnitude of change was consistently larger at 15 percent than at 40 percent retention; pattern of retention had little effect on compositional change. Despite major changes in vegetation structure, early-seral (ruderal) herbs contributed little to plant abundance and richness in most treatments.

Keywords: Forest understory, green-tree retention, late-seral species, logging slash, Pacific Northwest, plant succession, species diversity, structural retention, timber harvest, understory variability.

(see Pacific Wildland Fire Sciences Lab order form.)

Hanley, D.P; Reutebuch, S.E.

2005. Conifer pruning basics for family forest landowners. Pullman, WA: Washington State University. 8 p.

Conifer pruning is the practice of removing the lower branches from live green conifer trees. Without pruning, the lower branches on conifers, such as Douglas-fir, western larch, and ponderosa pine, may persist for up to 80 years. The primary objective of pruning for wood quality improvement is to produce a small, uniform knotty core throughout the length of the pruned bole so that clear wood volume will be maximized. Achieving this objective may result in increased financial returns to the landowner when the trees are harvested. This publication discusses general pruning rules and pruning operations, timing, and equipment.

Keywords: Conifers, pruning, family forest.

(see Pacific Wildland Fire Sciences Lab order form.)

Haynes, R.W.; Szaro, R.C.; Dykstra, D.P.

2005. Balancing conflicting values: ecosystem solutions in the Pacific Northwest of the United States and Canada. In: Sayer, J.; Maginnis, S., eds. Forests in landscapes: ecosystem approaches to sustainability. London, U.K.; Sterling, VA: Earthscan: 101–114. Chapter 7.

This chapter outlines the evolution of ecological approaches and their contribution to the development of current approaches for sustainable forest management in the Pacific Northwest region of North America. Here the evolution of science-based forest management and growing societal concerns about greater balance among the environmental, economic, and social consequences of land management have led to an increasing reliance on managing at the ecosystem level.

Keywords: Forest management, ecosystem approaches.

(see Portland Lab order form.)

Hemstrom, M.

2004. Science delivery initiative aims to get the word out. Western Forester. 49(5): 16–17.

The role of the Science Delivery Initiative is to extract additional meaning from existing scientific data by combining information from both related and seemingly unrelated sources to reveal trends and relations that might not initially have been apparent. The initiative solves problems by forming partnerships with those who need new knowledge and those who generate the data and information required to develop this knowledge. By understanding the anticipated applications of our outputs, we work to align products to meet clients' needs and provide timely and cost-effective solutions to users' problems.

Keywords: Science delivery, technology transfer.

(see Portland Lab order form.)

Hemstrom, M.

2003. Forests and woodlands of western North America. In: Zabel, C.J.; Anthony, R.G., eds. Mammal community dynamics. Cambridge University Press, Cambridge, United Kingdom: 9–40. Chapter 2.

Forest vegetation, including closed forests and woodlands, covers the majority of upland terrain in western North America. Forests vary tremendously as a function of migration history, climate, geology, and topography at the broad scale. Various estimates exist of the area of forest and woodland vegetation extant in Alaska, British Columbia, Washington, Oregon, California, Arizona, Nevada, Idaho, and those portions of Alberta, Montana, Wyoming, Colorado, and New Mexico west of the eastern front of the Rocky Mountains. A wide variety of vegetation occurs in areas that potentially support forests and woodlands, including forblands, grasslands, shrublands, deciduous woodland, deciduous forest, coniferous woodland, coniferous forest, and various mixtures.

Keywords: Ecoregions, plant community distribution, interior West, forests, woodlands.

(see Portland Lab order form.)

Marshall, D.D.; Turnblom, E.C.

2005. Wood productivity of Pacific Northwest Douglas-fir: estimates from growth-and-yield models. Journal of Forestry. 103(2): 71–72.

Growth and yield research began in the Pacific Northwest in the early 1900s. Since the 1930s, numerous yield tables and growth models have been developed for Douglas-fir. Comparisons of yields for Douglas-fir from three sources that span the 60 years since the first comprehensive yield tables were published demonstrate the potential gains in wood production achieved through management during that period.

Keywords: Douglas-fir, growth and yield, models.

(see Olympia Lab order form.)

Marcot, B.G.

2004. Wood decay in healthy forests: the paradox and the promise. Western Forester. 49(4): 4–5.

Snags are used in many ways by wildlife, but other forms of wood decay elements (WDE) are also valuable. These include down wood, root wads, tree stumps, litter, duff, broomed or diseased branches, hollow trees, and partially dead trees. In addition to providing habitat, they serve as moisture reservoirs, sites for mycorrhizal fungi, soil nutrients, and soil stabilizers and provide nurse logs for seedlings. They can also serve as fuel for fires and harbor insect pests. Various patterns of WDE distribution may serve different purposes and sites, but relatively large woody residue scattered across areas with minimal soil disturbance may be beneficial.

Keywords: Snags, wildlife trees, down wood, coarse woody debris, hollow trees, fuel.

(see Portland Lab order form.)

Marcot, B.G.; Gunderson, G.; Mellen, K.; Ohmann, J.L.

2004. DecAID Advisor: a tool for managing snags, down wood and wood decay in PNW forests. Western Forester. 49(4): 12–13.

DecAID Advisor is a tool recently produced by a team of USDA Forest Service experts in wildlife, forest inventory, ecology, entomology, and fungi for advising on management of snags, down wood, and other wood decay elements in forests of Washington and Oregon. DecAID is a statistical synthesis of information from published literature, databases, and inventories. The tool presents data on wildlife use of wood decay elements and of inventory levels of snags and down wood at various tolerance levels, and also a narrative interpreting the data for consideration in management for wood decay in forests.

Keywords: Snags, wildlife trees, down wood, coarse woody debris, forest inventory, insects and pathogens.

(see Portland Lab order form.)

Monserud, R.A.; Parry, D.L.; Todoroki, C.L.

2004. Recovery from simulated sawn logs with sweep. New Zealand Journal of Forestry Science. 34(2): 190–205.

A sawing simulator, AUTOSAW, was used to examine the effect of increasing sweep on lumber recovery. Sample material consisted of 52 logs from 22 western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) trees in western Oregon. All knots on the 4.9-m logs were measured, mapped, and converted into three-dimensional digital formats. The digital logs were then increasingly bent, in 25.4-mm (1-inch) increments, with the bend occurring at the mid-point for one set of logs and one-fourth-way from the small end of log for another, and sawn into primarily structural grade dimension lumber. On average, conversion decreased at a rate of 10 percent for each 100 mm increase in sweep, equivalent to a decrease of 5 to 7 percent for each 0.1 unit increase in sweep-to-diameter (s/d) ratio. Conversion losses were represented by an exponential decay function. There was no significant difference in conversions between the two sets of logs; however, the rate of loss of Select Structural and No. 1 Common lumber was greater for logs bent at the mid-point when sweep was within 51 to 152 mm (2 to 6 inches). Whereas the rate of loss of lower grades was represented by linear functions, those for higher grades and lumber value per cubic meter of log volume were described by exponential decay functions. A 5-percent loss in value was recorded when s/d equaled 0.09 for logs with diameter less than 200 mm, and 0.07 for larger logs.

Keywords: AUTOSAW, sweep, conversion, grade recovery, value, modeling, Tsuga heterophylla.

(see Portland Lab order form.)

Olson, D.H.; Wessell, S.J.; Sagar, J.P.; Bouska, C.K.; Nordyke, R.; Buchner, E.L.

2005. Managing forest biodiversity: a comprehensive multiscaled approach [Book Review]. Northwestern Naturalist. 86: 41–42.

This 2002 book by Lindenmeyer and Franklin on managing forest biodiversity offers tools for matrix management for species' habitat protection. Conservation principles are reviewed and the limitations of reserves for species protection are summarized.

Keywords: Biodiversity, management, matrix.

(see Corvallis Lab order form.)

Poage, N.J.; Tappeiner, J.C., II.

2005. Tree species and size structure of old-growth Douglas-fir forests in central western Oregon, USA. Forest Ecology and Management. 204: 329–343.

We characterized the structure of 91 old-growth forests dominated by Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) by using data from recent (1985–1991) old-growth timber sales in western Oregon. Both conventional measures, such as basal area and density, and multivariate techniques, such as cluster analysis and ordination, described the coarse-scale structure of old-growth forests in terms of diameter-class distributions by species. Across all sites, Douglas-fir accounted for 79 percent of the basal area of all species, and an average of 17 of the 19 large trees per hectare (>100 centimeters diameter at breast height) were Douglas-fir. Other species constituted only about 20 percent of the basal area at each old-growth site, on average, but largely accounted for the structural variation between sites.

Keywords: Old growth, forest structure, multivariate analysis, Douglas-fir, Pacific Northwest.

(see Portland Lab order form.)

Rapp, V.

2004. Forest Service forecasts forest future. FLC NewsLink. July 2004: 1, 4.

Scientists at the USDA Forest Service Pacific Northwest Research Station developed a visualization system for forests. EnVision creates graphic images of forests, accurately showing forest growth and development, fuel and fire hazard conditions, and alternative forest management activities. EnVision uses data from different sources to produce visual simulations of forest conditions and management alternatives. The program can be used at multiple scales, visualizing areas from less than 1 acre up to an entire landscape. Perhaps the most powerful use of EnVision has been to help break deadlocks in debates about forest management. State, private, and federal foresters across the country use EnVision graphics to explain forest dynamics and management scenarios to people. Technology transfer products help people learn and use EnVision. A variety of tools in the public-domain software package make it easy to use. Online tutorials, online reference materials, training workbooks, brochures, and posters are also available.

Keywords: EnVision, landscape visualization, technology transfer.

(see Station Director's Office order form.)

Todoroki, C.L.; Monserud, R.A.; Parry, D.L.

2005. Predicting internal lumber grade from log surface knots: actual and simulated results. Forest Products Journal. 55(6): 38–47.

Twenty-eight Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) logs were measured, mapped, sawn, and the lumber dried and graded. A corresponding set of digital log models was developed. Further sets that altered knot azimuth (within-measurement error), rake (according to branch distributions), and branch morphology (live or dead) were generated. All log models were processed in the sawing simulator AUTOSAW, and the simulated lumber with knot defects was graded to Western Wood Products Association criteria (American Lumber Standards). The simulations showed that lumber grade is sensitive to knot angle, in particular azimuth, and even more so to morphology. However, other factors not represented in this study have an additional effect on lumber grade. An index, grade average, was developed to quantify log quality in terms of lumber grades. In general, grade average decreased with increasing mean knot diameter. This tendency was stronger for simulated grade yield than actual. Grade average tended to overpredict when there were fewer than 10 surface knots, and to underpredict with smaller-diameter logs. The relation between actual and simulated grade average was quite poor. These results suggest that knowledge of the log surface knots alone is not enough to accurately predict internal lumber grade.

Keywords: Lumber grade, log surface knots, simulation.

(see Portland Lab order form.)

Wurtz, T.L.

2004. Bonanza Creek Experimental Forest/Caribou-Poker Creeks Research Watershed (Alaska). In: Adams, M.B.; Loughry, L.; Plaugher, L., comps. Experimental forests and ranges of the USDA Forest Service. Gen. Tech. Rep. NE-321. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 60–62.

The Bonanza Creek Experimental forest and Caribou–Poker Creeks Research Watershed are the only designated forest research facilities in the true boreal forest zone of the United States. Both are on Alaska state land, with Forest Service and university research activities conducted under a long-term lease and cooperative agreement, respectively. Major findings of the research program are that species have strong effects in boreal forest, and that successional changes in species composition are not a simple consequence of changes in competitive balance but involve species-driven changes in biogeochemistry and the physical environment. In addition, vertebrate herbivores are a powerful force in driving successional change through their effects on plant competitive interactions, and biogeochemistry and succession influences exchanges of methane, carbon dioxide, water, and energy in ways that could affect climate.

Keywords: Bonanza Creek Experimental Forest, Caribou-Poker Creeks Research Watershed, plant succession, biogeochemistry, carbon cycle.

(see Boreal Ecology Cooperative Research Unit order form.)

Wang, G.G.; Huang, S.; Monserud, R.A.; Klos, R.J.

2004. Lodgepole pine site index in relation to synoptic measures of climate, soil moisture and soil nutrients. The Forestry Chronicle: 80(5): 678–686.

Lodgepole pine site index was examined in relation to synoptic measures of topography, soil moisture, and soil nutrients in Alberta. Data came from 214 lodgepole pine-dominated stands sampled as a part of the provincial permanent sample plot program. Spatial location (elevation, latitude, and longitude) and natural subregions (NSRs) were topographic variables that might be considered as synoptic measures of climate. Soil moisture regimes (SMRs) were used as synoptic measures of soil moisture supply. Soil nutrient regimes (SNRs) were used as synoptic measures of soil nutrient supply. Simple measures of geographic location (elevation, latitude, longitude) carried the most predictive power, explaining between 33 and 37 percent of the variation. Site index decreased with elevation, increased with latitude, and had a quadratic relationship with longitude. The Lower Foothills NSR had a higher site index (16.1 m) than the Upper Foothills (14.0 m), Montane (11.8 m), and Subalpine (10.3 m) NSRs. Soil moisture regime variables were not significant. Soil nutrient regime variables were also not important, although one was significant in conjunction with elevation, latitude, and longitude (41 percent explained variation). Standard errors of estimate ranged between 2.64 and 2.94 m for the various synoptic models. Interaction terms between synoptic variables were examined but were found to be nonsignificant.

Keywords: Site index, climate regime, soil moisture regime, soil nutrient regime, Pinus contorta.

(see Portland Lab order form.)

Weiskittel, A.; Maguire, D.; Monserud, R.A.

2005. Influence of fertilization and thinning on Douglas-fir branch number and size. Stand Management Cooperative Quarterly Report. 2005(2): 5–7.

Silvicultural treatments applied in a stand's development can have a large influence on final log values because the number and size of branches formed are directly related to knot frequency and size, particularly for treatments applied at an early age. However, few studies have fully examined branching patterns and dynamics in stands with varying levels of intensive silvicultural treatments such as fertilization. Previous research on branch behavior in stand management cooperative plots either has been concentrated in young stands prior to canopy closure, focused on only live branches, or limited to branches located at breast height. This study seeks to illuminate changes in crown structure and dynamics imposed by intensive plantation management in an attempt to predict its influence on wood quality and growth response physiology.

Keywords: Fertilization, thinning, lumber grade, crown modeling, simulation.

(see Portland Lab order form.)

Genetics

Erickson, V.J.; Mandel, N.L.; Sorensen, F.C.

2004. Landscape patterns of phenotypic variation and population structuring in a selfing grass, *Elymus glaucus* (blue wildrye). Canadian Journal of Botany. 82(12): 1776–1789.

Source-related phenotypic variance was investigated in a common garden study of populations of *Elymus glaucus* Buckley (blue wildrye) from the Blue Mountain ecological province of northeastern Oregon and adjoining Washington. The primary objective of this study was to assess geographic patterns of potentially adaptive differentiation in this self-fertile allotetraploid grass, and use this information to develop a framework for guiding seed movement and preserving adaptive patterns of genetic variation in ongoing restoration work. Progeny of 188 families were grown for 3 years under two moisture treatments and measured for a wide range of traits involving growth, morphology, fecundity, and phenology. Variation among seed sources was analyzed in relation to physiographic and climatic trends, and to various spatial stratifications such as ecoregions, watersheds, edaphic classifications, etc. Principal component (PC) analysis extracted four primary PCs that together accounted for 67 percent of the variance in measured traits. Regression and cluster analyses revealed predominantly ecotypic or stepped-clinal distribution of genetic variation. Three distinct geographic groups of locations accounted for over 84 percent of the variation in PC-1 and PC-2 scores; group differences were best described by longitude and ecoregion. Clinal variation in PC-3 and PC-4 scores was present in the largest geographic group. Four geographic subdivisions were proposed for delimiting *E. glaucus* seed transfer in the Blue Mountains.

Keywords: Elymus glaucus*, morphological variation, local adaptation, seed transfer, seed zones, polyploid.*

(see Corvallis Lab order form.)

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

2005. Effect of growth ring orientation and placement of earlywood and latewood on MOE and MOR of very-small clear Douglas-fir beams. Wood and Fiber Science. 37(2): 207–212.

This study assessed the ring orientation effects in bending properties of very small specimens that were 10 by 150 mm. Modulus of elasticity (MOE) did not differ with growth-ring orientation, and modulus of rupture (MOR) was about 5 percent greater when specimens were loaded on the radial surface rather than the tangential surface. The variation of MOR was greater if the loads were applied to the tangential surface. The variation of MOR and MOE was greater if the loads were applied to the tangential surface as opposed to the radial surface. The choice of growth-ring orientation did not affect the relative ranking of trees with respect to MOR and MOE. Thus, within-tree variation as measured by using very small bending specimens can be minimized with loads applied to the radial face.

Keywords: MOE, MOR, orientation.

(see Corvallis Lab order form.)

Johnson, G.R.

2004. Common families across test series—How many do we need? Forest Genetics. 11(2): 103–112.

In order to compare families that are planted on different sites, many forest tree breeding programs include common families in their different series of trials. Computer simulation was used to examine how many common families were needed in each series of progeny trials to reliably compare families across series. Average gain and its associated variation stabilized after the addition of four to six common families.

Keywords: Progeny testing, common seed lots, connectedness.

(see Corvallis Lab order form.)

Johnson, G.R.; Cartwright, C.

2005. Genotype x shade effects for western hemlock. Canadian Journal of Forest Research. 35: 1496–1501.

Western hemlock families were grown under different levels of shade for 2 or 3 years at two sites to determine whether families performed differently relative to one another in the different shade environments. Differences were found for both shade levels and families, but practically no family-by-shade interaction was found. Results suggest that families selected in full-sun environments (clearcuts or farm fields) will still be well-suited for use in silvicultural systems where seedlings are planted in understory conditions.

Keywords: Progeny testing, genotype-environment interaction.

(see Corvallis Lab order form.)

Johnson, G.R.; Sorensen, F.C.; St. Clair, J.B.; Cronn, R.C.

2004. Pacific Northwest forest tree seed zones: A template for native plants? Nativeplants. 2004(Fall): 131–140.

Seed movement guidelines for restoration activities are lacking for most native grasses, forbs, and shrubs. The forestry community has decades of experience in establishing seed zones and seed movement guidelines that may be of value to restoration managers. We review the history of seed zone development in forest trees, with emphasis on the Pacific Northwest, and make some suggestions concerning seed transfer guidelines for other native plants.

Keywords: Seed movement, genetic variation, adaptation.

(see Corvallis Lab order form.)

Maguire, C.C.; Adams, W.T.; Kelsey, R.G.

2005. Additional studies using CFIRP treatments: Douglas-fir genetics and ambrosia beetle log colonization. In: Maguire, C.C.; Chambers, C.L., eds. College of Forestry Integrated Research Project: ecological and socioeconomic responses to alternative silvicultural treatments. Res. Contrib. 46. Corvallis, OR: Oregon State University, Forest Research Laboratory: 104–121. Chapter 7.

The primary biological objectives of the Oregon State University College of Forestry Integrated Research Project (CFIRP) were to assess impacts of diverse silvicultural treatments on vegetation structure and growth and on the abundance and diversity of wildlife. Stand conditions resulting from implementation of the CFIRP research design provided for the overlay of additional research projects that used subsets of the CFIRP units. This chapter describes studies focused on genetic ramifications of the CFIRP silvicultural treatments and chemical and biological interactions between ambrosia beetles (family Scolytidae) and aging Douglas-fir logs.

Keywords: Allozymes, genetic diversity, gene dispersal, seed dispersal, ethanol, ambrosia beetles, aging logs, anaerobic respiration.

(see Corvallis Lab order form.)

Temel, F.; Johnson, G.R.; Adams, W.T.

2005. Early genetic testing of coastal Douglas-fir for Swiss needle cast tolerance. Canadian Journal of Forest Research. 35: 521–529.

The possibility of early testing of coastal Douglas-fir (*Pseudotsuga menziesii* var. *menziesii* (Mirb.) Franco) for Swiss needle cast (SNC) (caused by *Phaeocryptopus gaeumannii* (Rhode) Petrak) tolerance was investigated by using 55 Douglas-fir families from western Oregon. Type-B genetic correlations between SNC symptom traits in 2-year-old seedlings with 10- and 12-year-old trees ranged from zero to 0.83. Genetic gain estimates indicated that family selection for SNC tolerance (e.g., greener needles or greater foliage retention) at the seedling stage can be very effective in increasing tolerance in older trees.

Keywords: Swiss needle cast, resistance, tolerance, breeding, Phaeocryptopus gaeumannii.

(see Corvallis Lab order form.)

Temel, F.; Johnson, G.R.; Stone, J.K.

2004. The relationship between Swiss needle cast symptom severity and level of (*Phaeocryptopus gaeumannii* colonization in coastal Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*). Forest Pathology. 34: 383–394.

One hundred eight Douglas-fir trees from six families were studied to investigate whether trees (families) exhibiting less severe Swiss needle cast (SNC) symptoms were more resistant (had less fungal colonization) or more tolerant (maintained healthy foliage under similar infection levels). The amount of *Phaeocryptopus gaeumannii* DNA in foliage did not differ significantly among three severity groups; therefore, differences in symptom severity were attributed to tolerance, not resistance. Average needle retention over the last four growing seasons was the only symptom correlated with the quantity of *P. gaeumannii*. Average needle retention decreased with amount of pathogen DNA in the mild disease symptom families, but was reversed in the severe symptom families.

Keywords: Swiss needle cast, resistance, tolerance, Phaeocryptopus gaeumannii.

(see Corvallis Lab order form.)

Withrow-Robinson, B.; Johnson, R.

2004. Selecting native plant materials for restoration projects: insuring local adaptation and maintaining genetic diversity. Corvallis, OR: Oregon State University Extension Service. 12 p.

Practical guidelines are given for seed movement in using locally adapted planting materials in restoration activities. Tree seed movement guidelines are discussed and the basic principles are encouraged for all plants. Collection guidelines are discussed and the basic principles are encouraged for all plants. Collection guidelines for appropriate numbers of parent plants to provide sufficient genetic diversity area also discussed.

Keywords: Local adaptation, seed zones, genetic diversity.

(see Corvallis Lab order form.).

Ye, T.Z.; Jayawickrama, J.S.; Johnson, G.R.

2005. Efficiency of using first-generation information during second-generation selection: results of computer simulation. In: Bailian, L.; McKeand, S., eds. Forest genetics and tree breeding in the age of geonomics: progress and future. Proceedings, IUFRO joint conference, Division 2: 214–217. http://www.ncsu.edu/feop/iufro_genetics2004/proceedings.pdf. (April 2006).

Computer simulation was used to examine the increased efficiency of progeny test data from a previous generation in addition to data from the current generation. Results showed that integration of data from both generations increased the accuracy of ranking individuals for forward selection in most instances, especially with low heritability, high dominance/additive genetic variance ratio and high genotype by environment interaction effect in the second generation, and high heritabilities in the first generation. However, the changes in rank correlation were usually less than 10 percent.

Keywords: Best linear unbiased prediction, breeding values, breeding efficiency, progeny tests, analyses.

(see Corvallis Lab order form.)

Geomorphology and Hydrology

Grant, G.E.; Lewis, S.L.; Kast, P.

2002. Sediment mass balance for Cougar Reservoir sediment releases. Corvallis, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Report prepared for Portland District Office, U.S. Army Corps of Engineers. 9 p.

Retrofitting Cougar Dam on the South Fork McKenzie River, Oregon, with a temperature control structure required drawdown of Cougar Reservoir over several months during spring 2002. The drawdown initiated incision of the reservoir delta that had developed in the 40 years since Cougar Dam was constructed. Remobilization of deltaic sediments resulted in a sustained release of turbid water from Cougar Reservoir from April to July 2002, prompting concern that sediment contained within the turbidity plume might intrude into river gravels, with potentially negative effects for fish and other aquatic biota.

Keywords: Cougar Dam, McKenzie River, salmon spawning, sediment.

(see Corvallis Lab order form.).

Lancaster, S.T.; Hayes, S.K.; Grant, G.E.

2003. Effects of wood on debris flow runout in small mountain watersheds. Water Resources Research. 39(6): ESG4-1–ESG4-21.

Debris flows have typically been viewed as two-phase mixtures of sediment and water, but in forested mountain landscapes, wood can represent a sizable fraction of total flow volume. The effects of this third phase on flow behavior are poorly understood. To evaluate whether wood can have a significant effect on debris flow runout in small mountainous watersheds, we used a landscape-scale model combining empirical, stochastic, and physical submodels of storms, fires, forest growth, tree fall, wood decay, soil production and diffusion, landslide initiation, debris flow runout, and fluvial sediment transport.

Keywords: Hillslope-stream interactions, debris slides and flows, landscape modeling, woody debris.

(see Corvallis Lab order form.)

Woodsmith, R.D.; Vache, K.B.; McDonnell, J.J.; Helvey, J.D.

2004. Entiat Experimental Forest: catchment-scale runoff data before and after a 1970 wildfire. Water Resources Research. 40: (W11701). 5 p.

Effects of wildfire on water quantity and quality are issues of major concern. Much has been learned from previous research, although site-specific data from both before and after wildfire are rare. The Entiat Experimental Forest (EEF) in central Washington state provides such a hydrologic record. In August 1970, a severe wildfire occurred following 10 years of stream gauging as part of a controlled land use experiment. A modified data collection program continued through 1977. Existing data from the EEF are available on the Internet. Data housed at the site include downloadable daily discharge, air temperature, humidity, precipitation, water temperature, 10-m DEMs, watershed boundaries, and gauge locations. These data are an archive for assessment of hydrologic response and model formulation, calibration, and testing. The EEF is being reinstrumented to investigate recovery from effects of the 1970 fire on water quantity, quality, and flow regime.

Keywords: *Aquatic habitat, runoff and streamflow, semiarid hydrology, surface water quality, wildfire effects.*

(see Wenatchee Lab order form.)

Harvesting

Dykstra, D.P.

2004. RILSIM 2.0 user's guide: financial analysis software for reduced-impact logging. Portland, OR: Blue Ox Forestry. 120 p.

This publication is a user guide to accompany the RILSIM 2.0 financial-analysis software. The user guide provides an overview of reduced-impact logging, explains what is new in version 2.0 of the software, provides instructions on how to install the software, and gives detailed information on how the software may be used. The objective of the RILSIM software is to encourage timber operators in developing countries to adopt reduced-impact logging techniques by helping them do a better job of planning their operations so that they fully understand the costs and benefits of better planning and control.

Keywords: Harvesting, financial analysis.

(see Portland Lab order form.)

Dykstra, D.P.

2004. RILSIM version 2.0: financial analysis software for reduced-impact logging. [CD-ROM]. Portland, OR: Blue Ox Forestry.

This software package is designed to facilitate harvest planning in tropical forests in order to encourage adoption of reduced-impact logging techniques. Users enter detailed information on the personnel and equipment that will be used for a harvesting operation, including the expected costs and anticipated production rates, and then define a series of "activities" that make up the operation. The software then calculates a timeline of activities and discounts the expected costs and revenues to a time point specified by the user. In this way, users can evaluate the potential costs and revenues from reduced-impact logging and compare them with costs and revenues from their current operations.

Keywords: Harvesting, financial analysis.

(see Portland Lab order form.)

Insects

McIver, J.D.; Stonedahl, G.

2004. Myrmecomorphy. In: Capinera, J.L., ed. Encyclopedia of entomology. Dordrecht, The Netherlands: Kluwer Academic Publishers: 1504–1508. Vol. 2.

Myrmecomorphy, or the morphological and behavioral mimicry of ants, has evolved at least 70 times in the arthropods. It has been identified in 9 families of spiders and 45 families of insects, representing 11 orders. Over 200 spider and insect genera are known to contain myrmecomorphs, and the number of species involved is in the thousands worldwide. Mimicry allows species to avoid predation (by resembling an unacceptable prey), allows species to live with ants undetected, or live close enough to ants to access their resources for food.

Keywords: Ant mimicry, defensive adaptations, spiders, plant bugs.

(see La Grande Lab order form.)

Invasive Plants and Animals

Gray, A.N.

2005. Nonnative plants in the inventory of western Oregon forests. In: McRoberts, R.E.; Reams, G.A.; Van Deusen, P.C.; McWilliams, W.H.; Cieszewski, C.J., eds. Proceedings, 4th annual forest inventory and analysis symposium. Gen. Tech. Rep. NC-252. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station: 11–16. http://ncrs.fs.fed.us/pubs/4380. [Date accessed unknown].

Vegetation data from the 1997 inventory of nonfederal forests in western Oregon were examined to assess the abundance of invasive nonnative plants detected by the inventory. Inventoried plants were the more common, identifiable species; composites and graminoids were underrepresented. Nonnative species were found on 1,040,000 ha (35 percent) of the nonfederal forest land in western Oregon. Abundance of most nonnatives was greater on lands that had been recently clearcut or thinned and was more closely related to stand density than climate. Most species were shade-intolerant, but shade-tolerant ivy and holly have the potential to greatly increase in abundance.

Keywords: Nonnative plants, western Oregon forest inventory .

(see Corvallis Lab order form.)

Harrington, T.B.; Miller, J.H.

2005. Effects of application rate, timing, and formulation of glyphosate and triclopyr on control of Chinese privet (*Ligustrum sinense*). Weed Technology. 19(1): 47–54.

Chinese privet (*Ligustrum sinense*) is a highly invasive shrub in the southeastern United States. Various rates, timings, and formulations of glyphosate and triclopyr herbicides were tested for controlling privet near Athens, Georgia. Response-surface models explained 59 to 75 percent of the variation in control of privet abundance and height. Percentage of control of cover, stem density, and height averaged 44, 42, and 35 points higher after glyphosate than after triclopyr treatments. Herbicide rate and formulation (liquid versus dry glyphosate products and water-soluble versus oil-soluble triclopyr products) did not significantly influence privet responses. Privet control was greatest in October and December treatments and least in June and August.

Keywords: Invasive seeds, bottomland hardwoods, crown cover, response surface analysis.

(see Olympia Lab order form.)

Invertebrates

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

2005. Longer-term effects of selective thinning on microarthropod communities in a late-successional coniferous forest. Environmental Entomology. 34(3): 646–655.

Microarthropod abundance and community structure within late-successional coniferous forests thinned 16 to 41 years earlier were compared to adjacent unthinned stands. Within the forest floor layer, total abundances of oribatid mites and mesostigmatid mites were reduced in thinned stands compared to unthinned stands. No differences were found for total Collembola in the forest floor or for any mite suborder within the top 5 centimeters of mineral soil. Family-level examination of mesostigmatid and prostigmatid mites revealed significant differences between stand types for both horizons. At the species level, thinning influenced numerous oribatid mites and Collembola. Multivariate analysis of variance and ordination indicated that forest thinning had little influence on the composition of oribatid mite and Collembola communities within either the forest floor or soil.

Keywords: Microarthropods, Acari, Collembola, forest thinning, late-successional forests.

(see Corvallis Lab order form.)

Landscape Ecology

Hemstrom, M.; Ager, A.A.; Vavra, M.; Wales, B.C.; Wisdom, M.J.

2004. A state and transition approach for integrating landscape models. In: Hayes, J.L.; Ager, A.A.; Barbour, R.J., tech. eds. Methods for integrated modeling of landscape change: Interior Northwest Landscape Analysis System. Gen. Tech. Rep. PNW-GTR-610. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 17–32. Chapter 2.

We will use state and transition modeling (STM) to project landscape dynamics in a portion of the Upper Grande Ronde subbasin, northeastern Oregon. The Interior Northwest Landscape Analysis System effort will develop both process-based models and STM to represent vegetation, disturbance, and management interactions across large landscapes. State and transition models are useful for integrating disturbances, management activities, and vegetation growth and development across large, variable landscapes, but are not currently useful for finding optimal solutions to meet landscape management objectives. Process-based models are useful for detailed modeling of vegetation changes and optimization but can be difficult to develop

and parameterize across many disturbances and highly variable vegetation conditions. We discuss advantages and limitations of STM in the context of integrated scientific analysis and land management planning at subbasin and broader scales. We provide an example of how such models might be used to project the integrated effects of vegetation management, fire, invasive plants, ungulate herbivory, and other disturbances on vegetation across a large landscape in northeastern Oregon. We suggest enhancements of existing STMs that will use process-based models to calibrate states and transitions.

Keywords: Landscape simulation, northeastern Oregon, landscape ecology.

(see Portland Lab order form.)

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

2005. Examining the recent climate through the lens of ecology: inferences from temporal pattern analysis. Ecological Applications. 15(2): 440–457.

Ecological theory asserts that the climate of a region exerts top-down controls on regional ecosystem patterns and processes. To provide empirical evidence of climatic controls, it would be helpful to define climatic regions that minimized variance in key climate attributes, within climatic regions—to define the periods and features of climatic regimes, then look for concordance between regional climate and ecosystem patterns or processes. Before we evaluated the recent climate of the northwestern U.S., we established a Northwest climatic region by clustering time series of the Palmer Drought Severity Index (PDSI) for the period of 1675–1978 for the Western United States. The background climatic regime and anomalies of the recent Northwestern U.S. climate were then identified through temporal pattern analysis involving application of correspondence analysis to the same PDSI time series. Our analysis distinguished 10 distinct periods and four unique types of regimes (climatic signals). Five of the 10 periods (79 percent of the record) were marked by mild and equitable moisture conditions (Pacific regime), the "background" climate of the Northwest. The remaining periods were anomalies. Two periods displayed a high-variance, mixed signal marked by switching between severe to extreme annual to interannual dry and wet episodes (High/Mixed regime). Two more periods displayed a moderate-variance, mixed signal marked by switching between moderate to severe annual to interannual dry and wet episodes (Moderate/Mixed regime). Only one period was unidirectional and relatively low variance, marked by persistent yet mild to moderate drought (Low/Dry regime). Our method distinguished decadal- to interdecadal-scale regimes, defined regime periods, and detected both mixed and unidirectional anomalies from the background climate. The ability to distinguish the variance, direction, and period of sequential climatic regimes provides a plausible basis for examining the role of past climate within terrestrial ecosystems of the Northwest. Linking historical climatic regimes to particular ecosystem patterns and processes also aids in the prediction of future ecosystem changes by providing evidence of the kinds of interactions that may be anticipated.

Keywords: ARIMA analysis, climate, climatic regime, climatic signal, correspondence analysis, fire regime, mixed and unidirectional anomalies, Northwestern United States, temporal pattern analysis.

(see Wenatchee order form.)

Hessburg, P.F.; Salter, R.B.; James, K.M.

2005. Evidence for mixed severity fires in pre-management era dry forests of the inland Northwest, USA. In: Agee, J.K.; van Wagtendonk, J.W., eds. Online proceedings from the symposium on mixed severity fire regimes: ecology and management. http://www.emmps.wsu.edu/fire/secondary/SYMPOSIUM.html.

Three ecological subregions of dry forest in eastern Oregon and Washington Cascades had mixed-severity fires more commonly than expected. One reason may be that estimates of historical fire severity have been based on point rather than patch or area observations. There is a bias in point-based observations to allocate samples to topographic and physiographic settings that have a history of low-impact fires. Mixed- and high-severity fires are generally inferred from the amount of mortality in the sample in a given year. Patch-scale observations account for low-, medium-, and high-severity fires directly. The difference in sampling bias and scale of observation may partially explain the tendency toward overestimating the extent of low-severity fires in general, and within dry forests in particular.

Keywords: Fire ecology, fire history, fire severity, dry forests, equilibrium dynamics, point sampling, area sampling.

(see Wenatchee Lab order form.)

Kennedy, R.S.H.; Spies, T.A.

2005. Dynamics of hardwood patches in a conifer matrix: 54 years of change in a forested landscape in coastal Oregon, USA. Biological Conservation. 122: 363–374.

Changes to minor patch types in forested landscapes may have large consequences for forest biodiversity. The effects of forest management and environment on these secondary patch types are often poorly understood. For example, do early-to-mid-successional minor patch types become more expansive as late-successional forest types are fragmented, or do they also become more fragmented in managed landscapes? We evaluated the dynamics of early-to-mid-successional hardwood patches in a conifer-dominated

landscape in relation to environment and land ownership in the central Coast Range of Oregon, USA, from the time of early logging to the present day using scanned and georeferenced aerial photographs and a geographic information system. Hardwood patches declined in size, number, total area, and within-patch cover-type heterogeneity, and became more irregular in shape. Patch turnover and fragmentation were high, with most patches present at the historical date disappearing by the present. Land ownership was important to hardwood patch dynamics; hardwoods declined on lands managed by the USDA Forest Service, increased on nonindustrial private lands, and were at similar levels at both dates on private forest industry lands. Patch locations became more restricted to near-stream, lower-elevation areas where hardwoods are competitive. The relatively extensive distribution of hardwood patches at the historical date probably resulted from earlier fire, selective logging, and grazing. In recent decades, forest management that includes fire suppression and intensive management. and ecological constraints, have resulted in a landscape in which early-to-mid-successional hardwood patches have been reduced in size, fragmented, and restricted to particular locales.

Keywords: Patch population dynamics, red alder, Alnus rubra*, historical landscapes, Oregon Coast Range, forest management.*

(see Corvallis Lab order form.)

Kennedy, R.S.H.; Spies, T.

2004. Forest cover changes in the Oregon Coast Range from 1939 to 1993. Forest Ecology and Management. 200: 129–147.

Forest land cover change in the central Coast Range of Oregon from 1939 to 1993 was common; landscape transitional pathways were distributed among many types, and no single transitional pathway was dominant. Larger coniferous forest types declined by 63 percent, from 36 to 13 percent of the landscape. Younger conifer stands showed the greatest expansion, increasing from 21 to 44 percent of the landscape. The importance of ownership as a factor affecting the type of vegetation cover present has increased greatly from historical times to the present day, whereas the relative influence of environment has lessened considerably.

Keywords: Forest dynamics, land cover change, old growth, historical landscapes, Oregon Coast Range, forest management.

(see Corvallis Lab order form.)

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 km^2 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

Cho, S.-H.; Wu, J.; Alig, R.

2005. Land development under regulation: comparison between the east and west sides of the Cascade Range in Oregon, Washington, and California. Review of Urban and Regional Development Studies. 17(1): 1–17.

We compare how socioeconomic factors, physical landscape, profit uncertainty, and local land use policies have affected land development on the east and west sides of the Cascade Range in Oregon, Washington, and California. It is found that the west side has more actively planned and regulated land use than the east side. Consequently, the more intense land use regulations on the west side have reduced more land development than on the east side. Risks associated with alternative land uses as well as profits were important in land development decisions of both sides.

Keywords: Land use, urban and regional development, alternative land use.

(see Corvallis Lab order form.)

Kline, J.D.

2003. Characterizing land use change in multidisciplinary landscape-level analyses. Agricultural and Resource Economics Review. 32(1): 103–115.

Economists increasingly face opportunities to collaborate with ecologists on landscape-level analyses of socioeconomic and ecological processes. This often calls for developing empirical models to project land use change as input into ecological models. Providing ecologists with the land use information they desire can present many challenges regarding data, modeling, and econometrics. This paper provides an overview of the relatively recent adaptation of economics-based land use modeling methods toward greater spatial specificity desired in integrated research with ecologists. Practical issues presented by data, modeling, and econometrics are highlighted, followed by an example based on a multidisciplinary landscape-level analysis in Oregon's Coast Range mountains.

Keywords: Spatial land use, landscape models, forest-urban interface, ecological economics.

(see Corvallis Lab order form.)

Kline, J.D.

2005. Our national concern about forestland development. TimberWest. 2005(May/June): 50.

As the U.S. population grows, many forestry professionals are thinking more about forest land development. Although forest policy debates often focus on whether to manage public forest lands for timber, ecological, or recreation purposes, almost three-fifths of the Nation's forests are privately owned. Although public forest lands will be with us for the foreseeable future, private forest lands have the potential to be lost to developed uses. Nationally, almost 1 million acres of forest land were lost to development annually from 1992 to 1997. Another 26 million acres could be lost by 2030. Should we be concerned?

Keywords: Land use change, development, forest-land social values, wildland-urban interface.

(see Corvallis Lab order form.)

Kline, J.D.; Alig, R.J.

2005. Forestland development and private forestry with examples from Oregon (USA). Forest Policy and Economics. 7: 709–720.

Growing human populations inevitably lead to the conversion of some forest lands to more intensive developed uses. Resulting landscape changes can influence long-term timber production possibilities and affect the quantity and quality of wildlife habitat, outdoor recreation, and open spaces that contribute to people's quality of life. Anticipating the potential effects of forest-land development can be important to formulating management and policy strategies that balance the multiple demands of society regarding land for development, resource production, and environmental protection. Previous research conducted in western Oregon has (1) examined factors related to historical forest-land development and projected future development and (2) examined effects of forest-land development on private forest management and investment activities. We briefly review these previous research efforts and combine their resulting data and models to examine what projected forest-land development might mean for private forestry in western Oregon over the next 50 years. The analysis draws together a broad body of recent research focused on western Oregon to provide a context for discussing forest-land development issues and their management and policy implications for the United States and abroad.

Keywords: Forest-land development, private forestry, land use, wildland-urban interface.

(see Corvallis Lab order form.)

Kline, J.D.; Alig, R.J.; Garber-Yonts, B.

2004. Forestland social values and open space preservation. Journal of Forestry. 102(8): 39–45.

Concerns have grown about the loss of forest land to development, leading to both public and private efforts to preserve forest land as open space. These lands comprise social values—ecological, scenic, recreation, and resource protection values—not typically reflected in market prices for land. When these values are present, it is up to public and private agencies to provide them in sufficient quantity. We discuss nonmarket social values in the context of forest-land market values to explain the economic rationale for public and private efforts to protect forest land as open space.

Keywords: Forest land, nonmarket values, forest amenities, land use.

(see Corvallis Lab order form.)

Kline, J.D.

2005. Forest and farmland conservation effects of Oregon's (USA) land-use planning program. Environmental Management. 35(4): 368–380.

Oregon's land use planning program is often cited as an exemplary approach to forest and farmland conservation, but analyses of its effectiveness are limited. I examine Oregon's land use planning program by using detailed spatial data describing building densities in western Oregon. An empirical model describes changes in building densities on forest and agricultural lands from 1974 to 1994 as a function of land's commuting distance to cities of various sizes, topographic characteristics, and zoning adopted under Oregon's land use planning program. The effectiveness of the planning program is evaluated based on the statistical significance of zoning variables and by computing estimated areas of forest and agricultural lands falling into undeveloped, low-density developed, and developed building density categories with and without land use zoning in effect. Results suggest that Oregon's land use planning program has provided a measurable degree of protection to forest and agricultural lands.

Keywords: Wildland-urban interface, spatial land use and landscape models, urban sprawl, Oregon land use law.

(see Corvallis Lab order form.)

Kuzminykh, J.V.; Alig, R.D.; Krankina, O.N.; Yost, A.S.

2005. Social-economic aspect of potential carbon flow to forest ecosystems. Forest Journal. 1-2: 130–135. In Russian.

The potential carbon stock in forest ecosystems of the Leningrad and western Oregon regions were analyzed to investigate effects of forest harvesting. To determine the extent of carbon sequestration, physical, ecological, economic, and social issues need to be considered, including different forest management objectives across major forest ownership groups. Even though projected futures reflect a broad range of policy options, larger differences result from the starting conditions determined by ownership and regional environmental conditions and past changes in forest management. An exception is a major change of management objective, such as the end of all timber harvest on national forests in the Pacific Northwest or complete elimination of mature timber in the St. Petersburg region, which could lead to substantial change in carbon stores over the next 50 years.

Keywords: Forest resource scenarios, socioeconomic drivers, climate change.

(see Corvallis Lab order form.)

Lettman, G.J.; Azuma, D.L.; Birch, K.R.; Herstrom, A.A.;

2004. Land use change on non-federal land in eastern Oregon, 1975–2001. Salem, OR: Oregon Department of Forestry. 42 p.

Forestry, grazing, and agriculture have traditionally been important parts of eastern Oregon's economy. It is therefore important to monitor and maintain the land base that supports those industries. As of 2001, 97 percent of the nonfederal land in eastern Oregon remained in forest, range, and agricultural uses. Between 1975 and 2001, land use shifted from range, agriculture, or wildland forests to low-density residential or urban; rangeland continues to be converted to more developed uses at a higher rate than forest or farm land. From 1975 to 2001, wildland forest decreased by 1 percent, and wildland range decreased by 2 percent. The amount of land used for intensive agriculture increased by 1 percent. Annualized rates of change in conversion of forest, range, and farm lands to residential and urban uses declined from the 1975–1986 period to the 1986–2001 period. Comprehensive land use planning in the latter period may have slowed the conversion, as the slowdown in the second period coincided with full implementation of land use plans and with increases in the rates at which population and personal income grew.

Keywords: Land use planning, forest resources, development, land use change, eastern Oregon.

(see Portland Lab order form.)

Rowland, M.M.

2004. On the road: workable solutions to the problems of roads and highways [Book review]. The Prairie Naturalist. 36(3): 198–199.

Fourteen authors, ranging from transportation specialists to ecologists, collaborated to write *Road Ecology: Science and Solutions* (Washington, DC: Island Press. 2003. 481 p.) The authors state that road ecology "uses the sciences of ecology and landscape ecology to explore, understand, and address the interactions of roads and vehicles with their surrounding environment." The book's intended primary audience is people associated with transportation, including engineers, environmental specialists, and social scientists. The book is organized into four major parts: (1) roads, vehicles, and ecology; (2) vegetation and wildlife; (3) water, chemicals, and atmosphere; and (4) road systems. The subject index is detailed, with many searchable subtopics, e.g., "road crossing effects." The book is highly recommended for anyone engaged in environmentally responsible transportation planning, as well as those planning research on road effects.

Keywords: Highways, land use planning, road ecology, road effects, transportation planning.

(see La Grande Lab order form.)

Mount St. Helens

Bisson, P.A; Crisafulli, C.M.; Fransen, B.R.; Lucas, R.E.; Hawkins, C.P.

2005. Responses of fish to the 1980 eruption of Mount St. Helens. In: Dale, V.H.; Swanson, F.J.; Crisafulli, C.M., eds. Ecological responses to the 1980 eruption of Mount St. Helens. New York: Springer Science and Business Media: 163–181. Chapter 12.

There are several patterns in the ecological processes that have influenced fish at Mount St. Helens after the 1980 eruptions. First, the rebound of fish populations in the food-rich conditions demonstrated that even cold-water species such as salmon and trout could prosper in relatively poor habitats if prey were abundant. Second, the rate of return to pre-eruption conditions has been strongly influenced by location relative to the volcanic explosion. Finally, management activities have altered the recovery of native fish communities in streams and lakes by changing riparian vegetation, sediment and dynamics, and through the introduction of nonnative species. Mount St. Helens has created an unprecedented opportunity to compare long-term changes in fish in streams.

Keywords: Mount St. Helens, salmon, trout, ecosystem recovery.

(see Olympia Lab order form.)

Dale, C.H.; Crisafulli, C.M.; Swanson, F.J.

2005. 25 years of ecological change at Mount St. Helens. Science. 308: 961–962.

The future of Mount St. Helens will be one of continuing change. The pace of ecological change will be determined by complex processes of ecological succession influenced by landscape position, topography, climate, and further biotic, human and geophysical forces. The current volcanic activity at Mount St. Helens attests to its dynamic character. Even so, many biotic, landform, and soil legacies of the 1980 eruption will influence ecological processes for centuries to come.

Keywords: Mount St. Helens; ecological change.

(see Olympia Lab order form.)

Dale, V.; Swanson, F.; Crisafulli, C.M., eds.

2005. Ecological responses to the 1980 eruption of Mount St. Helens. New York: Springer Science and Business Media. 348 p.

The May 18, 1980, eruption of Mount St. Helens in Washington state, USA, altered forests, meadows, lakes, and rivers and created new environments. Chapters in this book summarize the first 20 plus years of ecological responses to the eruption, including fish in lakes and rivers; vegetation response, small mammal, amphibian, and invertebrate community development; and change in landforms and stream flow.

Keywords: Mount St. Helens, disturbance, landscape ecology, geomorphology, succession.

(see Corvallis Lab order form.)

Rapp, V.

2005. Earth lab: watching Mount St. Helens recover. Odyssey. April 2005: 26–29.

When Mount St. Helens erupted on May 18, 1980, timing and chance played large roles in survival. Biological legacies both alive and dead were far more critical for recovery than scientists had realized. Wind-carried insect "rain" was more significant than ever suspected before. Refuges were vital. Over 100 new ponds created by the eruption, along with streams and small seeps, became oases and ecological hotspots. Birds, beetles, amphibians, small mammals, and large animals such as elk and cougars had very different patterns in how well they survived and how they have spread through the blast area. The small mammals such as gophers, ground squirrels, and mice have played important parts in the landscape's ecological recovery.

Keywords: Mount St. Helens, ecological recovery, biological legacies, small mammals.

(see Station Director's Office order form.)

Mycology

Castellano, M.A.; Trappe, J.M.; Luoma, D.

2004. Sequestrate fungi. In: Mueller, G.M.; Bills, G.F.; Foster, M.S., eds. Biodiversity of fungi— inventory and monitoring methods. Amsterdam: Elsevier Academic Press: 197–213.

Fungi play an increasingly important and more visible role in discussions on biodiversity, forest management plans, and conservation efforts. It is critically important to establish a standardized set of protocols for measuring and monitoring fungi diversity. Standardized quantitative sampling techniques are presented to allow mycologists to effectively accumulate compatible informative data on fungal diversity, distributions, ecology, and acquisition and maintenance of living fungal germplasm.

Keywords: Ascomycota, Basdiomycota, Zygomycota, biological diversity.

(see Corvallis Lab order form.)

Horton, T.R.; Molina, R.; Hood, K.

2005. Douglas-fir ectomycorrhizae in 40- and 400-year-old stands: mycobiont availability to late-successional western hemlock. Mycorrhiza. 15: 393–403.

Ectomycorrhizal (EM) roots were sampled in a 400-year-old stand of Douglas-fir and western hemlock in the western Cascade Range of Oregon to assess belowground interactions. Twenty-nine EM types had ≥0.01 gram total dry weight. Six of these types occurred with both tree hosts, 14 types occurred only with hemlock, and 9 types only with Douglas-fir. The degree of host specificity indicated by these numbers, however, was influenced by our sampling scheme and the patchiness of the fungi below ground. When hemlock seedlings were examined in a 60-year-old Douglas-fir forest, they shared 8 of 11 EM types with Douglas-fir. The ability to share fungi in common may influence the interaction between these two tree species, particularly the establishment of western hemlock as understory seedlings in Douglas-fir forests.

Keywords: Ectomycorrhizae, ITS-RFLP, phylogenetic analysis, community, succession, host specificity.

(see Corvallis Lab order form.)

Kretzer, A.M.; Dunham, S.; Molina, R.; Spatafora, J.W.

2005. Patterns of vegetative growth and gene flow in *Rhizopogon vinicolor* and *R. vesiculosus* (Boletales, Basidiomycota). Molecular Ecology. 14: 2259–2268.

We collected soprocarps and tuberculate ectomycorrhizae of both *Rhizopogon vinicolor* and *R. vesiculosus* from three approximately 50- by 100-meter plots in the Oregon Coast Range. Six and seven microsatellite markers were used to map the approximate size and distribution of genets in these two species. Strong clustering was detected in *R. vesiculosus* but not in *R. vinicolor.* These results demonstrate that isolation by distance does not occur in either species at the intraplot sampling scale and that clonal propagation (vegetative growth) is significantly more prevalent in *R. vesiculosus* than in *R. vinicolor.*

Keywords: Population biology, fungal clones, fungal ecology.

(see Corvallis Lab order form.)

Kretzer, A.M.; Luoma, D.L.; Molina, R.; Spatafora, J.W.

2003. Taxonomy of the *Rhizopogon vinicolor* species complex based on analysis of ITS sequences and microsatellite loci. Mycologia. 95(3): 480–487.

This paper readdresses species in the *Rhizopogon vinicolor* species complex by using sequence data from the internal transcribed spacer (ITS) region of the nuclear ribosomal repeat as well as genotypic data from five microsatellite loci. Analysis separates *R. vinicolor* species complex into two clades or clusters suggestive of two biological species.

Keywords: Internal transcribed species, microsatellite markers, Rhizopogon*, fungal species concepts.*

(see Corvallis Lab order form.)

Luoma, D.L.; Eberhart, J.L.; Molina, R.; Amaranthus, M.P.

2004. Response of ectomycorrhizal fungus sporocarp production to varying levels and patterns of green-tree retention. Forest Ecology and Management. 202: 337–354.

We present the initial results from an experiment that tests biodiversity assumptions behind current guidelines for ecosystem management. We examine contrasts in structural retention as they affect sporocarp production of ectomycorrhizal fungi—a functional guild of organisms well suited as indicators of disturbance effects on belowground

ecosystems. Our results lend support to the use of dispersed green-tree retention in combination with aggregated retention when maintaining sporocarp production is a goal Such a mix would ameliorate the effects of clearcutting as demonstrated in this study and may maintain higher levels of sporocarp production in the aggregates by reducing edge effects.

Keywords: Fungi, mushrooms, truffles, mycophagy, biomass, diversity.

(see Corvallis Lab order form.)

Plant Ecology

Gray, A.N.; Zald, H.S.J.; Kern, R.A.; North, M.
2005. Stand conditions associated with tree regeneration in Sierran mixed-conifer forests. Forest Science. 51(3): 198–210.

Fire suppression has significantly increased canopy cover, litter depth, and stem density in many western forests, altering microsite conditions that affect tree seedling establishment. We conducted studies in a mixed-conifer forest in the Sierra Nevada, California, to determine relationships between established understory trees and microsite quality, and to examine the effect of fire intensity and shrub cover on seedling establishment. Most of the conifer species were found on microsites with relatively high soil moisture and relatively low direct solar radiation. All species had greater frequency under shadier conditions except for Jeffrey pine, which was found on drier, more open microsites. Although seedlings were more abundant on mineral soil than expected, intact litter and forest floor was not a barrier to establishment. Mortality of planted seedlings was high, particularly in exposed areas. Although shrub cover may initially aid survival, few conifer saplings were present in shrub-dominated patches, possibly because shrubs can be aggressive competitors for soil moisture. The lack of regeneration, logs, or snags in many openings suggest that large gaps are hostile environments for tree seedlings. Results suggest that reductions in shrub cover may benefit tree establishment, but increasing understory light and decreasing surface soil moisture through canopy cover reductions may not.

Keywords: Natural regeneration, microclimate, fire, shrub competition, old-growth, Abies concolor, Abies magnifica, Calocedrus decurrens, Pinus jeffreyi, Pinus lambertiana, Prunus emarginata, Quercus kelloggii, Ceanothus cordulatus, Arctostaphylos patula.

(see Corvallis Lab order form.)

Meinzer, F.C.; Bond, B.J.; Warren, J.M.; Woodruff, D.R.
2005. Does water transport scale universally with tree size? Functional Ecology. 19: 558–565.

Recent hypotheses suggest that allometric scaling of functional attributes such as water transport obeys universal power functions of plant size. We employed standardized measurement protocols to describe the size-dependence of whole-tree water use among several species of both angiosperms and gymnosperms. Scaling of water use with tree size was universal among the angiosperms, but differed from that of the gymnosperms, which exhibited two or more scaling relationships depending on the measure of tree size employed. In both groups, rates of water transport were sigmoidal functions of tree size. Our results suggest that power functions do not always constitute mechanistically appropriate allometric scaling models.

Keywords: Allometry, sap flow, scaling, transpiration.

(see Corvallis Lab order form.)

North, M.; Chen, J.; Oakley, B.; Song, B.; Rudnicki, M.; Gray, A.; Innes, J.
2004. Forest stand structure and pattern of old-growth western hemlock/Douglas-fir and mixed-conifer forests. Forest Science. 50(3): 299–310.

We compared species composition, structure, spatial pattern, and environmental factors in two old-growth forests: Pacific Northwest western hemlock/Douglas-fir at the Wind River Canopy Crane research facility exhibiting gap-phase replacement and southern Sierra Nevada mixed conifer at the Teakettle Experimental Forest after 135 years without a fire. Wind River has nearly continuous canopy cover and a high foliage volume that severely reduces understory light and stratifies the canopy composition by shade tolerance. Large trees are regularly spaced from 0 to 15 meters and shade-tolerant and -intolerant species are "repelled." In contrast, Teakettle's canopy cover is discontinuous, foliage volume is one-fifth that of Wind River, and understory light is 15 times as much. Trees at Teakettle are significantly clustered in groups containing a mix of shade-tolerant and -intolerant species, separated by large gaps. Although Teakettle's gaps have higher moisture and a thinner litter layer than found in tree groups, regeneration in gaps is scarce. Fire suppression has increased stem density at Teakettle, but it has not filled in gaps, stratified the canopy by shade tolerance, or produced a composition consistent with patterns at Wind River. Teakettle's distinctly clustered stem distribution may result from a minimum canopy cover threshold needed for tree establishment.

Keywords: Stand structure, old-growth forest, spatial pattern.

(see Portland Lab order form.)

North, M.; Oakley, B.; Fiegener, R.; Gray, A.; Barbour, M.

2005. Influence of light and soil moisture on Sierran mixed-conifer understory communities. Plant Ecology. 177: 131–24.

Sierra Nevada forests have high understory species richness, yet we do not know which site factors influence herb and shrub distribution or abundance. We examined the understory of an old-growth mixed-conifer Sierran forest and its distribution in relation to microsite conditions. The forest has high species richness (98 species sampled), most of which are herbs with sparse cover and relatively equal abundance. Shrub cover is highly concentrated in discrete patches. Using overstory tree cover and microsite environmental conditions, four habitats were identified; tree cluster, partial canopy, gap, and rock/shallow soil. Herb and shrub species were strongly linked with habitats. Soil moisture, litter depth, and diffuse light were the most significant environmental gradients influencing understory plant distribution. Herb cover was most strongly influenced by soil moisture. Shrub cover is associated with more diffuse light, less direct light, and sites with lower soil moisture. Herb richness is most affected by conditions that influence soil moisture. Richness is positively correlated with litter depth and negatively correlated with direct light and shrub cover. Disturbance or management practices that change forest floor conditions, shallow soil moisture, and direct light are likely to have the strongest effect on Sierran understory abundance and richness.

Keywords: California, NMS ordination, patch, plant community, Teakettle Experimental Forest, understory diversity.

(see Portland Lab order form.)

Schaberg, P.G.; Hennon, P.E.; D'Amore, D.V.; Hawley, G.J.; Borer, C.H.

2005. Seasonal differences in freezing tolerance of yellow-cedar and western hemlock trees at a site affected by yellow-cedar decline. Canadian Journal of Forest Research. 35: 2065–2070.

To assess whether inadequate cold hardiness could be a contributor to yellow-cedar (*Chamaecyparis nootkatensis* (D. Don) Spach) decline, we measured the freezing tolerance of foliage from yellow-cedar trees in closed-canopy (nondeclining) and open-canopy (declining at elevations below 130 m) stands at three sites along an elevational gradient in the heart of the decline in southeastern Alaska. Foliar freezing tolerance was also assessed for sympatric nondeclining western hemlock (*Tsuga heterophylla* (Raf.) Sarg.). Measurements were made in the fall, winter, and spring to evaluate if seasonal differences in cold hardiness help explain species-specific injury. Significant differences in freezing tolerance attributable to site, canopy closure, species, and the interaction of canopy closure and species were each detected for at least one sample period. However, only two results were consistent with field reports of yellow-cedar decline: (1) between winter and spring measurements, yellow-cedar trees dehardened almost 13 °C more than western hemlock trees, so that yellow-cedar trees were more vulnerable to foliar freezing injury in spring than hemlock; and (2) stands below 130 m appeared more vulnerable to freezing injury than stands above 130 m.

Keywords: Cold tolerance, temperature, yellow-cedar.

(see Juneau Lab order form.)

Vance, N.C.; Bernhardt, P.; Edens, R.M.

2004. Pollination and seed production in *Xerophyllum tenax* (Melanthiaceae) in the Cascade Range of central Oregon. American Journal of Botany. 91(12): 2060–2068.

Xerophyllum tenax is a mass-flowering, nectarless herb in which self-pollination is unavoidable as anthers shed pollen onto the three, receptive stigmatic ridges attached to each pistil within a few hours after expansion of the perianth. We compared the pollination system with reproductive success in this species through controlled, hand-pollination experiments. Ovaries of flowers sampled from unbagged inflorescences were visited by pollen-eating flies (primarily members of the family Syrphidae), beetles (primarily *Cosmosalia* and *Epicauta* spp.), and small bees, and produced normal-sized capsules and mature seeds. Ovaries of flowers from inflorescences bagged to prevent insect pollination produced small capsules containing undeveloped or no seeds. Epifluorescence analyses suggest that 0.95 of the uncovered flowers are cross-pollinated by insects with pollen tubes penetrating style and ovary tissue. Flowers show a "leaky" but early-acting self-incompatibility system. While hundreds of pollen tubes germinate on each stigmatic surface following self-pollination, few pollen tubes penetrate the stigmatic surface and none penetrate the ovary. In contrast, when stigmas are cross-pollinated by hand with pollen from a second inflorescence, pollen tubes were seen penetrating style and ovary. Self-incompatibility in *X. tenax* parallels that of some species of *Trillium*, a sister genus within the Melanthiaceae.

Keywords: Beargrass, Melanthiaceae, pollen, pollination, seed production, self-incompatibility, Xerophyllum tenax.

(see Corvallis Lab order form.)

Wimberly, M.C.; Spies, T.A.

2002. Landscape- vs gap-level controls on the abundance of a fire-sensitive, late-successional tree species. Ecosystems. 5: 232–243.

Simulation models were used to explore the hypothesis that the patchy distribution of western hemlock (*Tsuga heterophylla*) in the Oregon Coast Range resulted from historical fires and seed source limitations. The model showed that the amount of hemlock in the landscape was particularly sensitive to variations in postfire fire return interval and fire severity. Hemlock was less sensitive to variations in postfire remnant patch density and canopy gaps. Where seed sources are limited by large disturbances, gap dynamics may have relatively little influence on landscape patterns of hemlock. The results corroborate empirical observations that the abundance and pattern of hemlock are sensitive to fire history, suggesting that fire effects may persist for centuries.

Keywords: Disturbance, succession gaps, regeneration landscape.

(see Corvallis Lab order form.)

Plant Pathology

Manter, D.K.; Kerrigan, J.

2004. A/C_i curve analysis across a range of woody plant species: influence of regression analysis parameters and mesophyll conductance. Journal of Experimental Botany. 55(408): 2581–2588.

A/C_i curve (net CO_2 assimilation rate (A) versus calculated substomatal CO_2 concentration (C_i)) analysis has become a popular tool for describing and modeling plant photochemistry under a wide variety of experimental assumptions. We examined (1) the validity of the general assumption that the rubisco portion of the A/C_i curve occurs below 20 to 25 Pa and (2) the effect of internal CO_2 conductance (gi) values on estimates of the maximum rate of rubisco-mediated carboxylation (Vcmax). Based on an analysis of 20 woody species from the Pacific Northwest, significant inter- and intraspecies variation occurred in the Ci value where the rubisco- and electron transport-limited portions of the curve intersect (Ci_t), which ranged from 20 to greater than 150 Pa and averaged about 37.6 and 61.7 Pa for conifer and hardwood species, respectively.

Keywords: A/C_i curve analysis, photosynthesis, internal CO_2 conductance, CO_2 assimilation, Vcmax, rubisco.

(see Corvallis Lab order form.)

Mathiasen, R.; Melgar, J.; Beatty, J.; Parks, C.

2000. First report of *Psittacanthus angustifolius* on *Pinus oocarpa* and *Pinus maximinoi*. Plant Disease. 84: 203.

The mistletoe *Psittacanthus pinicola* Kuijt (Loranthaceae) was described in 1987 from Belize parasitizing *Pinus caribea* var. *hondurensis* (Senecl.) Barr. et Golf. We discovered this mistletoe parasitizing *Pinus oocarpa* Schiede about 15 km north of Campamento, Honduras, and about 18 km north of Yoro. We also observed this mistletoe parasitizing *Pinus tecunumanii* Eguiluz & J.P. Perry about 20 km northeast of San Ignacio, Belize, in the Mountain Pine Ridge Region.

Keywords: Mistletoe, Psittacanthus pinicola.

(see La Grande Lab order form.)

Mathiasen, R.; Parks, C.; Nickrent, D.; Beatty, J.; Geils, B.

2001. Status of dwarf mistletoes in Central America. In: Angwin, P., ed. Proceedings of the 48th western international forest disease work conference. Redding, CA: USDA Forest Service, Northern California Shared Service Area: 78–89.

In an effort to discover more about the dwarf mistletoes occurring in Central America and southern Mexico, we traveled to Belize, Guatemala, Honduras, El Salvador, and Chiapas, Mexico. As a result of this work, we have extended the known distribution of some Central American mistletoes and found that others may be less common than reported by Hawksworth and Wiens in 1970 through 1996. We also learned more about the range of the hosts of these mistletoes and more about their phenology.

Keywords: Mistletoes, Central America.

(see La Grande Lab order form.)

Parks, C.G.; Aitken, M.J.

2003. CAB International datasheet on *Chrysomyxa arctostaphyli*. Online crop protection compendium 2004 edition. 11 p. http://www.cabi.org/compendia/cpc/index.htm.

The Crop Protection Compendium is an encyclopedic, mixed-media tool that brings together information from experts, edited and compiled by an independent scientific organization, and supported by a diverse international development consortium. It is published on CD-ROM and the Worldwide Web and is updated annually. A novel system of hyperlinking allows dynamic links to be created in real time. This data sheet on *Chrysomyxa arcostaphyli* encompasses a summary of information on the disease and its hosts and the countries where it occurs.

Keywords: Spruce broom rust, Chrysomyxa arctostaphyli.

(see La Grande Lab order form.)

Parks, C.; Mathiasen, R.; Beatty, J.

2001. True mistletoes on pine in Central America and Chiapas, Mexico. In: Angwin, P., ed. Proceedings, 48th western international forest disease work conference. Redding, CA: USDA Forest Service, Northern California Shared Service Area: 61–67.

The true mistletoes parasitizing pines in Central America and Chiapas are predominantly species in the genus *Psittacanthus*. Birds disseminate the seeds, but little is known about which avian species are responsible for dissemination in the pine forests of Central America and Chiapas. The other true mistletoes reported on pines in Central America and southern Mexico are members of the genus *Struthanthus*.

Keywords: Phorodendron, Psittacanthus.

(see La Grande Lab order form.)

Rippy, R.C.; Stewart, J.E.; Zambino, P.J.; Klopfenstein, N.B.; Tirocke, J.M.; Kim, M.-S.; Thies, W.G.

2005. Root diseases in coniferous forests of the inland West: potential implications of fuels treatments. Gen. Tech. Rep. RMRS-GTR-141. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 32 p.

After nearly 100 years of fire exclusion, a change in forest composition has occurred in many inland West forests of North America. Managers are implementing fuel treatments to lower the risk of wildfires. Impacts on root diseases should be considered before selecting appropriate fuel treatments. This paper provides examples of how fuel treatments may increase or reduce specific diseases and demonstrates their importance as considerations in the fuel management planning process. Several root diseases are addressed: Armillaria root disease, annosus root disease, laminated root rot, black stain root disease, Schweinitzii root and butt rot, tomentosus root disease, rhizina root rot, and stringy butt rot.

Keywords: Fire, fuels treatments.

(see Corvallis Lab order form.)

Range Management

Bleich, V.C.; Kie, J.G.; Loft, E.R.; Stephenson, T.R.; Oehler, M.W.; Medina, A.L.

2005. Managing rangelands for wildlife. In: Braun, C.E., ed. Techniques for wildlife investigations and management. Bethesda, MD: The Wildlife Society: 873–897.

This chapter revision includes sections on plant succession and wildlife management, contemporary issues, managing livestock on rangeland, rangeland riparian issues, fences, water development, and other topics.

Keywords: Range management; wildlife habitat.

(see La Grande order form.)

Vavra, M.

2004. Biodiversity: grazing management. In: Pond, W.G.; Bell, A.W., eds. Encyclopedia of animal science. New York: Marcel Dekker, Inc.: 1–3. DOI: 10.1081/E-EAS 120019479.

Grazing by livestock, or any other herbivore, has the potential to impact biodiversity. Habitat diversity is usually most directly affected by grazing. Grazing impacts affect plant community structure and composition, and nutrient cycling and energy flow. Unrestricted grazing can have detrimental effects on biodiversity. However, grazing systems can be designed that have no impact or even improve biodiversity.

Keywords: Biodiversity, livestock, grazing, herbivory, succession.

(see La Grande Lab order form.)

Recreation

Cerveny, L.K.

2004. Tourism and transformations in the Alaska frontier: a study of tourism growth and its effects on three southeast Alaska communities. Syracuse, NY: Syracuse University. 635 p. Ph.D. dissertation.

Tourism is one of the world's largest and fastest growing industries. Developing regions seek to expand their economic base through tourism, with endorsement of states and multilateral institutions. Meanwhile, tourism, as a product and process of globalization, can transform host communities and natural resources, affecting livelihoods and lifestyles. This dissertation uses a comparative case study approach to understand the role of tourism in shaping communities, economies, and natural resources in three rural Alaska sites. Sites selected were similar

in size, demographic composition, and economic history, but differed in their level of tourism involvement. Stakeholder analysis was employed to disaggregate the involvement of various social actors. The purpose of the study was (a) to understand how multilevel stakeholders engaged in the process of tourism development within host communities, and (b) to investigate how tourism impacts were distributed among various stakeholders. Dynamic relations among local and nonlocal stakeholders building a tourism economy were explored. Tourism impacts were examined among these stakeholders and other social groups to differentiate tourism beneficiaries and those bearing the burden of tourism.

Keywords: Tourism, community impacts, ethnography, Alaska.

(see Corvallis Lab order form.)

Kruger, L.E.; Alexander, S.J.

2004. Improving our understanding of recreation and tourism. Western Forester. 49(5): 8–9.

American society has been changing in many ways that affect management of natural resources for recreation and tourism. Technology and the development of resorts, visitor facilities, and homes in the wildland-urban interface have created higher and more diverse demands for recreation, creating challenges for resource managers. The Pacific Northwest Research Station has implemented a focused initiative to look at recreation and tourism questions to help address manager and community member needs.

Keywords: Recreation, tourism, resource-based communities, place attachment, decisionmaking frameworks.

(see Juneau Lab order form.)

Regional Assessments

Griffith, M.B.; Hill, B.H.; McCormick, F.H.; Kaufmann, P.R.; Herlihy, A.H.; Selle, A.R.

2005. Comparative application of indices of biotic integrity based on periphyton, macroinvertebrates, and fish to southern Rocky Mountain streams. Ecological Indicators. 5: 117–136.

To assess the relative sensitivity of assessments using community metrics for macroinvertebrates, periphyton, and fish assemblages, we compared the results of three parallel assessments using these assemblages at 86 stream reaches sampled in 1994 and 1995 by the Regional Environmental Monitoring and Assessment Program (R-EMAP) in the mineralized zone or historical mining region of the Southern Rockies Ecoregion in Colorado. We contrasted assessments by using community metrics for each taxa group selected to be diagnostic of the two large-scale stressor gradients identified in this ecoregion: discharges from historical hardrock metal mines and agriculture, particularly pasturing of livestock.

Keywords: Aquatic assemblages, community metrics, biotic indices, fish, macroinvertebrates, periphyton, streams, Southern Rockies Ecoregion, R-EMAP.

(see Olympia Lab order form.)

Ohmann, J.L.

2004. New forest vegetation maps facilitate assessment of biodiversity indicators over large, multi-ownership regions. In: Forest science in practice: Proceedings, Society of American Foresters national convention. Bethesda, MD: Society of American Foresters: 111–116.

Natural resource policy analysis and conservation planning are best served by broad-scale information about vegetation that is detailed, spatially complete, and consistent across land ownerships and allocations. A new generation of vegetation maps can be used to assess the distribution of vegetation biodiversity among land ownerships and allocations at a regional scale. The vegetation maps contain detailed tree- and stand-level attributes of vegetation composition and structure for each pixel in a regional landscape, which can be translated into vegetation biodiversity indicators at individual tree, species, community, and landscape levels. The new vegetation maps can be combined with models of stand and landscape dynamics to assess potential effects of alternative forest policies on biodiversity in future landscapes. Lastly, I discuss the importance of considering all land ownerships and allocations, including the matrix of seminatural, managed forests, in regional biodiversity assessments.

Keywords: Ecological indicators, gradient analysis, regional conservation planning, forest policy effects, Oregon Coast Range.

(see Corvallis Lab order form.)

Weinstein, D.A.; Laurence, J.A.; Retzlaff, W.A.; Kern, J.S.; Lee, E.H.; Hogsett, W.E.; Weber, J.

2005. Predicting the effects of tropospheric ozone on regional productivity of ponderosa pine and white fir. Forest Ecology and Management. 205: 73–89.

We simulated forest dynamics of the regional ponderosa pine-white fir conifer forest of the San Bernardino and Sierra Mountains of California to determine the effects of high ozone levels over the next century. We linked two models, TREGRO and ZELIG, to consider both physiological effects within individual trees and

competitive interactions within forest communities. We represented regional effects by simulating at three sites in California: Lassen National Park, Yosemite National Park, and Crestline in the San Bernardino Mountains. Of the two major dominant species in this forest, white fir showed little response, but ponderosa pine was predicted to show large effects.

Keywords: Ozone, air quality, assessment, forest condition.

(see Corvallis Lab order form.)

Remote Sensing

Cimon, N.; Wisdom, M.

2004. Accurate velocity estimates from inaccurate GPS data. In: Proceedings, 10th biennial USDA Forest Service remote sensing applications conference. Salt Lake City, UT: USDA Forest Service, Remote Sensing Applications Center.

We used an empirical technique to obtain an accurate velocity estimate from inaccurate GPS data. It relies on ever-increasing time-difference to reduce the relative error component in distance measurements based on GPS position data error. The technique was used to derive estimates of the average velocity for four sets of recreation visitor trials on a rural forest road system: for hikers, bikers, horseback riders, and all-terrain-vehicle users.

Keywords: Forest recreation, GPS, remote sensing, average velocity, ATV, hiking, mountain biking, horseback riding.

(see La Grande Lab order form.)

Corne, S.A.; Carver, S.J.; Kunin, W.E.; Lennon, J.L.; van Hees, W.W.S.

2000. Using artificial neural network methods to predict forest characteristics in southeast Alaska. In: Parks, B.O.; Clarke, K.M.; Crane, M.P., eds. Proceedings, 4th international conference on integrating geographic information systems and environmental modeling: problems, prospects, and research needs [CD-ROM]. Boulder, CO: University of Colorado; Denver, CO: U.S. Geological Survey. [Jointly published.]

The flora of the southeastern region of Alaska have been surveyed as part of the USDA Forest Service Forest Inventory and Analysis Program. Modeling the distribution of species and forest characteristics permits the interpolation of such data between survey locations and the prediction of characteristics in unsurveyed regions. We use neural network methods to generate models based upon simple inventory parameters such as geological location, elevation, slope, and aspect with complementary satellite image data. Predictive maps are generated by obtaining input data from digital elevation models. The results of the predictions are compared with both the data recorded in the database and with published classification maps for part of the study area produced by standard satellite image interpretation methods.

Keywords: Spatial interpolations, land use, remote sensing, graphical information systems, forest, artificial neural networks.

(see Anchorage Lab order form.)

Laurent, E.J.; Shi, H.; Gatziolis, D.; LeBouton, J.P.; Walters, M.B.; Liu, J.

2005. Using the spatial and spectral precision of satellite imagery to predict wildlife occurrence patterns. Remote Sensing of Environment. 97: 249–262.

We used unclassified spectral data for predicting the distribution of three warbler species over a 385 000-ha region of Michigan's Upper Peninsula by using Landsat ETM+ imagery and 433 locations sampled for 3 species of birds via point count surveys. We examined the influence of varying two spatially explicit classification parameters on prediction accuracy: (1) the window size used to average spectral values in signature creation and (2) the threshold distance required for bird detections to be counted as present. Maps were validated with Kappa values >0.3 and PCC >0.6. Comparisons with maps created by using gap analysis showed that spectral information predicted species occurrence better than could be done by using known land cover associations.

Keywords: Landsat, forest, birds, habitat, prediction, gap analysis, wildlife occurrence, Michigan, multiple-season images, accuracy assessment, image classifications.

(see Portland Lab order form.)

Lefsky, M.A.; Cohen, W.B.; Harding, D.J.; Parkers, G.G.; Acker, S.A.; Gower, S.T.

2002. LIDAR remote sensing of above-ground biomass in three biomes. Global Ecology and Biogeography. 11: 393-399.

Estimation of carbon storage in moderate- to high-biomass forests is difficult for conventional optical and radar sensors. In this study, we compare the relationships between LIDAR-measured canopy structure and coincident field measurements of aboveground biomass at sites in the temperate deciduous, temperate coniferous, and boreal coniferous biomes. A single regression for all three sites is compared with equations derived for each site individually. The single equation explains 84 percent of variance in aboveground biomass ($p<0.0001$) and shows no statistically significant bias in its predictions for any individual site.

Keywords: Remote sensing, biomass (trees), carbon storage, global carbon cycle, LIDAR.

(see Corvallis Lab order form.)

Lefsky, M.A.; Turner, D.P.; Guzy, M.; Cohen, W.B.
2005. Combining LIDAR estimates of aboveground biomass and Landsat estimates of stand age for spatially extensive validation of modeled forest productivity. Remote Sensing of Environment. 95: 549–558.

Widespread estimates of forest productivity are required to understand the relationships between shifting land use, changing climate, and carbon storage and fluxes. In this study, we developed an independent approach to estimating net primary production based on stand age and biomass that could be implemented over a large area and used in validation efforts. In western Oregon, productivity estimates made by using this method compared well with forest inventory estimates and revealed a significant bias in estimates from a spatially distributed biogeochemistry model. The generality of the relationship between LIDAR-based canopy characteristics and stand biomass means that this approach could potentially be widely applicable.

Keywords: Remote sensing, biomass, productivity, LIDAR, Landsat.

(see Corvallis Lab order form.)

Resource Inventory

Monleon, V.J.; Azuma, D.; Gedney, D.
2004. Equations for predicting uncompacted crown ratio based on compacted crown ratio and tree attributes. Western Journal of Applied Forestry. 19(4): 260–267.

Equations to predict uncompacted crown ratio as a function of compacted crown ratio, tree diameter, and tree height were developed for the main tree species in Oregon, Washington, and California by using data from the Forest Health Monitoring Program, USDA Forest Service. The uncompacted crown ratio was modeled with a logistic function and fitted by using weighted, nonlinear regression. The models were evaluated by using cross-validation. Mean squared error of predicted uncompacted crown ratio was between 0.1 and 0.15, overall bias was negligible, and correlation between the predicted and observed uncompacted crown ratio was high for most species. The sensitivity of crown fire risk to crown ratio estimation method was evaluated by using the Fire and Fuels Extension of the Forest Vegetation Simulator. Torching index, an estimate of the windspeed needed for a crown fire to develop, was significantly greater when compacted crown ratio was used instead of uncompacted crown ratio. The close agreement in torching indices simulated by using predicted and observed uncompacted crown ratio provides further evidence of the utility of the models developed in this study.

Keywords: Crown fire risk, crown base height, cross-validation.

(see Portland Lab order form)

Rural Communities

Kline, J.; Kruger, L.E.; Mazza, R.
2005. Demographic trends in southeast Alaska. In: Mazza, R.; Kruger, L.E., tech. eds. Social condition and trends in southeast Alaska. Gen. Tech. Rep. PNW-GTR-653. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 5–43.

Between 1990 and 2000, population growth in southeast Alaska lagged behind statewide and national growth, but differed significantly across some communities, with many increasing at rates comparable to those of the state and Nation. The ethnic composition of people in southeast Alaska roughly mirrors that of Alaska but has a greater proportion of people reporting as Native than in the United States and the nonmetropolitan United States. The median age of the southeast Alaska population is about equal to that of the Nation. On average, Alaska's population is better educated than that of the Nation, with some regional variation. Income and poverty differs by community. Per capita income in southeast Alaska exceeds that of the Nation, but growth in per capita income between 1990 and 2000 lagged that experienced by the rest of the country. Alaska has ranked first among all states for several years in per capita federal expenditures; in 2000 this was 65 percent higher than the national average. Housing for seasonal, recreational, or occasional use increased in southeast Alaska by more than twice the national average. The death rate for children and teenagers is higher in Alaska than in the Nation, but lower in the southeast region, compared to the state. Fetal alcohol syndrome is more prevalent in Alaska than the greater United States. Crime rates in Alaska during 2000 were comparable to those of the United States and nonmetropolitan United States, but varied by reporting agency in southeast Alaska.

Keywords: Social conditions, demographics, southeast Alaska, Tongass Land Management Plan.

(see Corvallis Lab order form.)

Silviculture

Cissel, J.; Anderson, P.; Berryman, S.; Chan, S.; Olson, D.; Puettmann, K.

2004. Bureau of Land Management density management study. In: Erickson, J., ed. The cooperative forest ecosystem research program annual report 2004. Corvallis, OR: Oregon State University: 31–36.

The USDI Bureau of Land Management, USDA Forest Service, USDI Geological Survey, and Oregon State University established the Density Management Study (DMS) in 1994 to develop and test options for young stand management to meet Northwest Forest Plan objectives in western Oregon. The DMS demonstrates alternative approaches to managing 40- to 70-year-old forest stands on low-elevation sites in western Oregon to create and maintain late-successional forest characteristics. Scientific and management objectives of the DMS include (1) evaluate effects of alternative forest density management treatments on important late-successional habitat, (2) determine treatment effects on selected plant and animal taxa, (3) assess the combined effects of density management and alternative riparian buffer widths on aquatic and riparian resources, (4) use DMS sites to develop approaches to implementation of new prescriptions and improve methods for effectiveness monitoring of plant and animal taxa, (5) use DMS sites to share results of practices and study findings with land managers, regulatory agencies, and policymakers, and (6) use results from DMS to conduct a long-term adaptive management process in which management implications and policy changes are regularly evaluated and changed as needed.

Keywords: Density management, riparian buffer, young stand management, Northwest Forest Plan.

(see Corvallis Lab order form.)

Harrington, C.

2005. Return of the king: western white pine. Northwest Woodlands. Spring 2005: 14–15.

Western white pine can grow well on a wide variety of sites from California to British Columbia and east to Montana. It has excellent growth rates on several types of "problem" sites such as frost pockets, droughty or infertile soils, and *Phellinus* root-rot infection areas. Unfortunately, however, it is susceptible to white pine blister rust, a serious disease that has killed millions of trees. Use of newly available rust-resistant stock and proper stand tending practices such as pruning greatly increase survival rates for planted trees and offer hope that the species will be managed on more acres in the future.

Keywords: Western white pine, blister rust, silviculture, pruning.

(see Olympia Lab order form.)

Harrington, T.B.; Harrington, C.A.; Schoenholtz, S.H.

2005. Forest productivity responses to logging debris and competing vegetation: effects of annual precipitation and soil texture. In: Harrington, C.A.; Schoenholtz, S.H., eds. Productivity of Western forests: a forest products focus. Gen. Tech. Rep. PNW-GTR-642. Portland, OR: U.S Department of Agriculture, Forest Service, Pacific Northwest Research Station: 173–175.

Logging debris and competing vegetation are being manipulated at two sites to determine their potential influences on selected soil factors and productivity of planted Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii*). The sites, located at Matlock, Washington, and Molalla, Oregon, were selected to differ in annual precipitation and soil texture. As part of the field tour for the Forest Productivity Conference, participants visited the Matlock site to observe the various treatments and vegetation responses in the first year since study initiation.

Keywords: Long-term site productivity, soil properties, microclimate, plantations.

(see Olympia Lab order form.)

Harrington, C.A.; Roberts, S.D.; Brodie, L.C.

2005. Tree and understory responses to variable-density thinning in western Washington. In: Peterson, C.E.; Maguire, D.A., eds. Balancing ecosystem values: innovative experiments for sustainable forestry. Proceedings of a conference. Gen. Tech. Rep. PNW-GTR-635. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 97–106.

The Olympic Habitat Development study was initiated in 1994 to evaluate whether active management in 35- to 70-year-old stands could accelerate development of stand structures and plant and animal communities associated with late-successional forests. The study used a variable-density thinning prescription as the main tool to alter stand structure; the prescription entailed creating gaps and retaining uncut areas, and thinning the remaining forest matrix. We assessed tree damage (primarily windthrow) following thinning, 5-year tree growth, and 3-year vegetation development in control and thinned plots. Windthrow damage was minor in most plots, occurring primarily in stands with high height-to-diameter ratios and located in vulnerable topographic positions. Tree growth responded positively to thinning. In addition, tree growth differed spatially—trees near gaps or along skid trails had better-than-average growth, whereas trees near uncut patches had poorer-than-average growth. Understory vegetation responded to thinning with increased percentage of cover and number of herbaceous species in thinned areas and in

created gaps. Percentage of cover of mosses and liverworts was greatest in undisturbed areas. Early results indicate that the thinning is operationally feasible and demonstrate that the variable-density thinning increases spatial heterogeneity within the stands.

Keywords: Tree growth, windthrow, implementation, new techniques.

(see Olympia Lab order form.)

Howell, K.D.; Harrington, T.B.

2004. Nursery practices influence seedling morphology, field performance, and cost efficiency of containerized cherrybark oak. Southern Journal of Applied Forestry. 28(3): 152–162.

Artificial regeneration of cherrybark oak (*Quercus pagoda* L.) was studied to determine effects of cultural and handling practices on seedling production costs and subsequent field performance. Seedlings were grown in a greenhouse in small, medium, or large containers with or without fertilization and then planted at a field site. Fifth-year stem diameter and height responses to treatment were proportional to those present at the time of planting, indicating that differences from nursery culture are maintained throughout early plantation development. Comparisons of price:yield ratio for seedlings from this study with those from two other commercial nurseries indicate that regeneration objectives are best fulfilled by planting large stock.

Keywords: Containerized seedlings, nursery, cherrybark oak, biomass.

(see Olympia Lab order form.)

Metlen, K.L.; Fiedler, C.E.; Youngblood, A.

2004. Understory response to fuel reduction treatments in the Blue Mountains of northeastern Oregon. Northwest Science. 78(3): 175–185.

Undergrowth vegetation response to fuel reduction treatments was evaluated in fire-adapted ponderosa/Douglas-fir forests in northeastern Oregon in the first growing season after burning and three seasons after thinning. Compared to the control, the burn-only treatment tended to reduce the diversity of the undergrowth and diminish the cover of grasses and shrubs while increasing the frequency of fire-adapted undergrowth species. The thin-only treatment had little impact on species diversity; however, a few graminoid species increased in both frequency and cover. Species diversity after the thin-and-burn treatment was similar to that of the burn-only treatment.

Keywords: Fire and Fire Surrogate Study, fuel reduction, understory vegetation, thinning, underburning.

(see La Grande Lab order form.)

Roberts, S.D.; Harrington, C.A.; Terry, T.A.

2004. Harvest residue and competing vegetation affect soil moisture, soil temperature, N availability, and Douglas-fir seedling growth. Forest Ecology and Management. 205: 333–350.

We examined performance of 3-year-old Douglas-fir seedlings subject to different vegetation control and biomass retention treatments on a productive Coast Range site. Objectives were to determine if treatments affected site resources 3 years after stand establishment, and if differences were correlated with seedling growth. Competition control and residue retention both resulted in higher soil moisture during the growing season, and greater apparent nitrogen availability. Differences were associated with greater average stem diameter and volume growth in year 3. We suspect that differences in available moisture were largely responsible for the observed growth responses, but that treatment differences in available nitrogen also influenced growth.

Keywords: Harvesting, competition control, residual biomass, soil moisture, nitrogen, Douglas-fir.

(see Olympia Lab order form.)

Social Sciences

Bradley, G.; Kearney, A.; White, S.

2005. Seeing the forest for the trees: visual resources research in the Capitol State Forest. In: Deal, R.L.; White, S.M., eds. 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: 44–45.

Visual impacts of alternative timber harvest practices are important considerations when developing timber harvest plans. Determining visual preferences for alternative timber harvest practices is one means of identifying the visual effects of alternative patterns. Ongoing work at the Capitol State Forest has provided a comprehensive look at visual preferences for six alternative harvest patterns by various interest groups. These groups include foresters, recreationists, environmentalists, educators, and the general public. Groups tend to share a common preference for patterns showing minimal disturbance, but are significantly different as the intensity of harvest practices increase. Foresters showed higher preferences for intensive forest management, while all other groups indicated a lower preference for intensive forest practices.

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

(see Portland Lab order form.)

Calver, M.C.; Bigler-Cole, H.; Bolton, G.C.; Gaynor, A.; Horwitz, P.; Mills, J.; Wordell-Johnson, G.W.

2005. Why "a forest consciousness?" In: Calver, M.C. [et al.], eds. Proceedings, 6th national conference of the Australian Forest History Society, Inc., Rotterdam, Netherlands: Millpress Science Publishers: xvii–xxiii.

The phrase "a forest consciousness" was used in a major statement made by Charles Lane Poole, Western Australia's Conservator of Forests 1916–21, for the 1920 British Empire Forestry Conference. It is both relevant and contemporary at the beginning of the 21st century. We chose it as the conference theme to encourage engagement with both a conscious awareness of forests and their values, and a sense of moral responsibility toward forest management. It stimulated a broad range of lively contributions that emphasized mainly the "awareness" aspect, although some authors addressed "moral responsibility." Perhaps "consciousness," like sustainability, is an evolving concept not yet fully mature.

Keywords: Lane Poole, consciousness, Australia forests.

(see La Grande Lab order form.)

Swanson, F.

2005. History, redux [Book review]. Forest Magazine. Winter 2005: 56–57.

Harold Steen's telling of the early history of the Forest Service is a fascinating account of the persistence of themes of conflicts surrounding federal forestry in the United States. Told largely from the view of turf wars at high levels of government, the story follows landmarks of federal legislation as Congress and interest groups attempted to steer the agency's policies and practices.

Keywords: Forest Service, history, forest policy, resource management.

(see Corvallis Lab order form.)

Scheuering, R.W.; Barbour, J.

2004. Focused science delivery makes science make sense. Western Forester. 49(5): 1–3.

This article describes the Focused Science Delivery (FSD) Program—its purpose, who benefits from it, and how it accomplishes its goals. It includes examples of FSD projects and gives contact information so that interested readers might respond. This is the lead-in article for an issue of Western Forester devoted entirely to the FSD program and its initiatives.

Keywords: Focused Science Delivery Program, communication, forest management, forestry science, USDA Forest Service.

(see Portland Lab order form.)

Soil

Deiss, J.; Byers, C.; Clover, D.; D'Amore, D.; Love, A.; Menzies, M.A.; Powell, J.; Walter, M.T.

2004. Transport of lead and diesel fuel through a peat soil near Juneau, AK: a pilot study. Journal of Contaminant Hydrology. 74: 1–18.

A set of peat column experiments was used to determine the transport potential of lead (Pb) and diesel range organics (DRO) in palustrine slope wetlands near Juneau, AK. This project is important to southeast Alaskan communities because limited land resources are forcing development of regional wetlands. This study was instigated by concerns that proposed modifications to a nearby rifle range using DRO-contaminated soil posed a potential risk to an anadromous fish-bearing stream 250 m from the site. Three pairs of peat columns were extracted from the rifle range for analysis, one pair along and two pairs across the natural bedding planes of the soil. One column in each pair was spiked with Pb and DRO and the other was used as a control. Approximately 1 year's worth of water (171 cm) was passed through each column, and leachate was collected at regular intervals. The results showed that substantial DRO transport only occurred along the bedding planes. Lead was surprisingly mobile, both along and across the bedding planes with estimated soil-water partition coefficients several orders of magnitude lower than commonly published values, probably because the peat was heavily Pb-loaded by lead from bullets and because the peat's acidic, organic-rich environment enhanced Pb mobility. The chemical outflow behavior agreed with a simple macropore transport model. These results underscore the need for caution when developing regional wetlands.

Keywords: Peat, contaminant transport, lead, diesel range organic, macropore, rifle range, wetland.

(see Juneau Lab order form.)

Homann, P.S.; Remillard, S.M.; Harmon, M.E.; Bormann, B.T.

2004. Carbon storage in coarse and fine fractions of Pacific Northwest old-growth forest soils. Soil Science Society of America Journal. 68: 2023–2030.

Seventy-nine pedons in 18 western Washington and Oregon forests were sampled to a depth of 100 centimeters to determine the importance of the soil fraction less than 2 millimeters (<2 mm) to whole-soil carbon (C) pools in Pacific Northwest old-growth coniferous forests. The <2-mm fraction was separated from the >2-mm fraction by air-drying, physically crushing soil, and sieving; C was determined by Leco combustion. The >2-mm fraction contained up to 46 percent of the whole-soil C and averaged 23 percent for the seven forests that had C in that fraction.

The whole-soil C in the surface 100 centimeters of mineral soil ranged from 30 to 400 milligrams C per hectare.

Keywords: Old-growth forests, biomass (soil) carbon cycling, permanent plots, reference stands, soil organic matter.

(see Corvallis Lab order form.)

McIver, J.D.

2003. Sediment transport and soil disturbance after postfire logging. Hydrological Science and Technology. 19(1-4): 335–347.

Recently there has been considerable debate on the practice of postfire logging, in which burned forests are entered soon after fire to recover commercially valuable trees. Proponents of the practice argue that postfire logging is part of a "restoration package" that can be used to control erosion (e.g., contour logging) and can help to mitigate costs of rehabilitation. Opponents argue that postfire logging damages sensitive soils and can lead to excessive erosion and sediment transport. Review of the literature on postfire logging shows that very little direct scientific information can be brought to bear on this issue. A handful of hydrological studies have indicated that burned sites can be unusually sensitive to logging, especially when ground-based logging systems are used. These studies, however, have demonstrated that there is considerable variation in environmental effect, due to differences in soil type, slope, weather conditions after logging, and the type of logging equipment used. In an effort to provide more information on postfire logging effects, an experiment was begun in 1997 to evaluate soil impacts and sediment transport after logging of stands burned by the 1996 Summit Fire on the Malheur National Forest. Soil disturbance and sediment transport were measured in four replicated units in each of three postfire harvest treatments (unharvested control, partial harvest, full harvest). Displacement, compaction, and erosion were the most commonly observed types of machine-caused soil disturbance. There was a significant difference among treatments in the percentage of mechanically disturbed soil area, with controls having less area disturbed than harvested units. Despite significant soil disturbance, however, little sediment transport out of experimental units occurred, owing largely to (1) the practice of hand felling, (2) logging over snow or on dry ground, (3) low slopes, (4) heavy soils, (5) no new roads, and (6) the absence of extreme weather events after logging. Visual inspections indicated that relatively little sediment left the experimental units in the short term, and that the existing road system was responsible for most sediment transport.

Keywords: Salvage logging, soil compaction, erosion, restoration.

(see La Grande Lab order form.)

Special Forest Products

Vance, N.C.

2004. Sustained use and conservation of wild plants: building on traditional knowledge at the local people and protected area interface. Medicinal Plant Conservation. 9/10: 51–54.

A symposium on the "sustained use and conservation of wild plants" at the 16th annual meeting of the Society for Conservation Biology sought to bring awareness and understanding of the uses and interdependency of wild plants and people and to evaluate the kinds of strategies that have been and are being implemented to sustain and conserve plant species that have served people for centuries and continue to do so today. Under this broad rubric, the presentations that addressed medicinal plants discussed key issues and problems and introduced new approaches to addressing these issues. Primary among the issues were sustainability and access and the need of greater ethno-ecological understanding at the nexus of conservation and use.

Keywords: Conservation, wild plants, medicinal plants, sustainability.

(see Corvallis Lab order form.)

Threatened, Endangered, Sensitive Species

Molina, R.

2004. Developing tools to sustain biological diversity. Western Forester. 49(5): 7.

The Biodiversity Initiative strives to provide innovative solutions to the complex problem of managing forests for biodiversity. Although this initiative is in its beginning stage, an initial scooping meeting has already taken place, and planning for the next steps is underway. The initiative is developing plans to conduct extensive scooping efforts in the management, agency, and private sectors, and to deliver usable products through publications, workshops, and meetings. The Biodiversity Initiative will focus most of its efforts in Oregon and Washington.

Keywords: Biodiversity, conservation, forest management.

(see Corvallis Lab order form.)

Proulx, G.; Aubry, K.; Birks, J.; Buskirk, S.; Fortin, C.; Frost, H.; Krohn, W.; Mayo, L.; Monakhov, V.; Payer, D.; Saeki, M.; Santos-Reis, M.; Weir, R.; Zielinski, W.

2004. World distribution and status of the genus *Martes* in 2000. In: Harrison, D.J.; Fuller, A.K.; Proulx, G., eds. Martens and fishers (*Martes*) in human-altered environments: an international perspective. [Location of publisher unknown]: Springer-Verlag Telos: 21–76. Chapter 2.

The genus *Martes* comprises seven species of martens, sables, and fishers, most of the forest-dwelling animals with valuable fur, distributed throughout North America, Europe, and Asia. Whereas the distribution of *Martes* significantly expanded in many parts of the world over the last 20 years, largely owing to several reintroduction programs, many populations are threatened by habitat loss and alteration. There is a need to develop cost-effective survey methods, monitor populations and fur-harvest activities, and assess the effects of natural and anthropogenic disturbance agents on habitat use by *Martes* species.

Keywords: Fisher, marten, distribution, status, conservation.

(see Olympia Lab order form.)

Wagner, R.S.; Miller, M.P.; Crisafulli, C.M.; Haig, S.M.

2005. Geographic variation, genetic structure, and conservation unit designation in the Larch Mountain salamander (*Plethodon larselli*). Canada Journal of Zoology. 83: 396–406.

Phylogenetic analyses of cytochrome b revealed a clade of haplotypes from populations north of the Columbia River derived from a clade containing haplotypes from the river's southwestern region. Haplotypes from southeastern populations formed a separate clade. Nucleotide diversity was reduced in northern populations relative to southern populations. These results were corroborated by analyses of RAPD loci, which revealed similar patterns of clustering and diversity. Network analyses suggested that northern populations were colonized following a range expansion mediated by individuals from populations located southwest of the river. Changes in the Columbia River's location during the Pliocene and Pleistocene likely released distributional constraints on this species, permitting their northern range expansion.

Keywords: Larch Mountain salamander, genetic structure, Pacific Northwest amphibians.

(see Olympia Lab order form.)

Wildlife

Bull, E.L.

2003. Declines in the breeding population of Vaux's swifts in northeastern Oregon. Western Birds. 34: 230–234.

I investigated trends in the breeding population of Vaux's swift (*Chaetura vauxi*) in northeastern Oregon by revisiting, in 2003, 39 stands of trees that contained swifts in 1991. In 2003, the number of swifts in these stands was significantly fewer, with only 46 percent of the stands still containing swifts. Only 29 percent of the 58 nest and roost trees the swifts were using from 1989 to 1997 were still suitable for nesting in 2003; the remainder had fallen over, broken off, or become riddled with cavities. Factors that may be affecting the population include tree mortality caused by insect outbreaks and disease, tree harvesting, wildfire, climatic shifts, and habitat changes in the winter range.

Keywords: Swift, Vaux's swift, cavity nester, population trends, northeastern Oregon.

(see La Grande Lab order form.)

Bull, E.L

2005. Long-toed salamander, *Ambystoma macrodactylum* Baird. In: Jones, L.L.C.; Leonard, W.P.; Olson, E.H., eds. Amphibians of the Pacific Northwest. Seattle, WA: Seattle Audubon Society.

This species account of the long-toed salamander (*Ambystoma macrodactylum*) provides information on physical description, distribution, life history, natural history, and habitat.

Keywords: Long-toed salamander, Ambystoma macrodactylum*; species account.*

(see La Grande Lab order form.)

Coe, P.K.; Johnson, B.K.; Stewart, K.M., Kie, J.G.

2004. Spatial and temporal interactions of elk, mule deer and cattle. In: Rahm, J., ed. Transactions, 69th North American Wildlife and Natural Resources Conference. Washington, DC: Wildlife Management Institute: 656–669.

We documented interactions among these species in relation to how they distributed themselves over the landscape throughout the grazing season (April–October). Understanding the influence of each ungulate species on the other is a vital link to understanding population productivity, and nutritional status across seasons. Analysis of resource selection functions indicated that niche partitioning among species became less pronounced as summer progressed and animals converged on areas where quality and quantity of forage was highest. Our results suggest that models to predict and map ungulate

distributions for management purposes take into account spatial and temporal interactions as well as competitive cascades among those species.

Keywords: Elk, mule deer, cattle, interactions, spatial, temporal, Starkey Project.

(see La Grande Lab order form.)

Findholt, S.L.; Johnson, B.K.; Damiran, D.; DelCurto, T.; Kie, J.G.

2004. Diet composition, dry matter intake and diet overlap of mule deer, elk and cattle. In: Rahm, J., ed. Transactions, 69th North American Wildlife and Natural Resources Conference. Washington, DC: Wildlife Management Institute: 670–686.

Our objectives were to determine dietary overlap among the three species and whether grazing by either cattle or elk affected subsequent foraging dynamics of elk, mule deer, or cattle. When they were grazing pastures for the first time, diet overlap was 49 percent between cattle and elk and 59 percent between mule deer and elk, but only 19 percent between cattle and deer. In pastures previously grazed by cattle, dietary overlap increased to 60 percent (cattle and elk), 64 percent (mule deer and elk), and 38 percent (cattle and mule deer). In pastures previously grazed by elk, dietary overlap between deer and elk increased to 67 percent. Bite rates of cattle declined in pastures previously grazed by cattle. Total dry matter intake of all three species did not decline in pastures previously grazed by cattle or elk.

Keywords: Diet overlap, elk, mule deer, cattle, grazing, Starkey Project.

(see La Grande Lab order form.)

Forsman, E.D.; Anthony, R.G.; Reid, J.A. [and others].

2002. Natal and breeding dispersal of northern spotted owls. Wildlife Monographs. 66(4): 1–34.

This monograph describes dispersal behavior of spotted owls based on a sample of 324 radio-marked juveniles and 1,151 owls that were banded and recaptured after dispersal from the original banding location. Median dispersal distances of radio-marked juveniles were 13.5 km for males and 22.9 km for females. Dispersal distances were similar for banded owls and radio-marked owls. About 6 percent of nonjuvenile owls dispersed to new territories each year. Most cases of breeding dispersal involved short movements between neighboring territories. Dispersal results in very low rates of close inbreeding in spotted owls, although inbreeding between distant relatives is common.

Keywords: Northern spotted owl, spotted owl dispersal.

(see Corvallis Lab order form.)

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

2004. Distribution and abundance of red tree voles in Oregon based on occurrence in pellets of northern spotted owls. Northwest Science. 78(4): 294–302.

Skeletal remains of 2,941 red tree voles were identified in pellets of 1,102 pairs of spotted owls. These data were used to clarify the range of the red tree vole in Oregon and to estimate the relative abundance of tree voles in different counties in Oregon. Tree voles appeared to be most common in the coastal communities of southwest Oregon. In the Cascade Range, the proportion of tree voles in owl diets was negatively correlated with elevation, with few tree voles detected in diets of owls that occupied areas above 3,600 feet elevation. Although owls definitely do not sample their prey randomly, we believe that our results do not reflect general patterns of tree vole abundance in Oregon.

Keywords: Spotted owl, Washington, home range, habitat use.

(see Corvallis Lab order form.)

Gaines, W.L.; Lyons, A.L., Lehmkuhl, J.F.; Raedeke, K.J.

2005. Landscape evaluation of female black bear habitat effectiveness and capability in the North Cascades, Washington. Biological Conservation. 125(4): 411–425.

We used logistic regression to derive scaled resource selection functions (RSFs) for female black bears at two study areas in the North Cascades Mountains. We tested the hypothesis that the influence of roads would result in potential habitat effectiveness (RSFs without the influence of roads) being greater than realized habitat effectiveness (RSFs with roads). Roads consistently had a negative influence on black bear RSFs across seasons and study areas. Roads reduced habitat effectiveness during all seasons at both study areas and changes in the potential habitat values ranged from 1.7 percent to 16.9 percent. The greatest reduction in habitat values occurred during the early season on the west-side study area owing to high open road densities. These results support the hypothesis that roads reduce habitat effectiveness for black bears. The influence of roads could be reduced through road closures to reduce open road densities and limit traffic volumes. We then used the scaled RSFs in a habitat-based population model to assess the influences of timber harvest and roads on potential black bear population sizes. On the west-side study area, the potential black bear population size was most influenced by moderate-use roads and timber harvest during the early season (41 percent reduction). On the east-side study area, low-use roads had the greatest effect on potential black bear population during the early season

(10 percent reduction). During the late season, in both study areas, roads had less influence on the potential population sizes as bears were able to access habitats away from roads. The habitat-population model provided reasonable estimates of bear densities compared to other study areas with similar habitats and could be extrapolated to estimate potential black bear populations in other areas with similar habitats. This approach may provide a useful link between the landscape ecology and population biology of black bears, and could eventually be useful in the development of habitat-based population viability analyses.

Keywords: Black bear, habitat effectiveness, habitat capability, North Cascades.

(see Wenatchee Lab order form.)

Jack, S.B.; Parks, C.G.; Stober, J.M.; Engstrom, R.T.
2004. Inoculating red heart fungus (*Phellinus pini*) to create nesting habitat for the red-cockaded woodpecker. In: Costa, R.; Daniels, S.J., eds. Red-cockaded woodpecker: road to recovery. Blaine, WA: Hancock House Publishers LTD: 447–452.

The expansion of short-rotation forestry in the southern United States has nearly eliminated old trees with heart rot decay that are needed by red-cockaded woodpeckers. Preliminary results of inoculating trees with red heart fungus (*Phellinus pini*) show 94 percent infection after 6 years. Nine of ten trees were used by woodpeckers for nesting within 6 years after inoculation. Thirteen years after inoculation, all trees are living and are used by woodpeckers and secondary cavity nesters. The presence of inoculated trees has not increased the risk of heart rot infection in uninoculated trees. Additional trials are being initiated in Georgia.

Keywords: Red heart fungus, inoculation, decay, cavities.

(see La Grande Lab order form.)

Johnson, B.K.; Ager, A.A.; Noyes, J.H.; Cimon, N.
2004. Elk and mule deer responses to variation in hunting pressure. In: Rahm, J. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 625–640.

Elk responded to hunters by fleeing, whereas deer responded by hiding. Energetic costs to elk from hunting may be significant and related to hunter density and number of days of hunting; the energetic costs to deer may not be as great. Resulting reduced fat levels may be more important during harsh winters and may carry over through the next year as cows rebuild tissues catabolized during winter. Our calculations did not account for disruption resulting in shorter foraging cycles or moving to areas with poorer forage. If these occur, the effects may be more pronounced than our estimate. Restricting motorized travel for hunters may reduce stress on unharvested animals.

Keywords: Elk, mule deer, hunter density, traffic, energetics, Starkey Project.

(see La Grande Lab order form.)

Johnson, B.K.; Wisdom, M.J.; Cook, J.G.
2004. Issues of elk productivity for research and management. In: Rahm, J. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 551–571.

We hypothesize that the underlying basis for elk productivity is nutrition and that predation, hunting, weather variation, and human disturbance are additive factors in their effects on the decline of productivity. Where limiting factors are prevalent, density-dependent effects may not be apparent. With high level of nutrition, elk recruitment would respond positively even with predation and hunting. If, however, predator-to-prey ratios were shifted dramatically by hunting, severe winter mortality, or increases in predators, then predation could keep elk at a lower equilibrium such that elk recruitment would remain low.

Keywords: Elk, productivity, populations, Starkey Project.

(see La Grande Lab order form.)

Kie, J.G.; Ager, A.A.; Bowyer, R.T.
2005. Landscape-level movements of North American elk (*Cervus elaphus*): effects of habitat patch structure and topography. In: Rahm, J. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 475–490.

We examined the effects of landscape structure on movements of North American elk by using previously developed models. Speed of movements by elk was not related to habitat patch characteristics. Elk did move parallel to stream drainages, however.

Keywords: Elk movements, landscape structure, topography.

(see La Grande Lab order form.)

Kie, J.G.; Ager, A.A.; Cimon, N.J.; Wisdom, M.J.; Rowland, M.M.; Coe, P.K.; Findholt, S.L.; Johnson, B.K.; Vavra, M.

2004. The Starkey databases: spatial-environmental relations of North American elk, mule deer, and cattle at the Starkey Experimental Forest and Range in northeastern Oregon. In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 475-490.

LORAN is a marine radio-navigation system that was well-established prior to widespread use of global positioning systems (GPS). The LORAN system comprises transmitting collars placed on individual animals and a control-receiving subsystem. Every 20 seconds, a central computer pages one of the many collars deployed. As many as 150 animals have been included in the user-defined paging list simultaneously. The LORAN receiver in the collar responds by collecting raw LORAN data, which are then retransmitted via a VHF radio link to one of several relay towers located throughout the Starkey Experimental Forest and Range.

Keywords: LORAN, GPS, elk, mule deer, cattle, Starkey Experimental Forest and Range.

(see La Grande Lab order form.)

Lehmkuhl, J.F.

2005. Wildlife adaptations and management in eastside interior forests with mixed severity fire regimes. In: Taylor, L.; Zelnik, J.; Cadwallader, S.; Hughes, B. Mixed severity fire regimes: ecology and management. Symposium proceedings. Misc. Publ. 3. Davis, CA: Association for Fire Ecology: 177–186.

Little is known about the effects of mixed-severity fire and the resulting patchy forest pattern on wildlife. I used species-habitat data to assess the percentage of breeding species associated with early- and late-seral conditions, snags, and down wood in three dominant interior forest types with low-, moderate-, and high-severity fire regimes. Wildlife appear well-adapted to patchy mixed-severity landscapes; thus a coarse-filter conservation strategy is appropriate. Two "families" of species of conservation concern need to be considered for additional fine-filter considerations: low-elevation old-forest associates and broad-elevation old-forest associates.

Keywords: Fire regimes, wildlife, fuel management, restoration.

(see Wenatchee Lab order form.)

Leonard, W.P.; Bull, E.L.

2005. Columbia spotted frog. In: Jones, L.L.C.; Leonard, W.P.; Olson, D.H., eds. Seattle, WA: Seattle Audubon Society. 4 p.

This species account of the Columbia spotted frog (*Rana luteiventris*) provides information on physical description, distribution, life history, natural history, and habitat.

Keywords: Columbia spotted frog, Rana luteiventris*, species account.*

(see La Grande Lab order form.)

Marcot, B.G.

2005. The ecological and cultural functions of invertebrates in the Congo River basin. In: Wings: Essays on Invertebrate Conservation. The Xerces Society. 28(1): 13–17.

Invertebrates of the interior Congo River basin have been inventoried in historical collections, but in general are little studied. Many species may be regionally endemic, and many species likely play critical ecological roles of decomposition of vegetation and cycling of nutrients in the rain forests. Invertebrates play key cultural roles as transmitters or sources of disease, but some species (caterpillars, in particular) are also sources of protein and food for people. Termite larvae are used for fishing. Army ants pervade rain forests. Future conservation may consider appropriate use rather than inviolate preserves.

Keywords: Africa, Congo, invertebrates, tropical insects, tropical entomology.

(see Portland Lab order form.)

Marcot, B.G.

2005. Observations of owls in Western Democratic Republic of the Congo (with a note on African wood owl vocalizations). Tyto Newsbrief. International Owl Society. March 2005: 9–15.

During an expedition in August-September 2004 to Democratic Republic of the Congo, 11 individual owls of 3 species were discovered in the course of nocturnal surveys (red-chested owlet, Pel's fishing owl, African wood owl) in swamp forests. Recordings were made of the song of African wood owls, and sound spectrogram analyses revealed a cadence and frequency distribution different from songs of this species recorded elsewhere in Africa, possibly suggesting a unique taxonomy.

Keywords: Africa, Congo, tropical owls.

(see Portland Lab order form.)

Noyes, J.H.; Johnson, B.K.; Dick, B.L.; Kie, J.G.

2004. Influence of age of males and nutritional condition on short- and long-term reproductive success of elk. In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 572–585.

We conducted a study in two trials, from 1989 to 1993 and from 1995 to 1999, to evaluate the influence of male age on conception dates and pregnancy rates of female elk in northeast Oregon. Results of the first trial showed a significant influence of male age on conception dates but not on pregnancy rates. Objectives of the second trial were to evaluate the interaction of male age and female nutritional condition and to validate findings of the first trial. A single cohort of males within a 78-km^2 enclosure was allowed to function as herd sires as they matured from 1½ to 5½ years of age. Reproductive and nutritional data were obtained from hunter-killed adult female elk.

Keywords: Elk, reproduction, nutritional condition, age, Starkey Project.

(see La Grande Lab order form.)

O'Neil, T.A.; Bettinger, P.; Marcot, B.G.; Luscombe, B.W.; Koeln, G.T.; Bruner, H.J.; Barrett, C.; Pollock, J.A.; Bernatas, S.

2005. Using spatial technologies: GIS, GPS, Landsat imagery, and FLIR. In: Braun, C.E., ed. Techniques for wildlife investigations and management. Bethesda, MD: The Wildlife Society: 418–447. Chapter 15.

This chapter reviews the use of spatial technologies—geographic information systems (GIS), global positioning system (GPS), and remotely sensed data (Landsat and other satellite imagery and forward-looking infrared [FLIR]). Spatial technologies assist resource managers with mapping and incorporate data sets from various sources into one format. They also consolidate information about an area or issue. Importance of data documentation and accuracy are discussed as well as Internet applications.

Keywords: GIS, GPS, Landsat, remote sensing, wildlife habitat, habitat mapping, FLIR.

(see Portland Lab order form.)

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

2004. Modeling animal movements using stochastic differential equations. Environmetrics. 15: 643–657.

Bivariate stochastic differential equations (SDE) were used for modeling movements of 216 radio-collared female Rocky Mountain elk at the Starkey Experimental Forest and Range in northeastern Oregon. Spatially and temporally explicit vector fields were estimated by using approximating difference equations and nonparametric regression techniques. Estimated vector fields of movement were mapped onto the project area at selected times of the day to examine spatial patterns of movement in relation to topography. Using the concept of a potential function, we were able to study the influence of roads and grassland foraging areas on elk movements. We identified broad spatial patterns of elk movements and showed the time-dependent effects of habitat features within the habitat mosaic at Starkey. Our analyses quantify the cycles of movements in spring and summer in terms of attraction or repulsion to specific habitat features, and illustrate the magnitude, timing, and direction of those movements.

Keywords: Cervus elaphus*, diffusion process, potential functions, random vector field, splines, telemetry data.*

(see La Grande Lab order form.)

Rowland, M.M.; Wisdom, M.J.; Johnson, B.K.; Penninger, M.A.

2004. Effects of roads on elk: implications for management in forested ecosystems. In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 491–508.

We evaluated the road-density variable of a widely applied elk habitat model by using >100,000 radiolocations of elk on the Starkey Experimental Forest and Range in northeastern Oregon. Locations were collected during spring and summer, 1993–95, and were used to calculate habitat effectiveness scores based on the traditional elk-road density model. The same locations were also used to calculate selection ratios of elk in relation to distance to roads. Our results validate prior research and views that elk avoid roads opened to motorized traffic.

Keywords: Roads, elk, habitat, traffic, Starkey Experimental Forest and Range.

(see La Grande Lab order form.)

Smith, W.P.; Gende, S.M.; Nichols, J.V.

2004. Ecological correlates of flying squirrel microhabitat use and density in temperate rainforests of southeastern Alaska. Journal of Mammalogy, 85(4): 663–674.

We studied habitat relations of the Prince of Wales flying squirrels (*Glaucomys sabrinus griseifrons*) in temperate, coniferous rain forest of southeastern Alaska because of concerns over population viability from extensive clearcut logging in the region. We used stepwise logistic regression (SLR) to examine relations between microhabitat use and individual habitat features (measured variables) and habitat "factors," which were independent linear combinations of individual habitat variables generated from factor analysis. Seasonal (spring, autumn) models were created for upland, old-growth western hemlock/Sitka spruce (upland-OG) and peatland mixed-conifer forests (peatland-MC). Density of large trees and abundance of *Vaccinium* were positively correlated with microhabitat use in peatland-MC during both seasons with the odds of capturing a flying squirrel increasing by factors of 2.7 and 16.9 during spring and autumn, respectively, with an increase in density of 10 trees per hectare. Microhabitat use of upland-OG during autumn was related to *Vaccinium* ground cover and density of hard snags (50-74 cm); microhabitat use during spring was inversely correlated with percentage of surface cover of water. The performance of SLR models in predicting capture sites with individual variables was similar to models of multivariate factors, suggesting that habitat "factors" were not more thorough in explaining variation in habitat use than individual habitat elements.

Keywords: Tree density, Glaucomys sabrinus griseifrons*, logistic regression, microhabitat use, northern flying squirrel, old growth, southeastern Alaska, temperate rain forest.*

(see Juneau Lab order form.)

Smith, W.P.; Gende, S.M.; Nichols, J.V.

2005. The northern flying squirrel as an indicator species of temperate rain forest: test of an hypothesis. Ecological Applications. 15(2): 689–700.

We studied habitat relations of northern flying squirrels (*Glaucomys sabrinus griseifrons*) in temperate rain forest of southeastern Alaska because of concerns over biological diversity from extensive clearcut logging in the region. We evaluated stepwise logistic regression (SLR) models of seasonal (spring, autumn) microhabitat use developed from individual habitat features (measured variables) and from habitat "factors," which were independent linear combinations of individual habitat variables generated from factor analysis. We compared the efficacy of single variable vs. multifactorial models in explaining variation in microhabitat selection to evaluate the suitability of the northern flying squirrel as a management indicator species. Multivariate models did not perform as well as models of individual variables in predicting capture sites. Two individual variables, density of large (>74 cm diameter at breast height) trees and ground cover of *Vaccinium* spp., explained much of the variation in microhabitat use. We conclude that the habitat of *G. sabrinus* in southeastern Alaska is not an emergent property of old-growth coastal coniferous forest and hypothesize that their diet may be less specialized in rain forest and depend less on hypogeous fungi than the diet of populations in the Pacific Northwest. Our results corroborate some patterns reported for mesic coniferous forests of western North America but suggest that the northern flying squirrel in temperate rain forest of southeastern Alaska differs ecologically from populations in the Pacific Northwest in important ways that may diminish its suitability as a management indicator species.

Keywords: Factor analysis, Glaucomys sabrinus griseifrons*, logistic regression, management indicator species, microhabitat use, multivariate habitat factors, northern flying squirrel, old growth, southeastern Alaska, temperate rain forest.*

(see Juneau Lab 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 among species' responses 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 the 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 Lab order form.)

Stewart, K.M.; Bowyer, R.T.; Dick, B.L.; Johnson, B.K.; Kie, J.G.

2005. Density-dependent effects on physical condition and reproduction in North American elk: an experimental test. Oecologia. 143: 85–93.

We examined condition and reproduction in elk at two population densities. Age-specific pregnancy rates were lower in the high-density population and were associated with declines in body condition.

Keywords: Elk, population density, condition, reproduction.

(see La Grande Lab order form.)

Swingle, J.K.; Forsman, E.D.; Sovern, S.G.

2004. A method for live-trapping tree voles. Northwestern Naturalist. 85: 134–135.

We describe a method for live-trapping red tree voles by using Havahard live traps. We captured three voles during 184 trap nights. This method is labor-intensive and requires specialized tree climbing skills, but is one more tool that can be used to study tree voles.

Keywords: Red tree vole, Arborimus longicaudis*, Sonoma tree vole,* Arborimus pomo*, live trapping, Oregon*.

(see Corvallis Lab order form.)

Thomas, J.W.; Wisdom, M.J.

2004. Has the Starkey Project delivered on its commitments? In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 798–812.

Keys to the Starkey Project's success have been many: (1) unique technologies that have facilitated the completion of a myriad of studies previously not possible; (2) long-term commitments by diverse federal, state, private, and tribal interests; (3) continued focus on ungulate issues of highest relevance to management; and (4) constant and open dialogue and sharing of the research with all interests and resource users. Perhaps most impressive is the economic return from the research, which has far exceeded the 20 million dollars invested by partners during the past 15 years. This unique and long-lasting program is a shining example of how applied research can and should be conducted.

Keywords: Research, Starkey Project, Starkey Experimental Forest and Range.

(see La Grande Lab order form.)

Vavra, M.; Wisdom, M.J.; Kie, J.G.; Cook, J.G.; Riggs, R.A.

2004. The role of ungulate herbivory and management on ecosystem patterns and processes: future direction of the Starkey Project. In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 785–797.

Forest conditions in the Western United States are such that major changes are likely in the coming decades. Dense forest understories resulting from fire suppression, tree mortality caused by insect and disease outbreaks, and ungulate grazing have contributed to the current situation. In the coming years, conflagrations will continue on forests where excessive fuel buildup has occurred, and extensive fuel reduction projects will be initiated to prevent them. In both cases, secondary succession will be initiated and herbivory will influence successional pathways and outcomes. It is expected that this ongoing research will interface with and be an integral part of related ungulate research in the interior Pacific Northwest.

Keywords: Ungulate, herbivory, management, future, Starkey Project.

(see La Grande Lab order form.)

Wisdom, M.J.; Ager, A.A.; Preisler, H.K.; Cimon, N.J.; Johnson, B.K.

2004. Effects of off-road recreation on mule deer and elk. In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 531–550.

We studied the effects of all-terrain vehicle (ATVs), horseback, mountain bike, and foot traffic on mule deer and elk during 2002 at the Starkey Experimental Forest and Range (Starkey), northeast Oregon. Movement rates and flight responses were substantially lower for elk during periods of rest and substantially higher during periods of

all four activities. Compared to elk, mule deer showed less change in behavior during periods of no human activity versus any of the four activities. Our results indicate that elk react similarly to the four off-road activities, in contrast to periods of no human activity. Our results suggest that all four off-road recreational activities deserve consideration in management of their effects on mule deer and elk.

Keywords: Mule deer, elk, Starkey Project, Starkey Experimental Forest and Range.

(see La Grande Lab order form.)

Wisdom, M.J.; Cimon, N.J.; Johnson, B.K.; Garton, E.O.; Thomas, J.W.

2004. Spatial partitioning by mule deer and elk in relation to traffic. In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 509–530.

We evaluated the responses of elk and mule deer to varying rates of traffic at the Starkey Experimental Forest and Range (Starkey) in northeast Oregon. Our study was important because of the large reduction in ungulate carrying capacity that may occur in areas near traffic and traffic-related human activities. Our study was conducted during spring-summer, 1993-95, within the 7762-ha main study area of Starkey. Road segments within the main study area were classified into eight rates of traffic, based on counts of traffic enumerated from more than 50 automated counters along roads. An automated telemetry system monitored the movements of 12 to 31 radio-collared females (by species by season) generating over 160,000 locations. Spring-summer habitat models for elk may not account for patterns of resource selection by mule deer on jointly occupied range; resource needs of each species must be addressed separately. Forage- or nutrition-based habitat models that exclude road or traffic variables have the potential to be highly inaccurate, given the large magnitude of difference in selection shown by sympatric populations of deer and elk in relation to rates of traffic and types of roads.

Keywords: Traffic, elk, mule deer, partitioning, telemetry, Starkey Experimental Forest and Range.

(see La Grande Lab order form.)

Wisdom, M.J.; Johnson, B.K.; Vavra, M.; Boyd, J.M.; Coe, P.K.; Kie, J.G.; Ager, A.A.

2004. Cattle and elk responses to intensive timber harvest. In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 727–758.

We evaluated the responses of cattle and elk to intensive timber harvest under a controlled, landscape experiment at the Starkey Experimental Forest and Range. Elk distributions shifted substantially in response to timber harvest, but cattle distributions were unchanged. Neither species of ungulate lost or gained weight in response to timber harvest, but elk vulnerability to being killed by hunters increased substantially after timber harvest. The increased openness following timber harvest, combined with the increased access to hunters provided by roads constructed during harvest had a substantial effect on elk vulnerability, but other effects on cattle and elk appeared minimal.

Keywords: Elk, cattle, timber harvest, timber management.

(see La Grande Lab order form.)

Wisdom, M.J.; Rowland, M.M.; Johnson, B.K.; Dick, B.L.

2004. Overview of the Starkey Project: mule deer and elk research for management benefits. In: Rahm, J., ed. Transactions of the 69th North American wildlife and natural resources conference. Washington, DC: Wildlife Management Institute: 455–474.

Managers have long been concerned about the welfare of mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) on public lands in the Western United States. In the 1980s, managers became especially focused on the potential effects of timber management, livestock grazing, road use, and ungulate harvest strategies on mule deer and elk. These resource practices caused extensive changes in environmental conditions during the 1980s and earlier decades, but the potential responses of deer and elk populations were uncertain and widely debated. As a result, the Starkey Project was initiated in the late 1980s at the USDA Forest Service's Starkey Experimental Forest and Range in northeastern Oregon.

Keywords: Mule deer, elk, management, Starkey Project, Starkey Experimental Forest and Range.

(see La Grande Lab order form.)

Wood Utilization

DeBell, D.S.; Singleton, R.; Gartner, B.L.; Marshall, D.D.

2004. Wood density of young-growth western hemlock: relation to ring age, radial growth, stand density, and site quality. Canadian Journal of Forest Research. 34: 2433–2442.

Breast-high stem sections were sampled from 56 western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) trees growing in 15 plots representing a wide range of tree and site conditions in northwestern Oregon. Growth and wood density traits of individual rings were measured via X-ray densitometry, and relationships of ring density and its components to age and growth rate were analyzed. Ring density was highest (0.49 g/cm^3) near the pith, declined to 0.40 g/cm^3 at age 10, remained stable to about age 25, and then increased gradually and remained between 0.43 and 0.44 g/cm^3 from age 38 to 45 and beyond. A negative influence of rapid growth on whole ring density was greatest at young ages and diminished with time, becoming nonsignificant beyond age 30. Earlywood density, latewood density, and latewood proportion were all negatively related to ring width at young ages. but by age 21–25, latewood proportion was the only component of ring density that remained significantly diminished by increased growth rate. Residual differences in wood density (after age and growth rate were considered) did not appear to be related to either stand density or site class. Overall, young-growth hemlock trees are relatively uniform in wood density and likely to be more so if grown in intensively managed stands.

Keywords: Western hemlock, wood density, ring age, stand density.

(see Olympia Lab order form.)

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 Forestry Research. 35: 331–33.9

Many stands of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) 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 the resulting wood quality. Modulus of elasticity (MOE), modulus of rupture (MOR), microfibril angle (MFA), 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 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. Trees from heavily infected stands (needle retention <2 years) had higher MOE, wood density, and latewood proportion and lower sapwood moisture content than trees from healthier stands. Breast-height age (BHage) was also correlated with these properties, but age alone did not explain all of the increases. MFA was not associated with SNC severity. Within stands, needle retention was not associated with MOE or MOR. The increase in latewood proportion in diseased stands appears to be the driving factor behind their increase in stiffness (MOE). Ring width decreased with decreased needle retention, and the examined wood properties generally showed stronger correlations with ring width than with needle retention.

Keywords: Swiss needle cast, MOE, MOR, wood quality.

(see Corvallis Lab order form.)

Nicholls, D.L.; Donovan, G.H.; Roos, J.

2004. Consumer preferences for kitchen cabinets made from red alder: a comparison to other hardwoods. Wood and Fiber Science. 36(3): 432–442.

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

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

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Effect of growth ring orientation and placement of earlywood and latewood on MOE and MOR of very-small clear Douglas-fir beams.

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