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Bibliographies

07-269

Pacific Northwest Research Station.

2007. Recent publications of the Pacific Northwest Research Station, first quarter 2007.

Keywords: Bibliographies (forestry).

http://www.fs.fed.us/pnw/pubs/1q07.pdf

07-495

Pacific Northwest Research Station.

2007. Recent publications of the Pacific Northwest Research Station, second quarter 2007.

Keywords: Bibliographies (forestry).

http://www.fs.fed.us/pnw/pubs/2q07.pdf

Fire

07-195

Youngblood, A.; Bigler-Cole, H.; Fettig, C.J.; Fiedler, C.; Knapp, E.E.; Lehmkuhl, J.F.; Outcalt, K.W.; Skinner, C.N.; Stephens, S.L.; Waldrop, T.A.

2007. Making fire and fire surrogate science available: a summary of regional workshops with clients. Gen. Tech. Rep. PNW-GTR-727. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 59 p.

The national Fire and Fire Surrogate (FFS) study is an integrated network of long-term studies designed to provide better information on the consequences of using fire and fire surrogate treatments for fuel reduction and forest restoration. Four regional workshops (in Montana, California, Alabama, and North Carolina) were conducted with invited clients to identify effective and efficient means of communicating FFS study findings to a wide array of users. This document is a summary and synthesis of the lessons learned during the four workshops. Participants identified key users of FFS science and technology, specific pieces of information that users most desired, and how this information might be applied to resolve fuel reduction and restoration issues. They offered recommendations for improving overall science delivery and specific ideas for improving delivery of FFS study results and information.

Keywords: Fire and fire surrogate study, fuel reduction treatments, forest restoration treatments, science delivery, communication plans, participatory management.

http://www.fs.fed.us/pnw/pubs/pnw_gtr727.pdf

Forest Management

05-070

Joslin, L.

2007. Ponderosa promise: a history of U.S. Forest Service Research in central Oregon. Gen. Tech. Rep. PNW-GTR-711. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 121 p.

Research in Oregon and Washington forests east of the Cascade Range crest began in the late 1890s. The Pringle Falls Experimental Forest was established in 1931. Early research focused on harvest and silviculture of the commercially valuable ponderosa pine. USDA Forest Service scientists and university colleagues pioneered research on the silviculture, ecology, insect pests, and diseases of ponderosa pine forests, and eventually studied other east-side forest ecosystems as well. Findings from Pringle Falls and, from 1963–1996, at the Bend Silviculture Laboratory, have become today's fundamental knowledge of east-side forest ecosystems. Forest science research continues today at Pringle Falls and other sites in the forests of central Oregon.

Keywords: Pringle Falls, experimental forest, history, ponderosa pine, Bend Laboratory.

http://www.fs.fed.us/pnw/pubs/pnw_gtr711.pdf

07-198

Routman, K.

2007. Forest communities and the Northwest Forest Plan: what socioeconomic monitoring can tell us. Science Findings 95. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 6 p.

As part of a comprehensive review of the Northwest Forest Plan's first 10 years, scientists assessed changing socioeconomic conditions in more than 1,300 forest communities in the Plan area. They also selected three national forests, one Bureau of Land Management district, and 12 associated communities for closer inspection to investigate the links between federal forest management and socioeconomic conditions. Outcomes associated with the Plan were mixed. Predicted timber outputs generally were not met, about a third of communities decreased in socioeconomic well-being between 1990 and 2000 while another third increased, and many of the initiatives intended to assist local economies were not timely or adequately funded to benefit communities most affected by timber-industry job losses.

Keywords: Northwest Forest Plan, socioeconomic conditions.

http://www.fs.fed.us/pnw/sciencef/scifi95.pdf

Miscellaneous

07-122

Sands, Y.; Richardson-Dodge, S.

2007. Sources and science : a guide to experts at the Pacific Northwest Research Station. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 90 p.

The Sources and Science is a publication targeted primarily to journalists and others who need expert sources for science information. More than 80 scientists currently conduct research for the Station. Many of them are profiled in this guide. This guide is divided into four broad categories representing scientists' areas of expertise: forests and plants, fire and air, wildlife and aquatics, and economics and social research. A glossary and two indexes—by scientist and subject—also are provided to help you understand and locate the information needed.

http://www.fs.fed.us/pnw/pubs/sources-science07.pdf

Plant Ecology

07-095

Johnson, C.G.

2007. Rangeland exclosures of northeastern Oregon: stories they tell (1936–2004). Gen. Tech. Rep. PNW-GTR-724. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

Rangeland exclosures installed primarily in the 1960s, but with some from the 1940s, were resampled for changes in plant community structure and composition periodically from 1977 to 2004 on the Malheur, Umatilla, and Wallowa-Whitman National Forests in northeastern Oregon. They allow one to compare vegetation with all-ungulate exclusion (known historically as game exclosures), all-livestock exclusion (known historically as stock exclosures), and with no exclusion (known as open areas). Thirteen upland rangeland exclosures in northeastern Oregon were selected and are presented with plant community trend data and possible causes of changes over time. Key findings are that moderate grazing by native ungulates afforded by the stock exclosures generally stimulated bunchgrasses to retain dominance and vitality; native bunchgrasses can replace invasive rhizomatous plants given a reduction in disturbance over time; shrubs increased, and invasive annuals that established following severe disturbances to the grassland community do diminish with aggressive competition from perennial bunchgrasses.

Keywords: Exclosure, northeastern Oregon, plant community, plant association, trend.

http://www.fs.fed.us/pnw/pubs/pnw_gtr724.pdf

Resource Inventory

06-298 *(Number published in previous list was in error. This is a corrected number)*

Gray, A.N.; Fried, J.S.; Christensen, G.; Potts, L.

2006. Timber resource statistics for forest land in eastern Washington, January 2002. Resour. Bull. PNW-RB-251. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 46 p.

This report summarizes timber resource statistics for the 20 counties in eastern Washington. The inventory sampled all private and public lands except those administered by the National Forest System in 2001, and those that were reserved from management for wood products. Area information for parks and other reserves was obtained directly from the organizations managing these areas. Statistical tables provide estimates of land area, timber volume, growth, mortality, and harvest for eastern Washington as a whole. Estimated area of forest on non-national-forest land

was 4.9 million acres, and net volume of growing stock on timberland was 8.7 billion cubic feet. Estimated annual growth on non-national-forest timberland from 1990 to 2001 was 203 million cubic feet; average annual mortality was 84 million cubic feet; average annual harvest was 288 million cubic feet.

Keywords: Forest inventory, statistics (forest), land area, land use change, timber volume, eastern Washington.

http://www.fs.fed.us/pnw/pubs/pnw_rb251.pdf

Wildlife

07-048

Saab, V.; Block, W.; Russell, R.; Lehmkuhl, J.; Bate, L.; White, R.

2007. Birds and burns of the interior West: descriptions, habitats, and management in western forests. Gen. Tech. Rep. PNW-GTR-712. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 23 p.

This color leaflet summarizes and highlights information from research on how fire management activities impact fire-associated bird species. Some species benefit from fire and some do not, and resource managers play an important role in influencing the outcomes of various bird species. This leaflet provides key findings related to management implications, and also provides references to more indepth information sources.

Keywords: Fire, birds, endangered species, nesting habitat, migratory birds, prescribed burning.

http://www.fs.fed.us/pnw/pubs/pnw_gtr712.pdf

Publications Available Elsewhere

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

Ecosystem Structure and Function

Lenihan, J.M.; Drapek, R.; Neilson, R.

2006. Terrestrial ecosystem changes. In: Smith, J.B.; Mendelsohn, R. The impact of climate change on regional systems, a comprehensive analysis of California. United Kingdom: Edward Elger: 60–85. Chapter 5.

In the future, global climate change will increasingly interact with and intensify the pressures of a growing population on California's natural ecosystems. Recent studies show that even gradual and apparently small changes in climate can lead to catastrophic shifts in ecosystems when ecosystem resilience has already been compromised by human exploitation. In this study, we used MC1, a state-of-the-art dynamic vegetation model, to investigate the sensitivity of natural ecosystems in California under two different future climate scenarios. MC1 simulates vegetation succession at large spatial extents through time while estimating variability in the carbon budget and responses to episodic events such as drought and fire. Results of the simulations demonstrate certain ecosystem sensitivities and interactions that are likely to be features of the response of both natural and semi-natural systems to the relatively certain rise in temperature and less certain changes in precipitation. The most widespread response was a shift from conifer-dominated forests to mixed forests of conifers and evergreen hardwoods, primarily in the northern half of the state.

Keywords: Global change, ecosystem change, California, simulation.

(see Corvallis lab order form)

Millar, C.; Neilson, R.; Bachelet, D.; Drapek, R.; Lenihan, J.

2006. Climate change at multiple scales. In: Forests, carbon and climate change: a synthesis of science findings. Portland, OR: Oregon Forest Resources Institute: 31–61. Chapter 3.

Climate change is a central focus of paleoecology, the study of past vegetation dynamics. Large climate changes over thousands of years have triggered speciations and the evolution of major adaptations among and within species. On scales of decades and centuries, smaller climate changes have driven mixing and remixing of plant communities and catalyzed shifts in population size. Without understanding these natural climate processes and the ways in which forest species are adapted to climate changes, decisions may be made that are counter-productive to the forests we wish to steward. The goal of this paper is to outline natural climate patterns and mechanisms as important context for understanding current and future changes.

Keywords: Climate change, forest management, past climates.

(see Corvallis lab order form)

Schultz, M.; Hennon, P.

2007. Spruce bettle epidemic and successional aftermath in Glacier Bay. In: Piatt, J.F.; Gende, S.M., eds. Proceedings of the 4th Glacier Bay science symposium. Reston, VA: U.S. Geological Survey: 12–15.

A beetle outbreak that began in the mid 1970s and continued into the 1990s caused significant mortality to Sitka spruce in the Beardslee Islands and a few neighboring vicinities at Glacier Bay National Park in Alaska. This paper reports on monitoring efforts to describe the extent of mortality, the persistence of dead standing trees through time, and the response of understory flora to this disturbance.

Keywords: Spruce beetle, plant succession, snag deterioration.

(see Juneau lab order form)

Fire

Ager, A.A.; Finney, M.A.; Kerns, B.K.; Maffei, H.

2007. Modeling wildfire risk to northern spottel owl (*Strix occidentalis caurina*) habitat in central Oregon, USA. Forest Ecology and Management. 246: 45–56.

In this paper we demonstrate a probabilistic risk analysis model for quantifying wildfire threats to spotted owl habitat and comparing the efficacy of fuel treatment scenarios. We used wildfire simulation methods to calculate spatially-explicit probabilities of habitat loss for fuel treatment scenarios on a 70 245-ha study area in central Oregon, USA. We simulated 1,000 wildfires with random ignition locations and weather conditions that replicated a recent large fire within the study area. A flame length threshold for each spotted owl habitat stand was determined using the Forest Vegetation Simulator and used to predict

the proportion of fires that resulted in habitat loss. Wildfire modeling revealed a strong spatial pattern in burn probability created by natural fuel breaks (lakes and lava flows). We observed a nonlinear decrease in the probability of habitat loss with increasing treatment area. Fuels treatments on a relatively minor percentage of the forested landscape (20 percent) resulted in a 44 percent decrease in the probability of spotted owl habitat loss averaged over all habitat stands. The modeling system advances the application of quantitative and probabilistic risk assessment for habitat and species conservation planning.

Keywords: Wildfire risk, expected loss, Northern spotted owl, wildfire simulation, forest vegetation simulator, FlamMap habitat conservation planning.

(see Corvallis lab order form)

Berry, A.H.; Donovan, G.; Hesseln, H.

2006. Prescribed burning costs and the WUI: economic effects in the Pacific Northwest. Western Journal of Applied Forestry. 21(2): 72–78.

Federal fuels managers are increasingly using prescribed fire to decrease hazardous fuels and risks to resources in wildiand and urban settings. Two factors have become apparent over the last several years: prescribed burning costs are rising, and costs exhibit substantial variability. Using multiple regression analysis, we show that the cost of fuels management is influenced by the wildland-urban interface, number of acres treated, designated protection areas, slope, elevation, treatment type, fire regime, agency, and season.

Keywords: Hedonic, fire, Colorado Springs, spatial statistics.

(see Portland lab order form)

Falk, D.A.; Miller, C.M.; McKenzie, D.; Black, A.E.

2007. Cross-scale analysis of fire regimes. Ecosystems. DOI: 10.1007/s10021-007-9070-7. http://www.springerlink.com/content/d33g467831737200/. (October 1, 2007).

We examine historical fire regimes in forests of western North America, focusing on how observed patterns of fire frequency change across spatial scales. To quantify changes in fire frequency across spatial scale, we derive the event-area (EA) relationship and the analogous interval-area (IA) relationship, using historical data from low- and high-severity fire regimes. The EA and IA provide multiscale descriptions of fire regimes, as opposed to standard metrics that apply only at a single scale. Patterns in fire-scaling relations can be used to identify how controls on fire regimes change across spatial and temporal scales. Future research that considers fire as a multiscale process will be directly applicable to landscape-scale fire management.

Keywords: Fire regimes, cross-scale analysis, interval-area, event-area.

(see Seattle lab order form)

Jakes, P.L.; Kruger, L.; Monroe, M.; Nelson, K.; Sturtevant, V.

2007. Improving wildfire preparedness: lessons from communities across the U.S. Human Ecology Review. 14(2): 188–197.

Communities across the United States have been taking action to adapt to the wildfire risk they face. In a series of case
studies conducted in 15 communities, researchers identified and described four elements that form the foundation for community wildfire preparedness: landscape, government, citizens, and community.

Keywords: Wildfire, community wildfire preparedness.

(see Juneau lab order form)

Lentile, L.; Morgan, P.; Hardy, C.; Hudak, A.; Means, R.; Ottmar, R.; Robichaud, P.; Kennedy Sutherland, E.; Szymoniak, J.; Way, F.; Fites-Kaufman, J.; Lewis, S.; Mathews, E.; Shovic, H.; Ryan, K.

2007. Value and challenges of conducting rapid response research on wildland fires. Gen. Tech. Rep. RMRS-GTR-193. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 11 p.

Rapid Response Research is conducted during and immediately after wildland fires, in coordination with fire management teams, in order to collect information that can best be garnered in situ and in real-time. This information often includes fire behavior and fire effects data, which can be used to generate practical tools such as predictive fire models for managers. We identify challenges including high costs, logistics, and safety; understanding and fitting into the fire management organization; building relationships with managers and other researchers; and science delivery. Our recommendations for safer and more effective Rapid Response Research are that researchers must understand the fire organizations and their objectives because a fire manager's primary responsibility is to manage the fire safely, not support research. In addition, researchers must be prepared with equipment, a "red card" signifying sufficient training and fitness, and appropriate

knowledge when arriving to do research on a fire. Further, researchers must have and follow an operations plan. We recommend using a liaison to build strong relationships with managers and sharing what was learned.

Keywords: Wildland fire, fire research, fire management.

(see PWFSL order form)

Fish

Hard, J.J.; Myers, J.M.; Ford, J.J.; Kope, R.G.; Pess, G.R.; Waples, R.S.; Winans, G.A.; Berejikian, B.A.; Waknitz, F.W.; Adams, P.B.; Bisson, P.A.; Campton, D.E.; Reisenbichler, R.R.

2007. Status review of Puget Sound steelhead (*Oncorhynchus mykiss*). Seattle, WA: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service: Tech. Mem. NMFS-NWFSC-81.

Variability in the duration of freshwater and marine residence of sockeye salmon *Oncorhynchus nerka* has been recognized for some time and is the basis for separating the species into different life history strategies. We analyzed the results of annual age-composition surveys of spawning sockeye salmon conducted by Alaska Department of Fish and Game in the Copper River Delta and Bering River regions of south-central Alaska from 1990 to 2004 to quantify the variability in freshwater and marine residence time. Significant variation among years and among locations was detected by multivariate analysis of similarity. The two most common life history forms were sockeye salmon that spent one winter in freshwater after emergence followed by either 2 or 3 years in marine waters before returning to spawn (1.2 or 1.3 European age notation).

Keywords: Sockeye salmon, life history.

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Powers, S.P.; Bishop, M.A.; Moffitt, S.; Reeves, G.H.

2007. Variability in freshwater, estuarine, and marine residence of sockeye salmon *Oncorhynchus nerka* within the Copper and Bering River Deltas, Alaska. American Fisheries Symposium. 54: 87–99.

Steelhead comprising the Puget Sound evolutionarily significant unit (ESU) are likely to become at risk of extinction throughout all or a significant portion of their range in the foreseeable future, but are not currently in danger of extinction. The current status of the species supports a listing of threatened under the Endangered Species Act.

Keywords: Steelhead, Puget Sound, Endangered Species Act.

(see Corvallis lab order form)

Williams, I.; Reeves, G.H.; Graziano, S.L.; Nielsen, J.L.

2007. Genetic investigation of natural hybridization between rainbow and coastal cutthroat trout in the Copper River Delta, Alaska. Transactions of the American Fisheries Society. 136: 926–942.

Distribution of hybrids of cutthroat and rainbow trout in the Copper River Delta appeared to be nonrandom. Most hybrid individuals were found in streams with rainbow trout rather than in streams with cutthroat. There was no significant correlation between unique stream channel process groups and extent of hybridization. The distribution of backcrossed individuals suggested that at least some hybrids were reproductively viable.

Keywords: Cutthroat trout, rainbow trout, hybrids.

(see Corvallis lab order form.)

Forest Management

Ager, A.A.; McMahan, A.; Hayes, J.L.; Smith, E.L.

2007. Modeling the effects of thinning on bark beetle impacts and wildfire potential in the Blue Mountains of eastern Oregon. Landscape and Urban Planning. 80: 301–311.

We simulated management scenarios with and without thinning over 60 years, coupled with a mountain pine beetle outbreak (at 30 years) to examine how thinning might affect bark beetle impacts, potential fire behavior, and their interactions on a 16 000-ha landscape in northeastern Oregon. We employed the Forest Vegetation Simulator, along with submodels including the Parallel Processing Extension, Fire and Fuels Extension, and Westwide Pine Beetle Model. We also compared responses to treatment scenarios of two bark beetle-caused tree mortality susceptibility rating systems. As hypothesized, thinning treatments led to substantial reduction in potential wildfire severity over time. However, contrary to expectations, the Westwide Pine Beetle Model predicted higher beetle outbreak-caused mortality in thinned versus unthinned scenarios. Likewise, susceptibility ratings were also higher for thinned stands. Thinning treatments favored retention of early seral species such as ponderosa pine, leading to increases in proportion and average diameter of host trees. Increased surface fuel loadings and incidence of potential crown fire behavior were predicted postoutbreak; however, these effects on

potential wildfire behavior were minor relative to effects of thinning. We discuss apparent inconsistencies between the simulation outputs and literature, and identify improvements needed in the modeling framework to better address bark beetle-wildfire interactions.

Keywords: Landscape simulation modeling, forest vegetation simulator, thinning, bark beetles, wildfire behavior, westwide pine beetle model.

(see La Grande lab order form)

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

2005. Bureau of Land Management Density Management Study. In: Erickson, J., ed. The Cooperative Forest Ecosystem Research (CFER) Program Annual Report 2005. Corvallis, OR: CFER: 36–42.

Annual progress report of the Bureau of Land Management Density Management Studies provides key findings across several study components including a riparian buffer study. Highlighted are more detailed findings of the Leave Island Study, conducted by Stephanie Wessell, graduate student at Oregon State University.

Keywords: Riparian buffers, leave islands, thinning, biodiversity.

(see Corvallis lab order form)

Lehmkuhl, J.F.; Kennedy, M.; Ford, E.D.; Singleton, P.H.; Gaines, W.L.; Lind, R.L.

2007. Seeing the forest for the fuel: integrating ecological values and fuels management. Forest Ecology and Management. 246: 73–80.

Management of dry forests often involves tradeoffs between ecological values, particularly those associated with closed-canopy forests, and reduction of severe wildlife risk. We review principles and our ecological research that can be used to design stand- and landscape-level fuel treatments in dry forests. We describe an ongoing project to develop the FuelSolve computer tool that optimizes the area and location of a fuel treatment by minimizing potential fire behavior and minimizing loss of spotted owl habitat from treatment and potential fire. We describe the FuelSolve prototype development, an evaluation of outputs for field use, and future development efforts.

Keywords: Dry forest, ecosystem values, fuels management, optimization modeling, restoration, northern spotted owl.

(see Wenatchee lab order form)

Lehmkuhl, J.F.; Mathur, P.K.; Sawarkar, V.B.; Holthausen, R.S.; Marcot, B.G.; Raphael, M.G.

2006. Managing Indian forests for biological diversity and productivity. In: McNeely, J.A.; McCarthy, T.M.; Smith, A.; Olsvig-Whittaker, L.; Wikramnayake, E.D., eds. Conservation biology in Asia. Kathmandu, Nepal: Society for Conservation Biology Asia Section and Resources Himalaya Foundation: 92–114.

We describe an approach for integrating protected areas, managed forests, community-owned forests, and the intervening human-dominated matrix to conserve biodiversity and to provide economic and social benefits in Indian forests. We identified four demonstration Conservation Areas (CA) that represent major Indian ecosystems. In each CA we did a biodiversity assessment, compiled wildlife-habitat relationships information, evaluated forest practices and human use, developed management strategies, and worked with field staff to identify management opportunities. A six-volume report and management guide was published (www.wii.gov. in).

Keywords: Biodiversity, conservation, forest management, India, landscape ecology.

(see Wenatchee lab order form)

Temesgen, H.; Goerndt, M.E.; Johnson, G.; Adams, D.; Monserud, R.A.

2007. Forest measurement and biometrics in forest management: status and future needs of the Pacific Northwest USA. Journal of Forestry. July/August: 233–238.

Forest biometrics and measurements programs (FMB) have been at the heart of forestry education in North America since its beginnings at the Biltmore Forest School more than 100 years ago. Over the intervening period, the field of forestry has changed in critical ways. It has evolved to embrace a much broader view of the goals for forest management: more types of forest outputs matter, not just timber. And it has become increasingly quantitative in its approaches to research and management. Rising forest values demand both more accuracy and precision in management prescriptions and projected outcomes, necessitating quantitative approaches. Both trends have magnified the importance of forest measurements and biometrics as tools of forestry science. Forest measurement focuses on collecting, summarizing, and analyzing information at tree, stand, and forest levels. Forest biometrics applies mathematics and statistics to analyze and quantify past, present, and future attributes at all three levels. By focusing on variation and its analysis, FMB allows managers and researchers to determine if treatments are statistically different. Combined, forest measurements and biometrics (FMB) offer valuable information for decisionmaking because they provide quantitative measures of current resources and

projections of the outcomes of management practices. FMB has become the dominant mode of quantitative thinking in other subdisciplines of forestry, such as silviculture, ecology, wood technology, and economics. FMB is essential to quantifying and analyzing variation, and managing the resultant uncertainty. We assert that FMB needs to be responsive to contemporary resource management challenges, uphold these professional requisites, and make valuable contributions to tackle the various challenges in the Pacific Northwest USA and around the world.

Keywords: Forest biometrics and measurements, decision support, landscape-level analysis.

(see Portland lab order form)

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

2007. Lumber volume and value from elliptical western hemlock logs. Forest Products Journal. 57(7/8): 76–82.

The effect of log ovality and orientation on lumber yield and value recovery was examined through sawing simulation. Ovality was modeled on digitized western hemlock (*Tsuga heterophylla*) logs by altering the ratio of minor to major axes on a given cross section from 1.00 (circular) to 0.80 (oval) in 0.05 unit decrements, while holding cross sectional area and volume constant. The log models were cant-sawn in the AUTOSAW simulator across the full range of rotational settings and "lumber" was tallied and priced according to Western Wood Products Association grade. Responses (lumber yield and value recovery) were normalized relative to those of the circular logs at their initial orientation to eliminate effects due to the large range in log diameters. Maximum responses were calculated and the orientations attaining those maxima recorded. Log ovality was, contrary to the common assumption, beneficial to lumber yield when the log was sawn at the optimum orientation. A 3.2 percent increase in yield relative to the circular logs was recorded for the optimally rotated logs with an ellipticity ratio of 0.80 (95 percent CI, 1.1 percent to 5.3 percent). With ellipticity 0.90, approximately equal to the average for western hemlock, the increase was 3.4 percent (95 percent CI, 1.8 percent to 4.9 percent). Ovality was neither beneficial nor detrimental to maximum value recovery; differences were not significant. Optimal lumber yield occurred more frequently at 90° and 270°, equivalent to primary sawing parallel to the major axis. However, value recovery fluctuated considerably, even with circular logs, and there was no unique angle at which maximum value recovery occurred.

Keywords: Ovality, ellipticity, product recovery, lumber grade, simulation.

(see Portland lab order form)

Genetics

Liston, A.; Parker-Defeniks, M.; Syring, J.V.; Willyard, A.; Cronn, R.

2007. Interspecific phylogenetic analysis enhances intraspecific phylogeographic inference: a case study in *Pinus lambertiana*. Molecular Ecology. Doi: 10.1111/j.1365-294X.2007.03461.x. 12 p.

Pinus lambertiana (sugar pine) is an economically and ecologically important conifer with a 1600 km latitudinal range extending from Oregon, USA to northern Baja California, Mexico. Like all North American white pines (subsect. *Strobus*), sugar pine is highly susceptible to white pine blister rust, a disease caused by the fungus *Cronartium ribicola*. We conducted a chloroplast DNA survey of *Pinus* subsect. Strobus with comprehensive geographic sampling of *P. lambertiana*. Sequence analysis of 12 sugar pine individuals revealed strong geographic differentiation for two chloroplast haplotypes. A diagnostic restriction site survey of an additional 72 individuals demarcated a narrow 150-km contact zone in northeastern California. In the contact zone, maternal (megagametophyte) and paternal (embryo) haplotypes were identified in 31 single seeds, demonstrating bidirectional pollen flow extending beyond the range of maternal haplotypes. The frequencies of the Cr1 allele for white pine blister rust major gene resistance, previously determined for 41 seed zones, differ significantly among seed zones that are fixed for the alternate haplotypes, or contain a mixture of both haplotypes. Interspecific phylogenetic analysis reveals that the northern sugar pine haplotype belongs to a dade that includes *P. albicaulis* (whitebark pine) and all of the East Asian white pines. Furthermore, there is little cpDNA divergence between northern sugar pine and whitebark pine (dS 0.00058). These results are consistent with a Pleistocene migration of whitebark pine into North America and subsequent chloroplast introgression from whitebark pine to sugar pine. This study demonstrates the importance of placing phylogeographic results in a broader phylogenetic context.

Keywords: Chloroplast introgression, Cronartium ribicola*, phylogeography,* Pinus lambertiana*,* Pinus *subsect.* Strobus*, white pine blister rust resistance.*

(see Corvallis lab order form)

St. Clair, J.B.

2007. Genetic variation in fall cold hardiness in coastal Douglas-fir in western Oregon and Washington. Canadian Journal of Botany. 84: 1110–1121.

Genetic variation in fall cold damage in coastal Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*) was measured by exposing excised branches of seedlings from 666 source locations grown in a common garden to freezing temperatures in a programmable freezer. Considerable variation was found among populations in fall cold hardiness of stems, needles, and buds. Variation in fall cold hardiness was strongly correlated with cold season temperatures of the source environment. Large population differences corresponding to environmental gradients are evidence that natural selection has been important in determining genetic variation in fall cold hardiness, much more so than in traits of bud-burst (a surrogate for spring cold hardiness), bud-set, and growth. Seed movement guidelines and breeding zones may be more restrictive when considering genetic variation in fall cold hardiness compared to traits of growth, phenology, or spring cold hardiness.

Keywords: Cold hardiness, genetic variation, adaptation, Pseudotsuga menziesii.

(see Corvallis lab order form)

St. Clair, J.B.; Howe, G.T.

2007. Genetic maladaptation of coastal Douglas-fir seedlings to future climates. Global Change Biology. 13: 1441–1454.

Climates are expected to warm considerably over the next century, resulting in expectations that plant populations will not be adapted to future climates. We estimated the risk of maladaptation of coastal Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*) to future climates as the proportion of nonoverlap between current and future populations as determined from genecological models derived from seedling common garden studies. The risk of maladaptation was large for most traits when compared to the risk associated with transfers within current seed zones. We recommend augmenting within-population variation by mixing local populations with some proportion of populations from lower elevations and farther south. Populations expected to be adapted to climates a century from now come from locations as far down in elevation as 450 to 1130 m and as far south in latitude as 1.8° to 4.9°.

Keywords: Climate change, genecology, adaptation, Pseudotsuga menziesii.

(see Corvallis lab order form)

Syring, J.; Farrell, K.; Businsky, R.; Cronn, R.; Liston, A.

2007. Widespread genealogical nonmonophyly in species of *Pinus* subgenus *Strobus*. Systematic Biology. 56(2): 163–181.

Phylogenetic relationships among *Pinus* species from subgenus *Strobus* remain unresolved despite combined efforts based on nrITS and cpDNA. To provide greater resolution among these taxa, a 900-bp intron from a Late Embryogenesis Abundant (LEA)-like gene (1FG8612) was sequenced from 39 pine species, with two or more alleles representing 33 species. Nineteen of 33 species exhibited allelic nonmonophyly in the strict consensus tree, and 10 deviated significantly from allelic monophyly based on topology incongruence tests. Intraspecific nucleotide diversity ranged from 0.0 to 0.0211, and analysis of variance shows that nucleotide diversity was strongly associated ($P < 0.0001$) with the degree of species monophyly. While species nonmonophyly complicates phylogenetic interpretations, this nuclear locus offers greater topological support than previously observed for cpDNA or nrITS. Lacking evidence for hybridization, recombination, or imperfect taxonomy, we feel that incomplete lineage sorting remains the best explanation for the polymorphisms shared among species. Depending on the species, coalescent expectations indicate that reciprocal monophyly will be more likely than paraphyly in 1.71 to 24.0 x 10^6 years, and that complete genome wide coalescence in these species may require up to 76.3 x 10^6 years. The absence of allelic coalescence is a severe constraint in the application of phylogenetic methods in *Pinus*, and taxa sharing similar life history traits with *Pinus* are likely to show species nonmonophyly using nuclear markers.

Keywords: Lineage sorting, monophyly, nonmonophyly, nuclear genes, Pinus.

(see Corvallis lab order form)

Willyard, A.; Syring, J.; Gernandt, D.S.; Liston, A.; Cronn, R.

2007. Fossil calibration of molecular divergence infers a moderate mutation rate and recent radiations for *Pinus.* Molecular Biology and Evolution. 24(1): 90-101.

Silent mutation rate estimates for *Pinus* vary 50-fold, ranging from angiospermlike to among the slowest reported for plants. These differences either reflect extraordinary genomic processes or inconsistent fossil calibration, and they have important consequences for population and biogeographical inferences. Here we estimate mutation rates from 4 *Pinus* species that represent the major lineages using 11 nuclear and 4 chloroplast loci. Calibration was tested at the divergence of *Pinus* subgenera with the oldest leaf fossil from subgenus *Strobus* (Eocene; 45 million years ago (MYA)) or a recently published subgenus *Strobus*

wood fossil (*Cretaceous*; 85 MYA). These calibrations place the origin of *Pinus* 190–102 MYA and give absolute silent rate estimates of 0.70–1.31 x 10^{-9} and 0.22–0.42 x 10^{-9} for the nuclear and chloroplast genomes, respectively. These rates are approximately 4- to 20-fold slower than angiosperms, but unlike many previous estimates, they are more consistent with the high per-generation deleterious mutation rates observed in pines. Chronograms from nuclear and chloroplast genomes show that the divergence of subgenera accounts for about half of the time since *Pinus* diverged from *Picea*, with subsequent radiations occurring more recently. By extending the sampling to encompass the phylogenetic diversity of *Pinus*, we predict that most extant subsections diverged during the Miocene. Moreover, subsection *Australes, Ponderosae,* and *Contortae*, containing over 50 extant species, radiated within a 5 million year timespan starting as recently as 18 MYA. An Eocene divergence of pine subgenera (using leaf fossils) does not conflict with fossil-based estimates of the *Pinus–Picea* split, but a Cretaceous divergence using wood fossils accommodates Oligocene fossils that may represent modern subsections. Because homoplasy and polarity of character states have not been tested for fossil pine assignments, the choice of fossil and calibration node represents a significant source of uncertainty. Based on several lines of evidence (including agreement with ages inferred using calibrations outside of *Pinus*), we conclude that the 85-MYA calibration at the divergence of pine subgenera provides a reasonable lower bound and that further refinements in age and mutation rate estimates will require a synthetic examination of pine fossil history.

Keywords: molecular evolution, Pinus*, silent substitution rates, chronogram, fossils.*

(see Corvallis lab order form)

Land Use

Pataki, D.; Alig, R.; Fung, A.S.; Golubiewski, N.E.; Kennedy, C.A.; McPherson, E.G.; Nowak, D.J.; Pouyat, R.V.; Romero Lankao, P.

2006. Urban ecosystems and the North American carbon cycle. Global Change Biology. 12: 1–11.

Approximately 75 to 80 percent of the population of North America currently lives in urban areas as defined by national census bureaus, and urbanization is continuing to increase. Future trajectories of fossil fuel emissions are associated with a high degree of uncertainty; however, if the activities of urban residents and the rate of urban land conversion can be captured in urban systems models, plausible emissions scenarios from major cities may be generated. Integrated land use and transportation models that simulate energy use and traffic-related emissions are already in place in many North American cities. To these can be added a growing data set of carbon gains and losses in vegetation and soils following urbanization, and a number of methods of validating urban carbon balance modeling, including top down atmospheric monitoring and urban "metabolic" studies of whole ecosystem mass and energy flow. Here we review the state of our understanding of urban areas as whole ecosystems with regard to carbon balance, including both drivers of fossil fuel emissions and carbon cycling in urban plants and soils. Interdisciplinary, whole-ecosystem studies of the socioeconomic and biophysical factors that influence urban carbon cycles in a range of cities may greatly contribute to improving scenarios of future carbon balance at both continental and global scales.

Keywords: Carbon balance, urbanization, urban systems.

(see Corvallis lab order form)

White, E.M.

2006. Forests on the edge: a case study of northwest Georgia watersheds. U.S. Department of Agriculture, Forest Service, State and Private Forestry. http://www.fs.fed.us/projects/fote/cases/georgia-casestudy-ew-103006.pdf.

The paper is a case study examining the conditions and trends in many of the factors influencing land use and land-use change within northwest Georgia. Current conditions and/or trends are presented for forest and timberland area, stumpage values, annual harvest volumes, annual harvest acres, annual land conversion acres, population, housing units, numbers of seasonal homes, and commute times. Also presented are spatial depictions of current forest cover and of forest cover projected to be impacted by future residential development. A brief discussion of the roles of local municipalities, counties, and Georgia state agencies in comprehensive planning in the state of Georgia is also included. Current and projected housing unit densities, (Theobald 2005) are also depicted.

Keywords: Land use, Georgia.

(available online at http://www.fs.fed.us/projects/fote/cases/georgia-casestudy-ew-103006.pdf)

White, E.M.

2006. Forests on the edge: a case study of northwest Washington. U.S. Department of Agriculture, Forest Service, State and Private Forestry. http://www.fs.fed.us/projects/fote/cases/nw-washington-casestudyfinaltew-062506.pdf.

The paper is a case study examining the conditions and trends in many of the factors influencing land use and land-use change within three counties and five watersheds in northwest Washington State. Current conditions and/or

trends are presented for forest and timberland area, stumpage values, annual harvest volumes, population, housing units, housing starts, and home sales. In addition, per-acre sales prices for undeveloped land are presented based upon transactions evidence for two counties within the study area. Also presented are spatial depictions of Designated Forest Resource Lands as identified in the comprehensive plans of the three study area counties. Current and projected housing unit densities, based upon the work of Theobald (2005) (as included in other Forests on the Edge publications), are also depicted spatially.

Keywords: Land use, northwest Washington.

(available online at http://www.fs.fed.us/projects/fote/cases/nw-washington-casestudyfinaltew-062506.pdf)

White, E.M.

2006. Forests on the edge: a case study of south-central and southwest Maine watersheds. U.S. Department of Agriculture, Forest Service, State and Private Forestry. http://www.fs.fed.us/projects/fote/cases/maine-casestudy-ew-062506.pdf.

The paper is a case study examining the conditions and trends in many of the factors influencing land use and land-use change within southern Maine. Current conditions and/or trends are presented for forest and timberland area, stumpage values, annual harvest volumes, annual harvest acres, annual land conversion acres, population, housing units, numbers of seasonal homes, and commute times. Also presented are spatial depictions of land ownership and forest parcel size based upon the work of Butler (2005) and Butler and King (2005). A brief discussion of the roles of local towns in comprehensive planning in the State of Maine is also included as is a brief statement relating to the uncertainty of the impact that closure of a large military base in the State may have on future land use. Current and projected housing unit densities (Theobald 2005) are also depicted.

Keywords: Land use, southern Maine.

(see Corvallis lab order form)

Landscape Ecology

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

2007. Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. Landscape Ecology. DOI 10.1007/s10980-007-9098-2. 22 p.

For some time, ecologists have known that spatial patterns of forest structure reflected disturbance and recovery history, disturbance severity and underlying influences of environmental gradients. In spite of this awareness, historical forest structure has been little used to expand knowledge of historical fire severity. Here, we used forest structure to predict premanagement era fire severity across three biogeoclimatic zones in eastern Washington State that contained extensive mixed-conifer forests. We found that the structure of mixed-conifer patches was formed by a mix of disturbance severities. In moist mixed-conifer, stand-replacement effects were more widespread in patches than surface fire effects, while in dry mixed-conifer, surface fire effects were more widespread by nearly 2:1. However, evidence for low-severity fires as the primary influence, or of abundant old parklike patches, was lacking in both the dry and moist mixed-conifer forests. The relatively low abundance of old, parklike or similar forest patches, high abundance of young and intermediate-aged patches, and widespread evidence of partial stand and stand-replacing fire suggested that variable fire severity and nonequilibrium patch dynamics were primarily at work.

Keywords: Fire severity, mixed-conifer forests, dry forests, nonequilibrium dynamics, mixed-severity fire, ecoregions, Inland Northwest USA, historical range of variability.

(see Wenatchee lab order form)

Natural Resource Policy

Haynes, R.; Adams, D.; Ince, P.; Mills, J.; Alig, R.

2006. Bioeconomic and market models. In: Shao, G.; Reynolds, K.M., eds. Computer applications in sustainable forest management: including perspectives on collaboration and integration. Dordrecht, The Netherlands: Springer: 171–197.

The United States has a century of experience with the development of models that describe forest product markets and trends in resource conditions. In the last four decades, increasing rigor in policy debates has stimulated the development of models to support policy analysis. At the same time increasing computational power has allowed the evolution of bioeconomic models that combine economic and resource models. These are used to provide the basis for forecasting future resource and market trends and to inform policy analysis. These more complex models have also extended options for policy analysis using approaches such as scenario planning to help decisionmakers gauge uncertainty.

Keywords: Forest sector modeling, policy analysis, supply, demand.

(see Portland lab order form)

Plant Pathology

Hennon, P.; D'Amore, D.; Wittwer, D.; Johnson, A.; Schaberg, P.; Hawley, G.; Beier, C.; Sink, S.; Juday, G.
2006. Climate warming, reduced snow, and freezing injury could explain the demise of yellow-cedar in southeast Alaska, USA. World Resource Review. 18(2): 427–450.

Yellow-cedar (*Chamaecyparis nootkatensis*) is a valuable tree species that has been experiencing concentrated mortality known as yellow-cedar decline on 200 000 ha of largely pristine forests in southeast Alaska. Mature trees that regenerated and grew during the Little Ice Age have been dying on low-elevation sites with wet soils and open canopies for about 100 years. We propose the following hypothesis to explain tree death (methods in parentheses): landscape features (digital elevation model via LiDAR) and soil properties (soil descriptions) produce poor drainage (wells and piezometers), which create open-canopy forests (LiDAR and hemispherical photography) and shallow rooting; exposure allows soils to warm in early spring (air and soil temperature loggers), which triggers dehardening, the loss of cold tolerance, and eventual spring freezing injury (electrolyte leakage testing of tissues). The distribution of yellow-cedar decline is associated with areas of low snowpack in winter and spring—locations that appear more common as climates warm. Snow delays soil warming and presumably protects yellow-cedar roots through periods of spring frosts. Limited to higher elevations throughout most of its natural range, perhaps yellow-cedar migrated to lower elevations during the Little Ice Age, and these trees are now vulnerable to the lack of protective snow in these exposed, open-canopy forests where forest decline is now severe.

Keywords: Freezing, forest decline, Chamaecyparis*, global warming, snow, exposure.*

(see Juneau lab order form)

Muir, J.A.; Hennon, P.E.; Negrave, R.W.
2007. Biology, ecology, and management of western hemlock dwarf mistletoe in coastal British Columbia: a synthesis of the literature. Technical Report TR-037. Nanaimo, BC: BC Ministry of Forests and Range, Coast Forest Region, Research Section. 28 p.

This report synthesizes the considerable research and data, both published and unpublished, concerning the biology, ecology, and management of western hemlock dwarf misteltoe in an effort to assist natural resource professionals, land managers, and scientists in British Columbia in dealing with the challenges of managing hemlock dwarf mistletoe. Although we focus on the presence of western hemlock dwarf mistletoe in coastal British Columbia, our discussion is supplemented by some reference to other jurisdictions on the west coast. Controversies and knowledge gaps are identified, and recommendations are presented for managing western hemlock dwarf misteltoe in British Columbia.

Keywords: Dwarf mistletoe, western hemlock dwarf mistletoe, forest management, land management, British Columbia, Pacific Northwest, literature review.

(see Juneau lab order form)

Trummer, L.; Hennon, P.; McCarter, J.; McGaughey, R.
2007. Using the new excel-based stand visualization add-in software to generate images depicting forest health issues. In: Proceedings of the 54th western international forest disease work conference. Missoula, MT: U.S. Department of Agriculture, Forest Service, Forest Health Protection: 79–84.

This paper describes a new user-friendly software program, the Stand Visualization Add-in for Excel, developed as an interface to the Stand Visualization System (SVS). The Add-In tool streamlines the process of creating forest images because it works directly from Excel using a standardized worksheet and simple menu commands. Also, the Add-In supports new treeform definitions to depict dwarf mistletoe infections in live trees and a range of mortality structures including uprooted, broken, and standing dead trees. Instructions are provided for downloading and utilizing features of the Add-In tool. Example images generated by the Add-In tool with data from Alaskan forests are used to illustrate the ability to communicate forest health scenarios and management treatments scenarios using SVS visualizations.

Keywords: Stand visualization system, mistletoe, snag.

(See Juneau lab order form)

Range Management

Vavra, M.; Parks, C.G.; Wisdom, M.J.
2007. Biodiversity, exotic plant species, and herbivory: the good, the bad, and the ungulate. Forest Ecology and Management. 246: 66–72.

Invasion of natural ecosystems by exotic plant species is a major threat to biodiversity. Disturbance to native plant communities, whether natural or management induced, is a primary factor contributing to successful invasion by exotic species. Herbivory by both wild and domestic ungulates exerts considerable impact on structure and composition of native plant communities. Although largely unrecognized as such, herbivory chronic, landscape-scale disturbance is capable of influencing plant communities as much as episodic events such as fire.

Keywords: Disturbance, competition, grazing, exotic plants, biological diversity, ungulates, herbivory.

(see La Grande lab order form)

Regional Assessments

Adams, D.M.; Haynes, R.W.

2007. The impact of public harvest in the U.S. on North American timber and product markets. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 11.

The role of public timberlands in regional and national timber supply has been the subject of controversy for decades, Public harvest in the United States rose during the 1960s and l970s as timber management programs were established to meet rising domestic wood needs. Harvest fell sharply in the 1990s as management focus shifted toward the provision of ecosystem services. The Timber Assessment Projection System is employed to examine what might have happened if public cut had not fallen in the 1990s and what could happen in the future if a program of restoration thinning were implemented on the national forests. Results of these simulations are consistent with past analyses in showing the importance of substitution across regions, owners, and products in damping the impacts of public cut changes at the national level, even though local effects may be large.

Keywords: Forest policies, policy analysis, national forests timber harvests.

(see Portland lab order form)

Adams, D.M.; Haynes, R.W.

2007. Methodological considerations in developing the timber assessment projection system. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Springer. Chapter 2.

This chapter considers the major modeling issues that arise in development of a resource and market projection system. It reviews recent evolution in policy and scenario planning and forest sector market modeling. It presents a basic outline of the Timber Assessment Projection System and compares its structure to that of other contemporary modeling approaches.

Keywords: Scenario planning, market model, supply, demand, inventory projection.

(see Portland lab order form)

Adams, D.M.; Haynes, R.W.

2007. Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. 594 p. ISBN: 978-1-4020-6308-4.

Forest policy deliberations in the United States have been informed by an increasingly sophisticated body of economic analysis, including integrated market and resource models. The U.S. Forest Service began development of the Timber Assessment Projection System in the late 1970s as a North American forest sector market and resource model designed to support periodic resource assessments. The system has evolved over time to meet the changing needs of forest policy analysts and in response to the emergence of new modeling and computational methodologies. It has been employed to simulate a wide range of resource and policy scenarios both by the Forest Service and an array of public agencies, nongovernment organizations and private firms. Although the Assessment System focuses on North America, the experience gained and lessons learned in its development and application are potentially useful to many countries and regions facing similar forest planning needs.

Keywords: Forest sector, modeling, forest policy.

(available for purchase from publisher at http://www.springer.com)

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

2007. The role of private management investment in long-term supply. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 12.

The base case projection described in chapter 9 envisions significant future expansion in private timber harvest based in part on growing investment in timber management, primarily in the South. Is this reasonable expectation, and how important are these investment inputs in shaping the projected future? Historical data on management inputs are limited. Planting and plantation area data suggest a fairly clear trend of intensifying management on forest industry lands in the South and Pacific Northwest West. The picture is less clear for nonindustrial private owners, although in the South, this group's inventory and harvest have risen steadily since the late l950s. Simulations examine

the impact of alternative investment assumptions on the projections, considering both an extreme case of no future shifts in types or management intensity classes and a case freezing only plantation establishment in the South.

Keywords: Silvicultural practices, forest type change, plantations.

(see Portland lab order form)

Alig, R.

2007. Long-term views of the U.S. land base. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 16.

This chapter examines the impacts of exogenous assumptions (e.g., policy) on projected shifts among major land uses, including private timberland area, and on timberland composition by land cover type. A base case and alternative scenarios were simulated using the AREACHANGE projection system. Historical changes include forest area reductions in some regions due to conversion of forests to agricultural uses, such as to cropland on nonindustrial private ownerships. In the future, however, reduction in forest land area is projected to result mainly from conversion to developed land uses such as urban expansion, highway and airport construction, surface mining, and reservoirs. However, a major source of uncertainty surrounding land-use change is future agricultural and climate change policies, including any directed at marginal agricultural lands. Changes in the areas of forest cover types often result from differences in land management objectives among owners and reflect the combined influence of natural forces and human-caused management actions. A key projected change is an increase in the area of pine plantations in the South, including on marginal agricultural land. The area of pine plantations responds over time to projected domestic timber harvest levels and prices, and also reflects effects from international markets, such as rising imports that affect prices for Southern timber. One area of uncertainty affecting future forest area and distribution among different forest cover types is global climate change. For example, expanding forest area through afforestation of economically marginal agricultural lands is one approach to reduce net emissions of carbon dioxide in the United States and other countries.

Keywords: Forest area change, land use scenarios, forest cover dynamics.

(see Corvallis lab order form)

Alig, R.; Plantinga, A.

2007. Methods for projecting areas of private timberland and forest cover types. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 5.

We summarize methods used to project area changes in land uses and forest cover types in the national Resources Planning Act (RPA) timber assessments over the past 20 years, since area projection modeling systems replaced expert opinion approaches. Such models reflect that key land-base changes such as afforestation and deforestation are driven by quite different socioeconomic factors. The prototype area change modeling system, the AREACHANGE projection system, was constructed in the early l980s for the South, where timber harvest are higher than any other country, to support a special study between periodic RPA Timber Assessments. The Southern prototype involved an area-base econometric approach, which has been applied in later RPA Timber Assessments regions and revised for the South. Other econometric models were developed in the late 1980s and later decades for the Pacific Northwest, Lake States, Maine, and other regions. Timber price projections from the Timber Assessment Projection System's modeling of markets are used as inputs in the first stage of the area-change projections. Timber harvest projections from the TANM model, as allocated to management units by the ATLAS model, along with timber management projections from the ATLAS model are used as inputs in the second stage of projecting area changes in major forest cover types. The AREACHANGE system provides the ATLAS system with projections of timberland area by region, ownership, and major forest type. The progression of area-change modeling was heavily dependent on the availability of land-use data.

Keywords: Land allocation, area change projections, forest-type transitions.

(see Corvallis lab order form)

Barbour, R.J.; Hemstrom, M.A.; Hayes, J.L.

2007. The Interior Northwest Landscape Analysis System: a step toward understanding integrated landscape analysis. Landscape and Urban Planning. 80: 333–344.

The Interior Northwest Landscape Analysis System (INLAS) project demonstrated a method for assembling teams of scientists to conduct integrated landscape analyses at the mid- or subbasin scale in the interior Northwestern United States. A state and transition modeling system (STM) with transition probabilities calibrated by using a stand-level silvicultural model to estimate rates of vegetative change was used as a central vegetative "modeling engine." It connected to a variety of resource-related

models including wildlife habitat quantity, insect activity, grazing by ungulates, timber management, and wood utilization potential. Where appropriate, the study team examined other vegetation modeling approaches including an optimization approach based on heuristic methods and modifications to an existing stand-level projection tool, which was integrated with existing fire and insect behavior models. The STM approach provided a relatively simple interface for most resource models. These were connected to examine the influence of vegetative succession, natural disturbances, and management over a 100- to 200-year horizon under three management scenarios: (1) background natural disturbance, (2) fire suppression only, and (3) active fuel management. Taken all together, the results suggest to us: (1) maintaining abundant large-tree multistoried structure in cool, moist forest conditions is likely to be difficult; (2) both active fuel treatment and passive management scenarios increased the proportion of large-tree single-story forests in dry forest conditions; and (3) fire suppression only was least effective in producing and maintaining these "legacy" structures in either dry or moist forest conditions.

Keywords: Integrated landscape analysis, science integration, state and transition modeling, legacy structure, forest vegetation simulator, wildlife habitat, ungulate herbivory, wood utilization.

(see Portland lab order form)

Haynes, R.W.; Adams, D.M.

2007. The challenge of developing models to support forest sector policy analysis. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 1.

The Timber Assessment Projection System was designed to support forest policy analysis and development in the United States. Its structure and capabilities reflect the historical role that resource projections and forecasts have played over the past century of U.S. forest policy development, the formalized requirements of the 1974 Forest and Rangeland Renewable Resources Planning Act for an assessment process, characteristics of the U.S. forest sector, and shifting management directions on both public and private lands.

Keywords: Policy analysis, model structure, planning legislation, forest sector, model development.

(see Portland lab order form)

Haynes, R.W.; Adams, D.M.

2007. Evolving views of the future of the U.S. forest sector. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 10.

There have been nine post World War II Timber Assessments, all motivated by three broad questions. Do we have enough resources to meet current and future wants? Can we describe the sustainability of forest resources in the face of increasing demand? Can we identify emerging problems while there is still time to design programs to offset them? Each of the Timber Assessments pictured the future in ways that strongly reflected contemporary views about key drivers of future conditions. Each also evolved in its reliance on underlying models of economic processes to both structure the development of projections and to increase the confidence that can be placed in individual projections. The Timber Assessments have covered a variety of issues, some short term and others that are enduring and universal to forest sectors worldwide. Some of these enduring issues include how to increase timber supplies before increases in product price reduce consumption excessively, the role that improved harvesting or processing technologies can play in increasing supplies and employment opportunities, how forest growth can be increased through improved forest management, how different land ownership patterns influence forest management, and the role of markets in allocating resources and providing incentives for both improved processing technology and forest stewardship.

Keywords: Timber, forest policy, forest planning.

(see Portland lab order form)

Haynes, R.W.; Adams, D.M.

2007. Exogenous assumptions—framing the base case and scenarios. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 7.

This chapter examines some of the broad considerations that help determine the number and form of exogenous variables in a model and the projections of their future behavior. It outlines the major classes of exogenous inputs used in the Timber Assessment Projection System and summarizes the exogenous variable projections for the base case that are not addressed in other chapters.

Keywords: Assumptions, models, conditional projections.

(see Portland lab order form)

Haynes, R.W.; Adams, D.M.

2007. The utility of forest sector models in addressing forest policy questions. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 17.

Forest sector models such as the Assessment System have much to add to current forest policy deliberations, and research is rapidly expanding their capabilities in identifying production tradeoffs between timber and noncommodity uses, looking at finer geographic scales, recognizing policy interactions across sectors, and characterizing uncertainty in policy outcomes. The Assessment System has remained a useful policy analysis tool over nearly three decades in part because of its mixed-model format, regional and owner detail, elaborated treatment of the private timber inventory and management investment, its myopic structure, and the collaboration of its developers with policymakers to adapt model structure to decision needs and to explain projection results.

Keywords: Model building, policy analysis, science/policy interface.

(see Portland lab order form)

Mills, J.R.; Adams, D.M.

2007. Timber inventory and management—ATLAS. In: Managing Forest Ecosystems Series, Vol. 14: Resource and market projections for forest policy development, twenty-five years of experience with the US RPA timber assessment. Dordrecht, The Netherlands: Springer. Chapter 6.

The ATLAS model is a framework that allows development of multiscale, customized growth and yield modules. In the Timber Assessment Projection System these modules represent aggregates of stands across a region and ownership with multiple management regimes. ATLAS employs an age-class structure to represent the timber inventory for areas managed on both even- and uneven-aged silvicultural systems. Inventory is represented by means of strata or units which are aggregations of basic plot-level data to some higher geographic or other descriptive level. Yield projections are derived from type-specific growth models in some regions and from empirical yield relations derived from basic inventory data in other instances. Yield projections are adapted to reflect both even-aged and partial cutting regimes. Allocation of private lands to various levels of management intensity depends on a model of management investment based on estimated land expectations values. Section 6.4 contrasts ATLAS with inventory projection approaches employed in other recent forest sector models.

Keywords: Inventory projection, growth model, management investment.

(see Portland lab order form)

Remote Sensing

Adamo, C.; Solomon, R.; Medaglia, C.M.; Dietrich, S.; Mugnai, A.

2007. Cloud microphysical properties from remote sensing of lightning within the Mediterranean. In: Levizzani, V.; Bauer, P.; Turk, F.J., eds. Measuring precipitation from space: EURAINSAT and the future. New York: Springer: 127–134. Chapter 10.

The joint use of concurrent data from the Precipitation Radar and Lightning Image Sensor instruments were used to observe the vertical structure of clouds in the Southern Mediterranean during a 5-month period.

Keywords: Lightning, precipitation, remote sensing.

(see Seattle lab order form)

Andersen, H.E.; Reutebuch, S.E.; McGaughey, R.J.

2006. Active remote sensing. In: Shao, G.; Reynolds, K.M., eds. Computer applications in sustainable forest management: including perspectives on collaboration and integration. The Netherlands: Springer: 43–66. Chapter 3.

The development of remote sensing technologies increases the potential to support more precise, efficient, and ecologically-sensitive approaches to forest resource management. One of the primary requirements of precision forest management is accurate and detailed 3D spatial data relating to the type and condition of forest stands and characteristics of the underlying terrain surface. A new generation of high-resolution, active remote sensing technologies, including airborne laser scanning (LIDAR) and interferometric synthetic aperture RADAR (IFSAR) have the capability to provide direct, 3D measurements of forest canopy structure and topography. High-resolution LIDAR can be used to measure forest structure characteristics and attributes of individual tree crowns composing the overstory forest canopy. IFSAR is a microwave remote sensing technology that is also capable of providing 3D positions of backscattering elements within a forest scene.

In this chapter, we describe the basic principles of these active remote sensing technologies in the context of forest canopy inventory and terrain mapping, and present an example of their application within a Pacific Northwest conifer forest.

Keywords: Forestry, LIDAR, IFSAR, INSAR, SAR, interferometry, canopy.

(see Anchorage lab order form)

McGaughey, R.J.; Reutebuch, S.E.; Andersen, H.E.
2007. Creation and use of LIDAR intensity images for natural resource applications. In: Proceedings of the 21st biennial workshop on aerial photography, videography, and high resolution digital imagery for resource assessment. Bethesda, MD: American Society of Photogrammetry and Remote Sensing. 12 p.

This paper presents an overview of airborne laser scanning and describes efforts to produce images using these intensity data. A new process is described for converting point data into raster products (images) that helps eliminate void areas in the final images due to the nonuniform density of LIDAR point data and facilitates the production of high-resolution images. Additional discussion describes efforts to enhance the appearance of near-ground features in areas covered by dense vegetation. Software to produce intensity images from LIDAR return data is available as part of the FUSION system.

Keywords: LIDAR, intensity, aerial photograph, orthophoto.

(see PWFSL order form)

Social Sciences

Charnley, S.; Fischer, A.P.; Jones, E.T.
2007. Integrating traditional and local ecological knowledge into forest biodiversity conservation in the Pacific Northwest. Forest Ecology and Management. 246: 14–28.

The potential for traditional and local ecological knowledge to contribute to biodiversity conservation has been widely recognized, but the actual application of this knowledge to biodiversity conservation is not easy. This paper synthesizes literature about traditional and local ecological knowledge and forest management in the Pacific Northwest to evaluate what is needed to accomplish this goal. We address three topics: (1) views and values people have relating to biodiversity; (2) the resource use and management practices of local forest users, and their effects on biodiversity; and (3) models for integrating traditional and local ecological knowledge into biodiversity conservation on public and private lands. We focus on the ecological knowledge of forest users belonging to three groups who inhabit the region: American Indians, family forest owners, and commercial nontimber forest product harvesters. We argue that integrating traditional and local ecological knowledge into forest biodiversity conservation is most likely to be successful if the knowledge holders are directly engaged as active participants in these efforts. Although several promising models exist for how to integrate traditional and local ecological knowledge into management, a number of social, economic, and policy constraints have prevented this knowledge from flourishing and being applied. These constraints should be addressed alongside any strategy for knowledge integration. Also needed is more information about how different groups of forest practitioners are currently implementing traditional and local ecological knowledge in forest use and management, and what the ecological outcomes are with regard to biodiversity.

Keywords: Traditional ecological knowledge, Pacific Northwest forest management, biodiversity conservation, American Indians, family forest owners, nontimber forest product harvesters.

(see Portland lab order form)

Threatened, Endangered, Sensitive Species

Aubry, K.B.; McKelvey, K.S.; Copeland, J.P.
2007. Distribution and broadscale habitat relations of the wolverine in the contiguous United States. The Journal of Wildlife Management. 71(7): 2147–2158.

We investigated the distributional ecology of wolverine in the contiguous United States by compiling and spatially referencing occurrence records and overlaying them on various spatial habitat layers. Historical records are concentrated primarily in Washington, California, Idaho, Montana, Wyoming, Utah, Colorado, Minnesota, Wisconsin, and Michigan. Currently, wolverine occur only in Washington, Idaho, Montana, and Wyoming. The only habitat layer that fully accounted for historical distribution patterns was snow cover that persists through the wolverine denning period, which may limit their distribution in the contiguous U.S. Reintroduction may be an appropriate conservation strategy in California, Utah, and Colorado.

Keywords: Alpine meadows, subarctic, climate, distribution, isolation, snow cover.

(see Olympia lab order form)

Clayton, D.R.; Olson, D.H.; Nauman, R.S.

2007. Conservation assessment for the Siskiyou Mountain salamander (*Plethodon stormi*), version 1.4. http://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-amphibians.shtml. (July 9, 2007).

This conservation assessment provides up-to-date species information regarding the biology, ecology, and threats to the Siskiyou Mountains salamanders, *Plethodon stormi*. It describes habitat or site conditions that are desirable to maintain the species if management of a particular locality is proposed.

Keywords: Salamander, rare, conservation, management, timber harvest.

(available online at http://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-amphibians.shtml)

Schaffer, A.; Myers, D.; Brennan, J.; Hallock, L.; Bisson, P.; Roni, P.; Carman, R.; Plotnikoff, R.; Simenstad, C.; Rumrill, S.; Mumford, T.

2007. HCP science review panel final report: comments and recommendations on covered species and potential effects analysis. Washington Department of Natural Resources, Aquatic Resources Program. 55 p. http:/www.dnr.wa.gov/htdocs/aqr/esa/dnrmged_research.html. (July 10, 2007).

The Washington Department of Natural Resources (DNR) assembled a Science Review Panel (Panel) to review the process and scientific information guiding the development of DNR's Aquatic Resources Habitat Conservation Plan (HCP). The purpose of this review was to assess whether DNR is using sound scientific principles and information in its development of the HCP. The Panel found that the fundamental information adopted or gathered for the HCP appears to be scientifically sound, with acknowledgements of some technical caveats and advice about the appropriateness of inclusion or exclusion of certain data sets. However, the organization of these data and their application in the Potential Effects Model do not necessarily take advantage of the best available science and may jeopardize the ultimate scientific credibility of the HCP irrespective of the validity of the conservation measures.

Keywords: Washington Department of Natural Resources, habitat conservation plan.

(available online at http://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-amphibians.shtml)

Schwartz, M.K.; Aubry, K.B.; McKelvey, K.S.; Pilgrim, K.L.; Copeland, J.P.; Squires, J.R.; Inman, R.M.; Wisely, S.M.; Ruggiero, L.F.

2007. Inferring geographic isolation of wolverines in California using historical DNA. The Journal of Wildlife Management. 71(7): 2170–2179.

Delineating a species' geographic range using the spatial distribution of museum specimens or even contemporary detection–nondetection data can be difficult. This is particularly true at the periphery of a species range where species' distributions are often disjunct. Wolverines (*Gulo gulo*) are wide-ranging mammals with discontinuous and potentially isolated populations at the periphery of their range. One potentially disjunct population occurred in the Sierra Nevada Mountains, California, USA, and appears to have been extirpated by the 1930s. Many early 20th century naturalists believed that this population was connected to other populations occurring in the Cascade Range of northern California, Oregon, and Washington, USA, but a recent analysis of historical records suggests that California wolverines were isolated from other populations in North America. We used DNA extracted from museum specimens to examine whether California wolverines were isolated. Both nuclear and mitochondrial DNA data indicate that California wolverines were genetically distinct from extant populations, suggesting long-term isolation. We identified two new control region (mitochondrial DNA) haplotypes located only within California. We used these data and referenced sequences from the Rocky Mountains, USA, to make inferences regarding potential wolverine translocations into California. In addition, we used these genetic data to make inferences about wolverine conservation throughout western North America.

Keywords: Geographic distribution, isolation, genetics, zoogeography, population structure.

(see Olympia lab order form.)

Wildlife

Bull, E.L.; Nielsen-Pincus, N.; Wales, B.C.; Hayes, J.L.

2007. The influence of disturbance events on pileated woodpeckers in northeastern Oregon. Forest Ecology and Management. 243: 320–329.

The effects of natural and human-caused disturbance on the density of nesting pairs of pileated woodpeckers, and, their nest success, and fidelity to home range were compared over 30 years in two areas and over 15 years in five additional areas. In one study area, density of nesting pairs decreased from five pileated woodpecker pairs to one after extensive regeneration cuts that eliminated most of the stands of mature and old-growth grand fir and reduced the density of nest and roost trees and foraging

substrate. Density of nesting pairs, nest success, and home range location remained fairly consistent over 30 years in a second study area with extensive tree mortality resulting from insect outbreaks but without regeneration harvests. The amount of unharvested stands and closed canopy stands in home range areas were positively correlated with nest success, and the amount of area in harvested stands was negatively correlated with nest success. High tree mortality and subsequent loss of canopy closure in stands of grand fir and Douglas-fir from insect outbreaks did not appear to be detrimental to pileated woodpeckers provided that dead trees and logs were abundant and that stands were not harvested.

Keywords: Pileated woodpecker, disturbance, Dryocopus pileatus*,management, coarse woody debris, northeast Oregon, harvest activity.*

(see La Grande lab order form)

Wood Utilization

Bumgardner, M.; Nicholls, D.; Donovan, G.

2007. Effects of species information and furniture price on consumer preferences for selected woods. Wood and Fiber Science. 39(1): 71–81.

Changes in hardwood resources and markets are influencing the manufacture and design of hardwood products, including the species used by manufacturers. Furthermore, the globalization of wood products markets is bringing new species choices to U.S. consumers. Our research evaluates preferences for six domestic wood species (three from the Eastern United States and three from the Western United States), as influenced by furniture price-point, species information, and furniture piece. Four separate treatment effects were considered, based on two price-points and the presence vs. absence of species information via a label. Four different furniture pieces were considered. Data were collected at home shows in the Pacific Northwest in late 2004 and early 2005. There were no significant differences between price-points at either level of species information, indicating that furniture price did not significantly influence species preferences for the furniture pieces investigated. However, species information was significant for three of the four furniture pieces at the higher price-point. For the entertainment center, preference was greater for cherry (*Prunus serotina*) when species information was provided, while oak (*Quercus rubra*) was more preferred when no species information was provided. For the dresser, no differences were noted. For the hutch, preference for cherry and maple was greater with the label while preferences for oak, birch, and spruce were greater with no label. Lastly, for the desk, spruce was more preferred with no information, while cherry was more preferred when species information was included. No differences between the species information levels were found at the lower price-point. Cherry was the most preferred species overall, followed by oak. With the exception of oak, consumer knowledge of the species investigated was found to be low. The findings suggest that for cherry and maple, it is beneficial to provide species information in product promotion at higher price-points, especially given the apparent dearth of species knowledge among consumers. It also seems that the reference furniture piece(s) used in studies assessing consumer preferences for wood species can influence the results.

Keywords: Economics, rural communities, wood utilization.

(see Sitka lab order form)

Hennon, P.; Woodward, B.; Lebow, P.

2007. Deterioration of wood from live and dead Alaska yellow-cedar trees in contact with soil. Forest Products Journal. 57(6): 23–30.

The deterioration of heartwood from live and dead Alaska-yellow-cedar trees was evaluated by exposing ministakes in soils at field sites in Alaska and Mississippi for 2- and 4-year intervals. Southern yellow pine sapwood served as a control. The vastly greater deterioration, as measured by weight loss, in Mississippi compared to Alaska (59 and 10 percent after 4 years, respectively) site was attributed to warmer temperatures, a longer growing season, and perhaps the presence of termites. The wood from Alaska-yellow-cedar trees dead 26 years did not differ in deterioration from the wood from live cedar trees, but wood from cedar trees dead 81 years experienced an intermediate deterioration between these classes and the pine controls. Slow changes in heartwood chemistry following tree death probably explain these differences for Alaska yellow-cedar. The results from this and several related studies indicate that heartwood from dead Alaska yellow-cedar trees is suitable for many indoor and outdoor applications long after tree death, but wood from live or dead cedar trees does not perform particularly well in contact with soil.

Keywords: Yellow recovery, salvage, decay, snag.

(see Juneau lab order form)

Lowell, E.C.; Parry, D.L.

2007. Value loss in ponderosa pine logs from beetle activity following fire in southern Oregon. Forest Products Journal. 57(7/8): 68–72.

Wormholes, stain, and decay in fire-damaged and fire-killed trees are causing rapid loss of value, and, to a lesser extent, volume when processed into wood products. Ponderosa pine trees killed in the Warner Mountain fire (southern Oregon) were found to be infested with wood-boring insects that were causing large amounts

of massed wormholes and associated blue stain fungi as soon as 3 months after the fire. A sawmill recovery study was conducted on 44 control logs and 119 "wormy" logs ranging in small-end diameter from 6 to 37 in (15 to 94 cm) to determine if there was any measurable merchantable volume loss in the fire-killed trees as a result of massed wormholes. No lumber volume was lost owing to worm-generated defect. Both the control and wormy logs averaged 78 percent in green cubic volume recovery. There was a significant drop in average value of $258/MBF lumber tally (2005 prices) from the control to the wormy log sample. In this study, value loss occurred primarily because of the presence of blue stain in lumber that would otherwise have produced the higher value Factory grades (e.g., Shop, Moulding). Almost 80 percent of the lumber volume sawn from the control logs was in the higher value Factory grades, whereas only 17 percent of the lumber from wormy logs received these grades. About 52 percent of the lumber produced from wormy logs was graded as lower value Dimension lumber as compared to 18 percent of the control being assigned under that grading system. Value loss increased with log diameter. The primary recommendation from these results is that loss should be handled in the valuation (appraisal) process rather than the measurement (scaling) process.

Keywords: Fire-killed trees, ponderosa pine, blue stain lumber, lumber value loss.

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Effects of species information and furniture price on consumer preferences for selected woods.

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