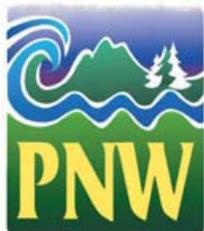

Resource Management and Productivity Program

Science Accomplishments in Fiscal Year 2007



Introduction

Enclosed for your interest are a number of highlights and accomplishments from the Resource Management and Productivity (RMP) Program over Fiscal Year 2007 (October, 2006 - September, 2007). The work is arrayed according to the three RMP Charter Issues (found elsewhere on the RMP web page). In each case, we have listed collaborative partners and provided the personal contact from our Program in case you would like to obtain additional information or research publications.

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Program Summary for 2007

In 2007, we had many worthwhile accomplishments, especially in the research area of climate change, as well as new silviculture textbook and new developments in LIDAR. First of all, a detailed study of field and laboratory experiments showed that nitrogen and phosphorus mineralization rates are very low in southeastern Alaskan wetlands provides information for modeling carbon sequestration and determining future scenarios of vegetation succession under changing climate conditions.

The need for climate change mitigation and adaptation has also spotlighted the importance of understanding adaptability of plants as they exist today and those native plants we might desire for restoring valued ecosystems. Yellow-cedar decline represents one of the best examples worldwide for how a minor shift in climate has had serious and unanticipated consequences in forest ecosystems. Managing long-lived forest trees in a changing climate is challenging but also essential because Alaska has so few tree species. There appears to be a regional shift from low-elevation yellow-cedar stands to high elevation stands due to climate shifts in the region where lower snowpack has combined with late winter and early spring freezing episodes. As climates warm in the Pacific Northwest, native Douglas-fir populations will be poorly adapted over the coming decades as current seed zones become less relevant. Considerably uncertainty remains, however, with respect to specific climate projections and appropriate time frames to consider.

New silviculture book: A team of scientists from Oregon State University and PNW Research Station has written the first comprehensive reference book on silviculture for the western U.S. Using an ecosystem framework as a basis for silviculture, the book includes chapters on ecology of shrubs and hardwoods, methods for regenerating forests, measurement of stand density, use of controlled fire, and other topics. Written with forest practitioners, policy makers, and students in mind, Professors at Oregon State University and University of California – Berkeley are currently using the book in their silviculture classes.

New LIDAR tools for application: The user-friendly software for processing and displaying airborne laser scanning (LIDAR) data has been updated by RMP scientists and is being distributed through the USDA Forest Service, Remote Sensing Application Center (RSAC). The tutorials provide an on-line software installation guide and task-specific tutorials focused on interactive display and presentation features of FUSION as well as the data processing environment.

Agenda2020: Finally, in the past year, the PNW Station was instrumental in helping Forest Service Research and Industry organize the first National Agenda2020 Symposium to highlight all the accomplishments of this partnership with industry since its inception, and how those results and technologies are being used by forest products industry to sustainably manage for wood production and maintain competitive strength in a global market. As a result, Forest Service R&D has greatly strengthened relationships and credibility with industry and universities, with the PNW Station viewed as providing critical leadership in the West.

Charles E. Peterson
RMP Program Manager
cepeter@fs.fed.us
503-808-2026



Key Findings

- Diversity in chloroplast genomes tracks the prevalence of blister rust resistance in sugar pine
- The first reference book for silviculture and ecology of western U.S. forests examines forest management within an ecosystem context
- Native Douglas-fir populations will be poorly adapted to climates expected by the end of the 21st century
- Enhancements to the LIDAR forest vegetation measurement software (FUSION) and expanded tutorials now available on-line

RMP Issue 1: Management to Sustain Production of Forest Products and Values Depends on Improved Fundamental Knowledge of Biology, Ecology, and Genetics of Plants in Forested and Non-Forested Ecosystems

[Key Finding] Diversity in chloroplast genomes tracks the prevalence of blister rust resistance in sugar pine

Accomplishment: Like all North American 5-needle pines, sugar pine is susceptible to white pine blister rust, and rust resistance (conferred by the Cr1 gene) is increasingly prevalent with decreasing latitude across its range. To understand the historical forces responsible for this gradient in resistance, we conducted a chloroplast DNA survey of sugar pine and near-relatives from North America and Asia. Chloroplast sequences from a survey panel revealed two major chloroplast types. Results show that haplotype differences localize to a narrow (~150 km) zone in northeastern California. Our results show that published frequencies of Cr1 differ significantly among groups containing the alternate chloroplast types. While chloroplast factors are not directly linked to resistance, the partitioning of chloroplast diversity between populations showing no resistance and measurable resistance indicates that these are genetically distinct groups that have only recently come into contact.

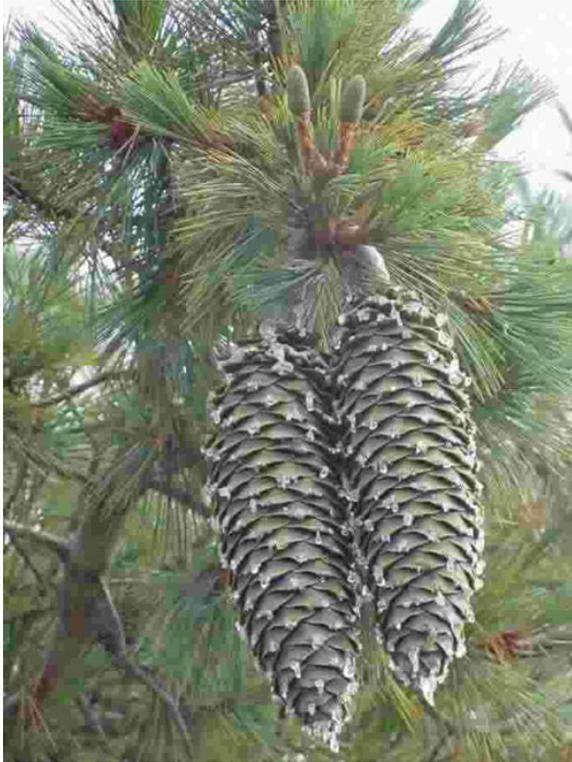
Use: These data are being used to develop models that quantify the historical prevalence of blister rust resistance in sugar pine, and to understand the molecular genetic basis of blister rust resistance in white pines.

Contact: Richard Cronn (rcronn@fs.fed.us), Resource Management and Productivity Program

Partners: Aaron Liston, Department of Botany and Plant Pathology, Oregon State University; USDA Forest Service Region 5 and 6 Genetics Programs

Publication:

Interspecific phylogenetic analysis enhances intraspecific phylogeographic inference: A case study in *Pinus lambertiana*. A. Liston, M. Parker-Defeniks, J.V. Syring, A. Willyard and R. Cronn. *Molecular Ecology* vol. 16 (2007)



Pinus lambertiana photo by Richard Sniezko, Dorena Genetic Resource Center, USDA Forest Service Region 6

[Key Finding] The first reference book for silviculture and ecology of western U.S. forests examines forest management within an ecosystem context

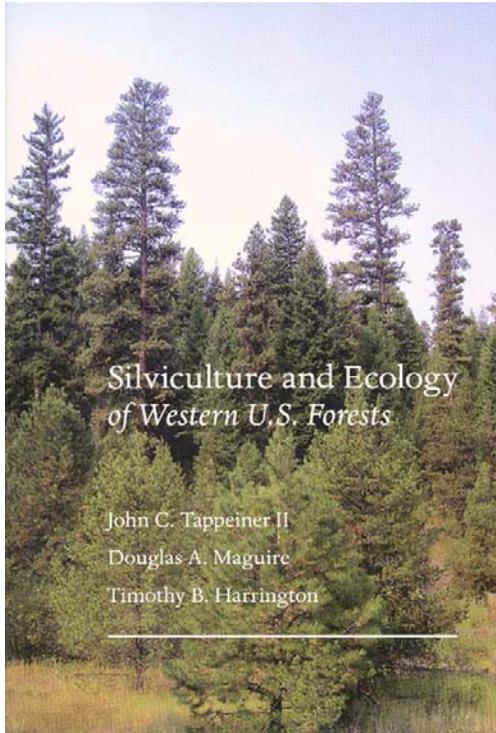
Accomplishment: Modern silviculture is more than just methods for cultivating forests. Today's foresters use silviculture to implement specific management objectives through carefully-designed prescriptions. Silvicultural treatments are used routinely to improve forest health, abate wildfire hazard, or create wildlife habitat. A team of scientists from Oregon State University and PNW Research Station has written the first comprehensive reference book on silviculture for the western U.S. Using an ecosystem framework as a basis for silviculture, the book includes chapters on ecology of shrubs and hardwoods, methods for regenerating forests, measurement of stand density, use of controlled fire, and other topics. The book synthesizes 40 years of forestry research, including over 900 references as well as the authors' research and management experiences. Written with forest practitioners, policy makers, and students in mind, the book provides a practical understanding of the science and application of silviculture.

Use: The book serves as a primary reference for land managers, scientists, and students interested in using silvicultural treatments to improve forest health, produce forest products, manage wildlife habitat, and accomplish other forestry objectives. Professors at Oregon State University and University of California – Berkeley are currently using the book in their silviculture classes.

Contact: Timothy B. Harrington, tharrington@fs.fed.us, Resource Management and Productivity Program

Partner: Oregon State University

Publication: Tappeiner, J.C., II; Maguire, D.A.; Harrington, T.B. 2007. *Silviculture and Ecology of Western U.S. Forests*. Corvallis, OR: Oregon State University Press. 440 p.



The first textbook on silviculture and ecology of western U.S. forests

Regional conference convenes researchers, managers, and policy-makers to form a Pacific Northwest Invasive Plant Council

Accomplishment: Invasive plant species threaten many terrestrial and aquatic communities in the Pacific Northwest with loss of native species, degradation of wildlife habitat, and alteration of basic ecosystem functions. To address these concerns and begin a dialogue of collaboration, a scientific conference was held in September entitled, “Meeting the Challenge: Invasive Plants in Pacific Northwest Ecosystems.” Nearly 60 papers and posters were presented, including keynote presentations by Ann Bartuska (Forest Service Deputy Chief for Research and Development), John Randall (The Nature Conservancy), Les Mehrhoff (University of Connecticut), and Doug Johnson (California Invasive Plant Council). The audience included over 180 professionals from public and private organizations responsible for monitoring, studying, or managing non-native invasive plants. A proceedings publication from the conference (PNW General Technical Report 694) includes twenty-eight papers on topics including early detection and rapid response; control techniques, biology, and impacts; management approaches; distribution and mapping of invasive plants; and partnerships, education, and outreach.

Use: The conference stimulated a scoping process that is currently underway at the University of Washington Botanic Gardens to initiate a Pacific Northwest Invasive Plant Council. Similar organizations in other regions of the U.S. have been highly effective at coordinating early detection and rapid response efforts, as well as educating land managers on prevention and control tactics for invasive plants.

Contact: Timothy B. Harrington, tharrington@fs.fed.us, Resource Management and Productivity Program

Partners: University of Washington, Botanic Gardens; The Nature Conservancy; and Montana State University, Center for Invasive Plant Management.

Publication

Harrington, T.B.; Reichard, S.H. tech. eds. 2007. Meeting the Challenge: Invasive Plants in Pacific Northwest Ecosystems. Gen. Tech. Rep. PNW-GTR-694. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 166 p.



Invasive Plant: Purple loosestrife (*Lythrum salicaria*)

New techniques [Nuclear microsatellites] developed for assessing genetic diversity in antelope bitterbrush available for planting

Accomplishment: Antelope bitterbrush (*Purshia tridentata*) is an arid-land shrub that occupies an important ecological niche in many fire-prone communities across the western United States. Because of its importance as a food source for large mammals and granivores, bitterbrush is frequently planted by Federal agencies in post-fire revegetation and landscape restoration activities. We are currently analyzing genetic diversity of bitterbrush as part of a larger effort to develop seed movement guidelines. Eight novel nuclear microsatellite loci developed for this species show high levels of polymorphism (13-33 alleles per locus), and observed levels of

heterozygosity that meet theoretical expectations. An initial survey of 12 populations reveals moderate but significant ($F_{ST} = 0.13$, $p < 0.01$) genetic differentiation among populations. These markers are being applied to assess genetic diversity in bitterbrush cultivars, and to quantify neutral genetic differentiation among populations. These results will be combined with quantitative genetic data to identify adaptive traits in this key restoration shrub.

Use: These microsatellite markers are currently being used to assess the amount and kind of neutral diversity available in USDA NRCS cultivars (e.g., 'Lassen', 'Maybell') that are widely planted on public lands.

Contact: Matthew Horning (mhorning@fs.fed.us) and Richard Cronn (rcronn@fs.fed.us), Genetics Team, Resource Management and Productivity Program

Partners: USDA NRI Managed Ecosystems Program; US Forest Service Region 5 and Region 6 Genetics Programs



Post-fire re-sprouting is one of many traits that are being analyzed in the Forest Genetics Team's bitterbrush common gardens.

Forested wetlands and bogs have lower rates of nitrogen and phosphorus mineralization than previously believed for southeastern Alaska

Accomplishment: A detailed study of field and laboratory experiments showed that nitrogen and phosphorus mineralization rates are very low in southeastern Alaskan wetlands. The high internal nutrient re-cycling rates in open bogs indicates that these ecosystems retain N and P. Forested wetlands did not have as great a potential for internal nutrient cycling and are sites for exchange between vegetation and surface waters. Estimates for carbon cycling and sequestration in terrestrial ecosystems relies on accurate estimates of the magnitude nitrogen and phosphorus cycles.

Use: This information can be used in modeling carbon sequestration and determining future scenarios of vegetation succession under changing climate conditions.

Contact: David D'Amore ddamore@fs.fed.us; Resource Management and Productivity Program

Partners: University of Alaska-Southeast, University of Alaska-Fairbanks

Publications:

Fellman, J.B. and D.V. D'Amore. 2007. Nitrogen and phosphorus mineralization in three wetland types in southeast Alaska. *Wetlands* 27:44-53.

Hood, E., J.B. Fellman, and R.T. Edwards. 2007. Salmon contributions to dissolved organic matter and nutrient loads in a coastal stream in Southeastern Alaska: An application of fluorescence spectroscopy. *Limnology and Oceanography* 52:1580-1587.



Jason Fellman collects soil samples for a nitrogen and phosphorus mineralization experiment in a southeast Alaskan bog.

RMP Issue 2: A Wide Range of Silviculture and Genetic Practices is Needed to Provide the Variety of Conditions, Services, and Products that will be Demanded from Forested Lands

[Key Finding] Native Douglas-fir populations will be poorly adapted to climates expected by the end of the 21st century

Accomplishment: Climates are expected to warm considerably over the next century, resulting in expectations that plant populations will not be adapted to future climates. Using results from seedling common garden studies, we examined the relationship between population variation in adaptive traits and environmental variation of seed sources to estimate differences between current populations and populations that are expected to be adapted to future climates. Risk of maladaptation was estimated as the amount of nonoverlap between current and future populations as determined by mean differences and genetic variation within populations for a trait. The risk of maladaptation was large for most traits when compared to the risk associated with transfers within current seed zones, particularly for the more drastic climate change scenarios.

Use: As climates warm in the coming decades, current seed zones will become less relevant. Considerably uncertainty remains, however, with respect to specific climate projections and appropriate time frames to consider. We recommend addressing uncertainty through increasing within-stand diversity by planting mixtures of local seed sources and seed sources from lower elevations and further south.

Contact: Brad St.Clair (bstclair@fs.fed.us), Resource Management and Productivity Program

Partner: Oregon State University

Publication:

St.Clair, J.B. and G.T. Howe. 2007. Genetic maladaptation of coastal Douglas-fir seedlings to future climates. *Global Change Biology* 13: 1441-1454.

The collaborative and competitive spirit of the regional Agenda2020 partnership has a positive impact on other forestry research programs throughout the country

Accomplishment: The national Agenda2020 program has a strong suite of sustainable forestry projects funded by USDA Forest Service Research and Development, in collaboration with the American Forest and Paper Association, in high priority areas such as soil and tree productivity, molecular biology and biotechnology, and management. The partnership helps the country reduce its dependency on fossil fuels, increase carbon sequestration, promote sustainable development in rural communities, and increase the global competitiveness of the industry. This year we completed the second three-year commitment from the three western research stations (Rocky Mountain, Pacific Northwest, and Pacific Southwest), universities, and timber industry partners, increasing the number of collaborative studies through a combined investment of about \$4 million, with about \$1 million from timber companies and \$3 million from the research stations. In 2007, the PNW Station Agenda2020 partnership successfully completed a dozen projects that address long-term site productivity, genetics, and tool development, and also reflect stronger funding linkages and collaboration among the stations.

Use or Application: Results and technologies from the Agenda2020 partnership are being used by forest products industry to sustainably manage for wood production and maintain competitive strength in a global market.

Outcomes: In the past year, the PNW Station was instrumental in helping Forest Service Research and Development organize (including handling all logistics) the first National Agenda2020 Symposium to highlight all the accomplishments of this partnership with industry since its inception. As a result the Station and Forest Service R&D in general have greatly strengthened relationships and credibility with industry and universities, with the PNW Station viewed as providing critical leadership in the West.

Contact: Charley Peterson, cepeterson@fs.fed.us, Resource Management and Productivity Program

Partners: Private industry, NGO's (e.g., American Forest & Paper Association, National Council on Air and Stream Improvement); and Universities (e.g., University of Washington, Oregon State University, University of Idaho).

Scientists providing international leadership on how forested lands can sustainably contribute timber and other forest values in an environmentally acceptable manner

Accomplishment: Over the past five years, scientists from the Resource Management and Productivity Program have worked closely with the International Union of Forest Research Organizations (IUFRO) in demonstrating the value and relevance of long term studies, in particular those large-scale experiments with operational treatments, that address joint production of wood and ecological and social values. The vast majority of these large experiments were initiated in the 1990's and are now showing significant results. Major tech-transfer and information-sharing activities have included leading and organizing international symposia in 2003 (Creating a legacy for sustainable science-based forest management: lessons learned from field experiments; Davos, Switzerland), 2004 (Balancing Ecosystem Values: Innovative Experiments for Sustainable Forestry; at Portland, Oregon), and 2005 (Long-term multi-purpose experiments in the forest sector; requested by the IUFRO Congress, Brisbane, Australia). The conferences have also included substantial field trips.

Use or Application: Collectively, many of the variable retention harvest and thinning options, along with new studies in uneven-aged silviculture regimens, are gaining wider use on federal lands in Alaska, the western US and on crown lands in British Columbia

Outcomes: These three symposia, including the co-authored USGS-USFS plenary address at the 2005 Congress, are the culmination of scientific efforts that continue to broaden the forest silviculture discussions beyond simply growth and yield to the current use of and appreciation for, silviculture as a vital forestry discipline and tool for producing and maintaining a wide range of ecological and social values.

Contact: Charley Peterson, cepeterson@fs.fed.us, Resource Management and Productivity Program

Partners: University of Washington, Oregon State University, U.S. Forest Service Region 6 and Region 10 (Alaska), Umpqua National Forest, Gifford Pinchot National Forest, U.S. Bureau of Land Management, Washington State's Department of Natural Resources, British Columbia Ministry of Forestry, Canadian Forest Service, U.S. Dept of Defense, the Demonstration of Ecosystem Management Options Study (DEMO), and the Pacific Northwest Research Station

Current Publications:

C.E. Peterson and R. C. Szaro, eds. 2006. Building a Foundation for Sustainable Science-based Forest Management: Long-term multi-purpose experiments in the forest sector. Special issue of Allg. Forst- u. J.-Ztg. (ALLGEMEINE FORST- und JAGDZEITUNG), 177. Jg., 6/7:97-136. ISSN 0002-5852

Peterson, C. E. and D.A. Maguire, Douglas A., eds. 2005. 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. 389p.

Szaro, R.C., C.E. Peterson, K von Gadow, and N Kräuchi (Eds). 2004. Creating a Legacy for Sustainable Science-based Forest Management: lessons learned from field experiments. For. Snow Landsc. Res. Vol 78, Issue 1/2. 208p. ISSN 1424-5105

Research is characterizing the unique importance of headwater streams to downstream aquatic resources and watershed condition

Accomplishment: Small, headwater streams have historically received little consideration relative to larger fishbearing streams. The importance of headwater streams to downstream aquatic resources and overall watershed condition is increasingly being recognized. PNW scientists are playing a major role in developing original and synthetic research addressing several high priority research needs and information gaps for basic ecology, biology, and physical attributes of riparian systems and processes; and the influences of management practices and policy on the provision of riparian services from headwater streams. This work has been captured in a recent special issue of Forest Science focusing on the science and management of forest headwater streams. Of 21 papers included in the issue, at least 12 direct links to the PNW Research Station through authorship by station scientists or by collaborators on projects receiving PNW funding, including the Station's Agenda 2020 program.

Use: This body of work will be useful to managers and policy makers in developing best management practices and riparian reserve guidelines; or in developing watershed assessments and restoration or conservation plans.

Contact: Paul D. Anderson, pdanderson@fs.fed.us, Resource Management and Productivity Program

Partners: Air and Land Interactions Program, Ecosystem processes Program, Bureau of Land Management; Oregon Headwaters Research Cooperative; Weyerhaeuser Company; The National Council for Air and Stream Improvement (NCASI)

Publications:

Anderson, P.D.; Larson, D.J.; Chan, S.S. 2007. Riparian buffer and density management influences on microclimate of young headwater forests of western Oregon. Forest Science. 53(2): 254-269.

Danehy, R.J.; Chan, S.S.; Lester, G.T. [and others]. 2007. Periphyton and macroinvertebrate assemblage structure in headwaters bordered by mature, thinned, and clearcut Douglas-fir stands. Forest Science. 53(2): 295-307.

Rykken, J.J.; Chan, S.S.; Moldenke, A.R. 2007. Headwater riparian microclimate patterns under alternative forest management treatments. Forest Science. 53(2): 270-208.

Patterns of Yellow-cedar decline can be used to guide management of the species

Accomplishment: Abundant experimental and observational evidence indicates that the mechanism of yellow-cedar tree death is a form of freezing injury related to premature dehardening of the trees in spring. Trees exposed by inadequate canopy are subject to soil warming in the late winter and early spring that triggers dehardening leaving the trees more vulnerable to freezing damage. Trees that are covered by snow are protected from injury, usually at high elevation. There appears to be a regional shift from low-elevation yellow-cedar stands to high elevation stands due to climate shifts in the region where lower snowpack has combined with late winter and early spring freezing episodes. Yellow-cedar decline represents one of the best examples worldwide for how a minor shift in climate has had serious and unanticipated consequences in forest ecosystems. Managing long-lived forest trees in a changing climate is challenging but also essential because Alaska has so few tree species.

Use: Research and development on yellow-cedar decline have progressed to the point where we can propose a strategy to simultaneously conserve and actively manage yellow-cedar by:

1. Identifying the current and future distribution of yellow-cedar decline through remote sensing and climate and landscape modeling.
2. Shifting some timber harvesting to the decline-impacted forests where wood properties of dead trees are largely retained and, regardless of salvage, forests are transitioning away from yellow-cedar.
3. Promoting the regeneration and growth of yellow-cedar in forests that are not currently declining nor are projected to be declining in a warming climate.

Contact: David D'Amore ddamore@fs.fed.us, Resource Management and Productivity Program

Partners: Northern Research Station, University of Vermont, University of Alaska-Fairbanks

Publication:

Hennon, P.; D,V. D'Amore; et al. 2006. Climate Warming, Reduced Snow, And Freezing Injury Could Explain The Demise Of Yellow-Cedar In Southeast Alaska, USA. World Resource Review Vol. 18 No. 2: 427-450



Standing dead yellow-cedar trees interspersed with healthy western hemlock are a common site on low-elevation hillslopes in southeast Alaska.

Retaining 2.5-acre forest aggregates during harvest provides microclimatic conditions that are comparable to those in undisturbed forest and suitable, in the short-term, for persistence of forest-dependent species

Accomplishment: Variable retentions, in particular forest aggregates, are receiving stronger consideration for regeneration harvest in forest ecosystems managed for both timber and ecological objectives. If residual forest aggregates are to serve as temporary refugia for species sensitive to disturbance or environmental stress, microclimatic conditions must be sufficiently buffered. We compared microclimatic conditions inside 2.5-acre aggregates to conditions in adjacent harvest areas and larger tracts of undisturbed forest (controls). Light availability and temperature, were greatest at the edge, but declined sharply inside the aggregate, with most change occurring within 66 feet of the edge. Soil temperatures exhibited greater spatial variation and stabilized further from the edge (33 to 99 feet). Our results, compared with previous studies of ground vegetation, suggest that 2.5-acre aggregates are sufficiently large to contain areas with light, temperature, and soil moisture that are comparable to those in undisturbed forest and suitable, in the short-term, for persistence of forest-dependent species.

Use: Current retention standards in the Northwest Forest Plan allow for retention of forest aggregates as small as 0.5 acres (~82 feet in radius). Our results suggest that even if the depths of edge effects were not affected by patch size, microclimatic conditions in aggregates this small would be severely compromised. However, within 2.5-acre aggregates, levels of light and temperatures at the forest floor can be surprisingly similar to those of interior forests. Moreover, short-term responses of vascular and non-vascular plants suggest that adverse ecological effects may be limited to a relatively narrow region of the edge. These results can be used to develop retention guidelines that better meet management objectives.

Contact: Troy Heithecker, theithecker@fs.fed.us, Resource Management and Productivity Program

Partners: USDA Forest Service Region 6, University of Washington, Oregon State University, University of Oregon, Gifford Pinchot and Umpqua National Forests, and the Washington State Department of Natural Resources as partners in the Demonstration of Ecosystem Management Options Study (DEMO)

Publications:

Heithecker, T.D., Halpern, C.B., Edge-related gradients in microclimate in forest aggregates following structural retention harvests in western Washington, *Forest Ecol. Manage.* (2007), doi:10.1016/j.foreco.2007.05.003. This publication is available on the journal website at: <http://dx.doi.org/10.1016/j.foreco.2007.05.003>

Heithecker, T.D.; Halpern, C.B. 2006. Variation in microclimate associated with dispersed-retention harvests in coniferous forests of western Washington. *Forest Ecology and Management*. 226: 60-71.

A new synthesis of silvicultural research and management in the Douglas-fir region includes factors that have shaped and influenced research direction

Accomplishment: Over the last century silvicultural practices in the Douglas-fir region evolved through a combination of formal research, observation, and practical experience of forest managers and silviculturists, and changing economic and social factors. These practices have had a great influence on the economic well-being of the region and on the present characteristics of the region's forests. This long history is unknown to most of the public, and much of it is unfamiliar to many natural resource specialists. PNW scientists trace the history of how we got where we are today and the contribution of silvicultural research to the evolution of forest practices. Special attention is given to the large body of information developed in the first half of the twentieth century that is becoming increasingly unfamiliar to both operational foresters and—perhaps more importantly—to those engaged in forestry research. Current trends in silviculture and silviculture-related research are also emphasized.

Use: This publication provide forest researchers and managers awareness and access to results from silviculture research results that are difficult to find in online databases, particularly in the case of older studies that were conducted in the first half of the twentieth century. Many of these studies have relevance to newer silviculture regimes being proposed and implemented to address multiple resource objectives.

Contact: Robert O. Curtis, rcurtis@fs.fed.us, Retired PNW emeritus scientist, Resource Management and Productivity Program

Publication:

Curtis, Robert O.; DeBell, Dean S.; Miller, Richard E.; Newton, Michael; St. Clair, J. Bradley; Stein, William I. 2007. Silvicultural research and the evolution of forest practices in the Douglas-fir region. Gen. Tech. Rep. PNW-GTR-696. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 172 p.

RMP Issue 3: Improved Models, Databases, Measurement Techniques, and Analysis Tools are Needed to Evaluate Forest Management Options

[Key Finding] Enhancements to the LIDAR forest vegetation measurement software (FUSION) and expanded tutorials now available on-line

Accomplishment: The FUSION software system, user-friendly software for processing and displaying airborne laser scanning (LIDAR) data, has been updated by the PNW and is being distributed through the USDA Forest Service, Remote Sensing Application Center (RSAC). The software has been enhanced to facilitate processing of data for large projects and several new metrics have been added to help characterize vegetation structure over large land areas. The FUSION tutorials, developed by RSAC, provide an on-line software installation guide and task-specific tutorials focused on interactive display and presentation features of FUSION as well as the data processing environment (<http://www.fs.fed.us/eng/rsac/>). Using the tutorial (and companion sample LIDAR dataset) users learn how to process LIDAR data into ground models and forest canopy height models, measure individual trees, and automate processing tasks for large projects.

Outcome: The FUSION LIDAR software system has been used for several projects on national forests (Idaho Panhandle, Rogue-Siskiyou, Siuslaw), by researchers at several universities (University of Washington, Mississippi State, Oregon State, Colorado State), and by other federal, state, or private groups (USGS, BLM, Fort Lewis Military Reservation, Washington DNR & DFW, Weyerhaeuser, Port Blakely Tree) to display and analyze forest vegetation.

Contact: Bob McGaughey, bmcgaughey@fs.fed.us, Resource Management and Productivity Program

Partners: Joint Fire Sciences Program; University of Washington, Precision Forestry Cooperative; Fort Lewis Military Reservation; Weyerhaeuser

Publication:

Introduction to Fusion on-line manual available at: www.fs.fed.us/eng/rsac/fusion/

New Tools/Emerging Technologies

Tool: Regional Wetland Delineation Manual for Alaska

Function: A guide for delineating wetlands in Alaska that uses indicators that are specific to Alaskan ecosystems to determine wetland boundaries based on soils, plants and hydrology.

How to get it: The guidebook is available on-line from the USACOE at:

http://www.usace.army.mil/cw/cecwo/reg/reg_supp.htm

Contact: David D'Amore ddamore@fs.fed.us; Resource Management and Productivity Program

Webpage: “Large-Scale Silvicultural Experiments In Western Oregon and Washington” Located on the USDA Forest Service PNW Research Website.

Function: Mechanism for enhancing communication and information exchange among scientists, cooperators and other stakeholders interested in large-scale, operational silviculture studies in the Pacific Northwest.

How to get it: <http://www.fs.fed.us/pnw/research/lse/>

Symposia, Workshops, and Tours

Event: RMP provided major contributions to the *National Workshop on Forest Productivity and Technology: Cooperative Research to Support a Sustainable and Competitive Future* held in Washington, DC, November 7-10, 2006 and sponsored by USFS, American Forest & Paper Association (AF&PA), and The National Council for Air and Stream Improvement (NCASI). 110 participants

Event: Integrating Science and Experience in Silviculture Prescriptions Workshop

Location/Date: Vancouver, WA, June 15-16, 2007

Description: Practicing land managers and research scientists convened to present and discuss operational silviculture projects considered to represent state-of-the art practices. Discussions focused on the assumptions, scientific knowledge and tools being used in the development of operational practices. The two primary outcomes were establishment of communication among practitioners and researchers, and a compilation of research needs to address limitations in knowledge or tools to meet current and projected issues in silviculture.

Participants: 70+ participants representing NFS, BLM, and NGO silviculturists and resource specialists; PNW Scientists and Program Managers; Oregon State University and University of Washington Faculty

Event: Western Forest Climate Change Task Force Workshop

Location and date: Vancouver, WA, December 13, 2006

Description: This workshop brought together researchers and managers from Oregon, Washington and British Columbia to learn about climate change impacts on forest ecosystems and discuss the development of a multi-disciplinary taskforce of forest managers, forest geneticists, tree breeders, silviculturists, and tree physiologists to evaluate potential genetic and silvicultural options for mitigating effects of climate change. Number of participants: 16

Event: “Managing for Wildlife Habitat in West-Side Production Forests.” Workshop - Vancouver, WA, October 18, 2006. The workshop included a panel of 11 speakers from research, management, or policy backgrounds who shared prescriptions and guidelines for managing wildlife habitat in forests cultivated primarily for wood production. A proceedings publication from the workshop (PNW General Technical Report 695) includes a summary of

each presentation plus a synthesis paper that addresses how to integrate habitat management into existing silvicultural systems. 150 participants.

“Capitol Forest Research Tour.” Olympia, WA, July 13, 2007. Scientists from the Silviculture and Forest Models Team met with managers and resource specialists from the Washington State Department of Natural Resources to visit and discuss results of the Silvicultural Options Study. Topics included methods for establishing understory conifers in mature forests and silvicultural systems for regenerating forests given different management constraints. 21 participants.

“Forest measurement and monitoring with LIDAR Workshop.” Portland, OR, March 20, 2007. At the request of the BLM, PNW scientists developed and presented a half-day workshop in which LIDAR forest measurement research results were presented, followed by demonstrations of the PNW LIDAR Fusion software system to local, state, and federal resource specialists and managers. 45 participants.

“Forest measurement and monitoring with LIDAR Workshop.” Colville, WA, April 19, 2007. At the request of the Colville National Forest and the Northeast Washington Forestry Coalition, PNW scientists presented a half-day workshop in which LIDAR forest measurement research results were presented, followed by demonstrations of the PNW LIDAR Fusion software system to private, state, and federal resource specialists and managers. 40 participants.

“Hardwood Silviculture Cooperative Annual Meeting.” Olympia, WA, July 12, 2007. As part of the annual Hardwood Silviculture Cooperative Meeting, the team conducted a tour of its oak research sites in the Olympia area for private, state, and federal scientists and managers. 15 participants.

Conservation Education

Project name: Outdoor School

Location: Corvallis, Oregon; Corvallis Public Schools

Description: Outdoor school is a program for middle schoolers to receive environmental education in a natural setting. in Benton County. A member of our Team developed the Plants curriculum focused on hands-on course material that covered plant and pollinator biology, conservation, and integration with soils, wildlife, forestry and water. Two other Team members served as instructors. About 250 6th-grade school children are served.

Project name: Forest Camp – Project Learning Tree

Location: Sweet Home, Oregon; Rural Benton Co. Schools

Description: Forest Camp is an outdoor learning event for 5th and 6th graders. The curriculum is focused on the ecology of forests with our Team providing interactive instruction in the “web of life” concept illustrating the interactive linkages among biotic and abiotic elements of forest ecosystems. Our team contributed one person to provide one day of instruction for 100-120 5th students.

“Hands-on Experience with Science” series, Lincoln Elementary School, Olympia School District, Olympia, WA—A forester for the Resource Management and Productivity team in Olympia, WA made 12 visits to speak with second and third graders on a variety of natural

resource topics including radio tracking, measuring trees, weather stations, plant reproduction, and graphing ecological data. Number of participants: 25 per visit

Honors and Awards

Science Findings May 2007 -- David D'Amore: The mysterious demise of an ice-age relic: Exposing the cause of yellow-cedar decline.

Science Finding for September 2007 -- Keith Aubry and Charley Peterson: Green-tree Retention in Harvest Units: Boon or Bust for Biodiversity?

Nan Vance, retired Research Plant Physiologist with the Biology and Culture of Forest Plants Team in Corvallis was named an Emeritus Scientist for 2007-2009. In this capacity, Nan will continue her research on the fundamental ecology of native plants and pollinators, and applied research into seed collection, handling and deployment methods for restoration of native plant communities.

Submission " A rigorous assessment of tree height measurements obtained using airborne lidar and conventional field methods ", published in the Canadian Journal of Remote Sensing, published in Volume 32, Number 5, October, 2006, was awarded Second Place in the "CJRS Best Paper of the Year - 2006 Competition".

Cooperator Funding

<u>Cooperator</u>	<u>Funded Activities</u>
Center for Invasive Plan Management	Evaluating competitive ability of native grasses to exclude Scotch broom
DOD, U.S. Army, Fort Lewis	<ul style="list-style-type: none"> •Biology and silviculture of Oregon white oak •Regeneration of Douglas-fir in the understory <ul style="list-style-type: none"> -Modeling understory, midstory, overstory development -Management of understory shrubs •LIDAR for forest canopy and inventory
Green Diamond Resource Company	•Effects of soil and climatic factors on early growth and long-term productivity of Douglas-fir in response to woody-debris manipulation and competing vegetation control
GROWISER, Andy Huber	Grande Ronde Overlook Wildflower Institute Serving Ecological Restoration. Joint study on restoration of <i>Cypripedium montanum</i> and other rare forbs and grasses in collaboration with Peter Bernhardt, St. Louis University
Joint Fire Sciences Program	Use of LIDAR and IFSAR to measure vegetation structure
Nez Perce National Forest, Salmon River	Salmon River Canyon - Use of prescribed fire

National Fire Plan Funded: Canyon Weed Management Area	in native vegetation restoration and mitigation of non-native invasive species
National Science Foundation	(cooperative research) Gymnosperm Tree Of Life
Olympic National Forest	Olympic Habitat Development Study
Oregon State University Seed Lab	Joint project testing <i>in vitro</i> and in the field native forbs and grasses of the mid Willamette valley uplands and oak savanna
Port Blakely Tree Farms	Effects of soil and climatic factors on early growth and long-term productivity of Douglas-fir in response to woody-debris manipulation and competing vegetation control
RMRS - Shrub Lab, Provo, Utah	Genetic diversity in Intermountain restoration plants
PNW-FIA	Use of LIDAR for forest inventory and monitoring
Tongass National Forest	Tongass-Wide Young-Growth Studies
University of Alaska, Southeast	Soil contributions to watershed functions: Influence of basin characteristics on carbon and nutrient inputs to southeast Alaska streams
University of Norte Dame	The role of salmon-derived nutrients in managed U.S. forests
USDA CSREES NRI Program	Genetic variation and adaptation in antelope bitterbrush
USDA Olympic National Forest and Region 6 Forest Health & Protection	Whitebark pine ecology study
USDI BLM	<ul style="list-style-type: none"> •Impacts of density management on microclimate and microsite of riparian buffers and upland forests •Timbered Rock Reforestation, Stand Development and Fuels Study •Determination of seed zones for high priority restoration species
USDI BLM/USDA FS	<ul style="list-style-type: none"> •Great Basin Native Plant Selection and Increase Project •Genetic diversity and seed movement guidelines for bluebunch wheatgrass
USDI BLM & WA-DNR	Effect of tree damage on timber quality
USFS Savannah River Forest Station	Remeasure Longleaf pine thinning and midstory control study
Weyerhaeuser Company	LIDAR for forest inventory and monitoring
Weyerhaeuser Company & National Agenda 2020	Fall River long-term site productivity study
Western Regional Agenda 2020	<ul style="list-style-type: none"> •Mechanisms of genetic variation in productivity of young Douglas-fir plantations •Modeling genetic gain in established Douglas-fir

- plantations
- Discovery of genes controlling complex traits in Douglas-fir
- Effects of soil and climatic factors on early growth and long-term productivity of Douglas-fir in response to woody-debris manipulation and competing vegetation control

Support to Cooperators

<u>Agency and Study Title</u>	<u>Principal investigator</u>
Agricultural Research Service Plant Introduction Center: Genecology of mountain brome	Richard Johnson
Mississippi State University: Midstory tree growth following variable density thinning	Scott Roberts
Ohio State University: Control mechanisms of branching in woody species	Morris Cline
Oregon State University:	
•Synthesis of genetic and silvicultural options for adapting to climate change in Western forests	Glenn Howe
•Rapid threat assessment for impacts of genetically modified organisms on wildlands	David Harry
•Assessment of overstory and understory vegetation for DEMO project	Douglas Maguire
•Initial post-treatment assessment of green-tree retention effects on ectomycorrhizal fungi: DEMO	Daniel Luoma
•Data management for DEMO project	Gody Spycher
•Interactive responses of ecosystem components to varying levels and patterns of green-tree retention - DEMO	Douglas Maguire
•Effects of soil factors on Douglas-fir responses to woody debris removal and competing vegetation control	Stephen Schoenholtz
•Sea Grant, Watershed Stewardship Education Program: Content and digital curriculum development for module on <i>Riparian Areas Function and Management</i>	Tara Nierenberg
•Sampling alternatives to quantify spatial forest structure and diversity in riparian areas	Temesgen Hailemariam
•Vegetation dynamics and fire hazard in mixed-species restoration plantings	Klaus Puettmann
•Realized genetic gain trials	Keith Jayawickrama
St. Louis University: Pollination ecology and insect systems of beargrass for sustainable management of harvested native plants; pollination systems of <i>Cypripedium montanum</i>	Peter Bernhardt
University of Oregon: Critical public perceptions of forest successional pathways	Robert Ribe
University of Washington:	
• Effects of forest management on mineralization of organic matter in a coastal Douglas-fir stand	Robert Harrison
• Assessment of overstory and understory vegetation - DEMO	Charles Halpern
• Effects of organic matter retention and management on long-term productivity of PNW Douglas-fir plantations:	Rob Harrison

nutrient processes and leaching responses