timber harvest/volume ratios. The five counties with the lowest timber harvest/volume ratios were Josephine, Marion, Washington, Multnomah, and Tillamook. Most of these counties had rapidly growing populations and people who expressed concerns about viewsheds, forest fragmentation, and recreation needs in forests.

For counties with high timber harvest/volume ratios, the growing-stock volume per acre continued to decline slightly after 1977. The five counties with the highest timber harvest/volume ratios were Yamhill, Lane, Curry, Douglas, and Columbia. Changes in land uses appeared to be the overwhelming cause of changes in timberland area and volume; climate variations did not appear to be the cause.

Contact: Joseph Donnegan, jdonnegan@fs.fed.us, Forest Inventory and Analysis Program

Oregon forest inventory results provided to Oregon Department of Forestry

Updated information is available on Oregon forests, with "forest land" defined as land at least 10 percent covered by trees of any size, larger than 1 acre, and at least 120 feet wide. For inventory, the division between western and eastern Oregon is considered the crest of the Cascade Range. The information has been provided to the Oregon Department of Forestry for their upcoming review of the state Forest Practices Act.

Western Oregon has an estimated 19 million acres of land, with about 80 percent of this land forested and 71 percent of the forest acres being timberland. Lands administered by the Forest Service and BLM make up about 48 percent of the timberland.

Eastern Oregon has an estimated 42.2 million acres of land; about 32 percent of this land is forested, with 76 percent of the forest acres being nonreserved timberland. The amount of forest land in eastern Oregon has increased by about 650,000 acres since the 1930s. Ponderosa pine is predominant out of the 31 tree species in eastern Oregon. The Forest Service, BLM, and other federal agencies manage about 71 percent of eastern Oregon forests; about 27 percent is privately owned;

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and the remaining 2 percent is managed by the Oregon Department of Forestry and other nonfederal public agencies. Eastern Oregon has about 25.7 billion cubic feet of timber, of which about 312 million cubic feet per year were harvested between 1987 and 1999. These results were published in PNW-GTR-578.

Although ozone injury is common in California forests, no ozone injury has been detected in Oregon forests since ozone monitoring began in 1998. Ozone causes visible injury to foliage and may cause long-term growth loss and contribute to tree death when combined with insects or disease.

Contact for western Oregon forests: David L. Azuma, dazuma@fs.fed.us, Forest Inventory and Analysis Program
Contact for eastern Oregon forests: Sally Campbell, scampbell01@fs.fed.us, Forest Inventory and Analysis Program

Science-based framework for monitoring the success of riparian management and restoration projects will help in monitoring watersheds on large and small scales.

New method tested for predicting spotted owl abundance and nesting success

Traditionally, northern spotted owl populations have been assessed by calling in adult owls, banding them, locating owl nests, climbing trees to count young owls in nests, and then relocating owls and nests each year. These surveys are expensive and time consuming and may disrupt owls. Scientists are testing a method based on the type and amount of forest vegetation around a nest site for its accuracy in predicting owl survival and reproductive rates. The two methods have been tested in three Oregon forests, one near Roseburg, one in the Coast Range, and one in the west central Cascade Range.

Results suggest that it is difficult to predict survival and productivity of owls based on vegetation attributes alone, because weather, age of owls, and the presence or absence of barred owls have a strong influence as well. Preliminary comparison of the two methods indicates that the traditional demographic methods are more accurate.

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Red tree voles: Who are they and where do they go?

Tree voles are unique arboreal mice that occur only in Oregon and northern California. Red tree voles are also a primary food for northern spotted owls. Accurate information about the seldom-seen, canopy-dwelling voles has been scarce, but new taxonomic and genetic studies have clarified vole taxonomy. Scientists established conclusively that the red tree vole, found in Oregon and parts of northern California, is indeed a distinct species from the Sonoma tree vole, whose range is northern California beyond the red tree vole's range. Research also determined that both species are distinct from the whitefooted vole and heather voles, and that some debated populations of the tree voles are not valid subspecies. Genetic work continues to determine if there are unique and isolated subpopulations within the red tree vole species.

Scientists are also investigating red tree vole ecology and behavior. The use of tiny radio collars, weighing less than a gram each, has allowed scientists to track red tree vole movements in forest canopies and year-round. So far, the radio telemetry work has shown that red tree voles use multiple nests in different trees and that both male and female voles stay up in trees year-round. No use of ground nests has been detected, but occasional use of cavity nests has been documented. So far, no evidence has emerged of seasonal differences in vole movements. Better knowledge of red tree vole ecology can be used in estimating the effects of forest management on this preferred prey of northern spotted owls.

Contact: Eric Forsman, eforsman@fs.fed.us, Ecosystem Processes Program

New findings on wild salmon genetic diversity could lead to improved conservation strategies

Wild salmon have survived in the tumultuous and changing environments of southeast Alaska rivers by developing hundreds of specially adapted salmon runs, or "stocks." Each salmon stock is genetically adapted to its home watershed through variations in life history, disease resistance, size, and migratory behavior. The conservation of wild salmon requires giving thought to conserving their genetic diversity.

Scientists looked for these markers of wild salmon genetic diversity: (1) high potential for adaptive variation, including distinctive run timing; (2) a distinctive trait in combination with high spawner

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Conservation of wild salmon requires thought to conserving their genetic diversity.

abundance, or genetic markers (allozymes) that diverge from geographic clustering patterns; and (3) more than one distinctive characteristic or freshwater habitat shared with other distinctive populations. Of 47 salmon populations that have been adequately sampled from a population of 9,000 populations in southeast Alaska, 22 populations met the criteria for genetic diversity.

Protecting freshwater habitats for these stocks with high genetic diversity may be the most practical approach for conserving Pacific salmon diversity. Freshwater habitats for 6 of the 22 identified populations are located in watersheds without restrictive land use designations such as roadless, wilderness, or national park. Habitat protection for just a few additional watersheds could help preserve much genetic diversity in wild salmon.

Contact: Mason D. Bryant, mdbryant@fs.fed.us, Aquatic and Land Interactions Program

Effectiveness monitoring asks if aquatic strategies are achieving goals in Northwest Forest Plan area

The Northwest Forest Plan (NWFP) brought together land-based strategies to protect old-growth forests, spotted owls, and associated species, with stream-network based strategies to protect watersheds, salmon, and other aquatic life. Effectiveness monitoring was a vital part of the plan, asking if the new strategies were achieving the plan's goals.

Station scientists developed a science-based framework and program for monitoring the success of riparian management areas and restoration projects in the NWFP area. The program is designed to evaluate the ecological status and trends of watersheds. A suite of indicators is measured: amounts and composition of riparian vegetation, number of roads and stream crossings, and other data that reveal the ecological integrity of and threats to streams. Data are fed into decision support models that can help determine trends and cause-and-effect relationships. The framework can be used to monitor watersheds at the scale of the NWFP area, and at smaller scales such as individual ranger districts.

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Community-level socioeconomic monitoring underway in Northwest Forest Plan area

In finding out how people are faring under the Northwest Forest Plan (NWFP), Station scientists looked to the U.S. census, conducted every 10 years, for socioeconomic data. Station scientists needed first to delimit communities, or describe their geographic boundaries. The U.S. census uses several types of geographic units for different purposes. "Census places" leave out many people in unincorporated rural areas, but "block group aggregations" count everyone. For the NWFP region, excluding major metropolitan areas, the block group aggregations include almost 4 million people, but the census places include only 2.5 million people, leaving out nearly 1.5 million people in the geographic area.

Using the block group aggregation process, scientists identified 1,325 communities in the NWFP area, including many unincorporated rural areas. These results, published in PNW-GTR-570, are being used as the framework for community-level socioeconomic monitoring, now underway in 12 communities and 4 federal forests in Washington, Oregon, and California. Scientists are monitoring social and economic trends in the communities and evaluating how these trends are linked to NWFP implementation. The results, to be published at the end of 2004, will be one measure of how well the NWFP is meeting its socioeconomic goals. Complete socioeconomic monitoring also may include indepth case studies, studies of non-place-based communities (skiers or hunters, for example), and other measures.

Contact for delimiting approach: Ellen Donoghue, edonoghue@fs.fed.us, Human and Natural Resources Interactions Program
Contact for socioeconomic monitoring: Susan Charnley, scharnley@fs.fed.us, Human and Natural Resources Interactions Program
Partners: USDA Forest Service Pacific Northwest and Pacific Southwest Regions

LIDAR maps the ground accurately through heavy forest canopy

Airborne laser scanning systems (commonly referred to as **LI**ght **D**etection **A**nd **R**anging, or LIDAR, systems) can map open ground with an accuracy within 6 inches of actual elevation. A new study tested the accuracy of LIDAR in heavily forested areas. A high-resolution map of the ground was produced from high-density LIDAR data for a mountainous second-growth forest near Olympia, Washington. Next, in a ground survey, coordinates were measured for several hundred checkpoints under canopy conditions ranging from clearcut areas to dense second-growth stands.

The LIDAR map was found to be extremely accurate. Overall LIDAR elevation error was extremely low (8 inches), with errors slightly higher in dense canopy areas. LIDAR is potentially very useful for mapping small streams, gullies, and high-risk erosion sites under heavy forest cover, as well as for providing better data for road and harvest planning. Further research is underway to determine whether LIDAR is useful for mapping forest vegetation structure and characterizing fuel conditions in forests.

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Tom Iraci

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New methods supply more accurate data about juniper expansion in eastern Oregon.

Plot sizes evaluated for western juniper seedlings, and plot designs tested for mature coastal Douglas-fir forests

The Station Forest Inventory and Analysis (FIA) Program collects data on over 2,000 forest plots in Oregon, Washington, and California annually. Scientists regularly test plot designs and sampling methods for efficiency and accuracy.

In western juniper forests, seedlings and saplings grow from natural regeneration and typically are sparsely and irregularly distributed among large junipers. Their chances of long-term survival are good, however, and a stocking survey needs to count these future overstory trees to be accurate. Scientists tested the accuracy of four plot sizes for evaluating western juniper forest land and tallying seedlings and saplings accurately. They found that the plot size can be adjusted depending on stand density and the level of acceptable error, offering a way to control sampling costs. Results should improve the accuracy of juniper forest land inventories. The FIA Program used this method to evaluate seedlings and saplings in the 1998 inventory of eastern Oregon.

In mature coastal Douglas-fir forests, an improved plot design is being used to monitor stand structure. A study showed that sampling 40 percent of a 1-hectare (2.471 acres) plot, using four subplots, was required to keep the error rate for estimated density of large trees (trees larger than 48 inches diameter breast height) to acceptable levels. The improved accuracy of the sampling makes inventory data more useful for looking at stand structure, forest development, carbon storage, and species diversity. The improved plot design is now being used on all FIA Program field plots.

Contact for plots in mature coastal Douglas-fir forests: Andrew Gray, agray01@fs.fed.us, Forest Inventory and Analysis Program
Contact for evaluating plot size in western juniper: David L. Azuma, dazuma@fs.fed.us, Forest Inventory and Analysis Program

Automated interpretation of aerial digital photographs tested for juniper inventory

In eastern Oregon, juniper inventory supplies data about the rapid expansion of juniper, changes in stand density, and effects on understory species. Scientists tested a method for automatically interpreting aerial infrared photographs of juniper plots. The juniper trees were generally apparent on most of these images, and trained staff could estimate juniper distribution, density, and size from the photographs. An automated interpretation technique was tested that used a combination of image preprocessing and rule-based, crown-delineation techniques, to identify the same information. The automated interpretation identified junipers correctly 74 percent of the time when junipers were present. In images with no junipers, the automated technique incorrectly identified junipers as being there only 2 percent of the time. When automatic interpretation reaches acceptable levels of accuracy, the technique could decrease inventory costs.

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Goal 3: Develop Science-Based Options for Informed Management

Key Findings and Products:

- The dynamic MC1 model can incorporate historical, current, and projected weather and climate information, along with vegetation information, to forecast current-year fire risks over the United States. Through MC1, scientists are producing 6-month fire risk forecasts that will allow agencies to better anticipate firefighting needs. Over the last several years, MC1's forecasts have been validated for accuracy as the fire seasons unfolded.

- The BlueSky smoke modeling framework effectively predicts smoke impacts from both wild and prescribed fires. In 2003, BlueSky became operational in the Northwestern United States and in parts of Arizona and New Mexico. It was used to coordinate and plan prescribed burning across land ownerships, and it was used on at least three large wildfires to help determine firefighting strategies and warn nearby communities of potential health impacts.

- The BioSum computer model can be used in any geographical area to evaluate the area's potential to supply wood for a biomass cogeneration plant or any other type of wood processing plant. BioSum can be used to determine whether areas proposed for these types of plants have the right mix of resources, terrain, and transportation infrastructure to make the proposed operation economically feasible.

- The new Spatial Resource Support System (SpaRSS) project uses geographic information system methods and existing information on forest inventories, population density, and fire threat to demonstrate a method for allocating funding to various state and private forestry programs.

- In the Blue Mountains of northeastern Oregon, analysis of the forests, fire threat, and potential timber removals associated with fuel reduction show that only 29 percent of the 5.5 million federally administered acres in the Blue Mountains are available for timber management activities. Only about one-fourth of the accessible, heavily stocked acres on federal lands have commercial potential. Of these, only about 10 percent (about 40,000 acres) would have enough timber value to offset the costs of fuel reduction treatment.

- The Douglas-fir levels-of-growing-stock (LOGS) study, begun in the 1960s, continues to yield results. The LOGS study has shown that thinning will produce larger trees quickly but also can reduce stand volume production over short rotations, depending on the intensity of the treatment and the productivity of the site.

- Thinning and underplanting increase structural diversity in stands previously managed intensively for wood production, which cover nearly a million acres in western Oregon alone. Heavy thinning and underplanting can lead to improved structural and biological diversity in young forests within 8 years.

- A new tool is available to advise forest managers on the role and importance of dead wood. Managers can use "DecAID" to prescribe snag and down wood sizes and amounts needed for wildlife and to evaluate the effects of current conditions and proposed activities on wildlife species that use snags and down wood.

- Genetic research has determined that

some families of Douglas-fir can tolerate Swiss needle cast infection. New seed orchards have been established to develop a Douglas-fir seed source that can be used in species mixes where moderate levels of the disease are present.

- Alternative mechanical harvesting techniques can reduce fuel loads and protect large, live, retention trees, but differ in environmental effects and economic efficiency. Two log extraction systems both reduced fuels and protected large trees, but the forwarder yarding system caused slightly more damage to trees than the skyline yarding system. However, operational costs for the skyline harvest units were nearly double the costs on the forwarder units.

- Wildland fires will continue to burn. The question before public land managers and policymakers is, How might we influence the timing, severity, and pattern of wildland fires to achieve ecological management goals such as renewal of stream habitats? Active management of fire and fuels for stream restoration goals is most effective when a full spectrum of ecological patterns and processes is considered.

- New methods were developed to characterize stream bottom types and were tested in the highly variable streams found in the upper Grande Ronde subbasin in northeastern Oregon. Managers can use these new methods as they design plans to protect and restore riparian ecosystems. For example, management needs are different for steep, high-gradient (Type A) streams and low-gradient, meandering (Type E) streams.

- Collaborative groups, such as the Applegate Partnership in southwestern Oregon, are successful where there is an opportunity for providing evaluation and feedback, engaging needed participants, and responding to groups critical of the collaborative process.

Accomplishments

Dynamic model effectively forecasts current-year fire risks over the United States

The dynamic MC1 model can incorporate historical, current, and projected weather and climate information, along with vegetation information, to forecast current-year fire risks over the United States. The model uses huge climate databases, with actual observed weather covering the whole country from 1895 to the present. Weather databases are brought up to date each month. For near-term forecasts, MC1 uses 6-month weather forecasts produced by three global climate models, all of which take into account fully dynamic oceans, including current sea surface temperatures and short-term anomalies such as El Niño.

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The new model's fire season forecasts have been validated over the last several years. This experimental model will eventually help managers plan for fire season contingencies.

Over the last several years, MC1's forecasts have been validated by their accuracy as the fire seasons unfolded.

The model's consensus forecast for the 2003 fire season predicted a lower level of fire risk compared to 2001 and 2002. Observed fire activity in the 2003 fire season correlated well with MC1's forecast. The model forecast the approximate location of the B and B complex in Oregon, and it forecast late-season fires in southern California. However, since the model does not yet incorporate Santa Ana winds, it did not predict the severity and extent of the late-season wildfire disaster in southern California.

Although preliminary results are encouraging, the model should still be considered experimental. Fire managers across the country are evaluating the model; eventually the model should be useful for anticipating firefighting needs. Policymakers at all levels, from local to national, are very interested in how the model can help them plan for fire season contingencies. Officials including the Secretaries of Agriculture and the Interior, USDA Undersecretary, and USDA Forest Service Chief have requested briefings on the model and research.

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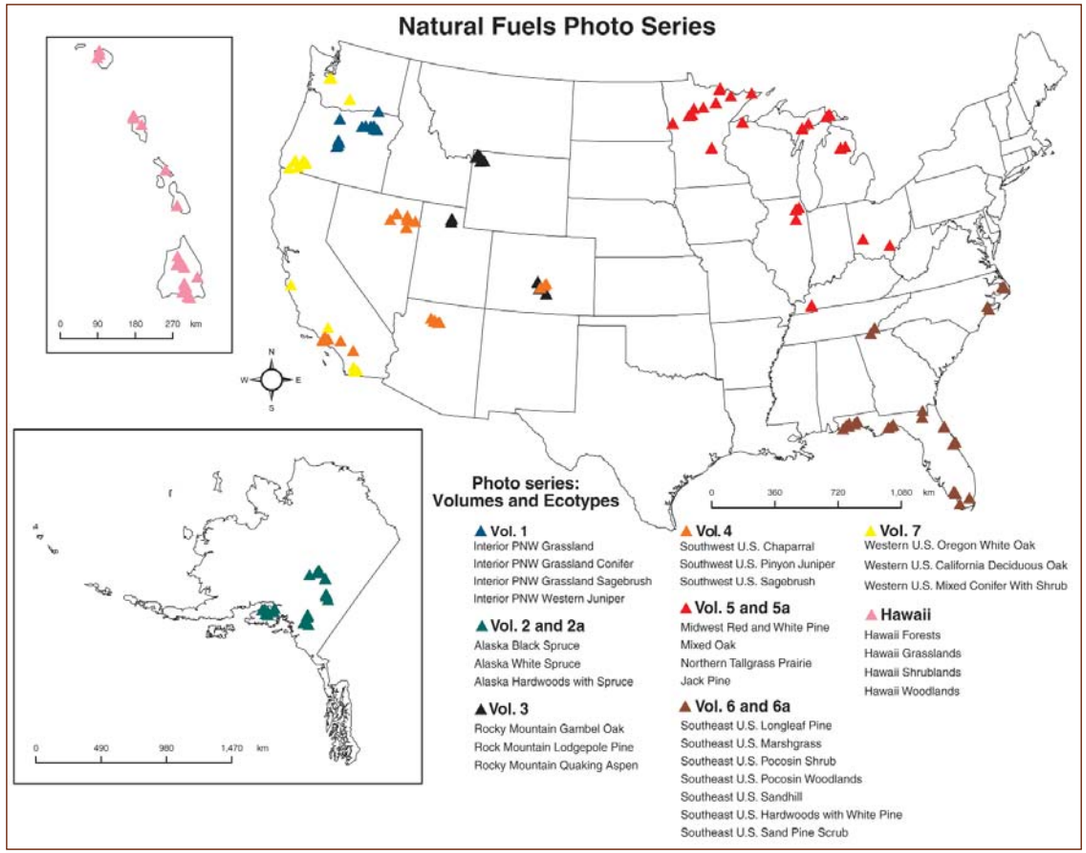
Partners: Oregon State University, Desert Research Institute, Scripps Institute of Oceanography
More information: Science Update 6, January 2004. *Western Forests, Fire Risk,* and *Climate Change*. www.fs.fed.us/pnw/pubs/science-update-6.pdf.



Clint Wright

Natural fuels photo series now cover ecotypes throughout the United States, including Alaska and Hawaii.

Natural fuels photo series are used to rapidly assess fuel properties

Wildland fuel loads are critical data for fire behavior forecasts, prescribed burn plans, and smoke management. The collection of detailed and precise fuels data takes time-consuming field inventory; best guesses are a poor substitute. Fire managers have relied

on photo series guides for years as invaluable guides to quickly and accurately assess fuel loads on timber harvest units.

Scientists have developed photo series guides to natural forest and grassland fuels to provide the same quick, accurate assessments for the wide range of natural fuel situations. Over the past 5 years, 10 photo series volumes, representing 35 ecosystem types throughout the Americas from central Alaska to central Brazil, have been completed and distributed to thousands of land managers, scientists, and researchers throughout the world. Managers can use the guides to quickly figure the tons per acre in standard fuel categories and arrive at a total biomass for field sites.

Hundreds of managers are learning each year to use these guides, through National Wildfire Coordinating Group fire training courses. Today, nearly all federal, state, and private fuel and fire managers use these photo series to quantify fire severity and hazard, air pollutant emissions, and other fire effects. Average fuel inventory time per field site has been reduced from 21 to 3 person-hours, saving $1,500 in inventory costs per unit sampled. The photos and data are also being used to describe new fuel models for improved fire behavior prediction. Information for ordering the guides is at http://www.fs.fed.us/pnw/fera/pmsorder.html.

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Partners: Rocky Mountain, Pacific Southwest, and Southern Research Stations; USDA Forest Service Fire and Aviation Management (Washington Office) and Southwestern Region; USDI Fish and Wildlife Service

Smoke ventilation and hazard system is used by hundreds of fire managers

The ventilation climate information system (VCIS) is a 40-year database that includes twice-daily values of wind, smoke mixing height, and their product, a ventilation index. Users can determine the probability of good or poor smoke ventilation and smoke dispersal at any time of the year or from any point on the landscape, by accessing the system's Web-based map and database at http://www.fs.fed.us/pnw/fera/vent/. Prescribed-fire managers and forest planners use VCIS to estimate smoke effects. Through a geographic information system, data layers from VCIS can be combined with data layers about fuel condition, fire regime, grazing patterns, lightning potential, and drought potential, to produce fire risk maps that include all the risk factors.

About 400 fire managers have been trained to use VCIS for prescribed fire and forest planning. During the 2002 Biscuit Fire in Oregon, the incident command team used the system to estimate continuing smoke impacts and issue smoke hazard warnings to about 500,000 people in the region around the fire. Work continues to improve VCIS's documentation to meet National Environmental Policy Act requirements.

Contact: Sue Ferguson, sferguson@fs.fed.us, Managing Disturbance Regimes Program

BlueSky smoke model gives a clear picture of what smoke is doing

Smoke from prescribed fires and wildfires affects air quality. The BlueSky smoke modeling framework effectively predicts smoke impacts from both wild and prescribed fires. BlueSky links information on atmospheric processes with components of fuel structure, moisture dynamics, consumption, emissions, fire behavior, plume dynamics, and dispersion and deposition of gases and aerosols. The prototype uses several existing

Tom Iraci

The BlueSky smoke model is being used on large wildfires to warn nearby communities of potential health impacts.

BlueSky has been used on at least three large wildfires. Through eight workshops, Station scientists introduced BlueSky to over 150 managers and regulators from 10 states and 5 regional and local air agencies.

computer models (CONSUME, EPM, and FCC) also developed by Station scientists.

In 2003, BlueSky became operational in the Northwestern United States and parts of Arizona and New Mexico, and was linked with the Environmental Protection Agency's Rapid Access INformation System (RAINS). It gave fire managers a much improved ability to estimate how much smoke would be produced, to track the actual smoke produced, and to forecast smoke movement for the next several days. BlueSky is being used to coordinate and plan prescribed burning across land ownerships, and it has been used on at least three large wildfires to help determine firefighting strategies and warn nearby communities of potential health impacts. Through eight workshops, Station scientists introduced BlueSky to over 150 managers and regulators from 10 states and 5 regional and local air agencies.

The BlueSky smoke modeling framework can be accessed on the Web site http://www.fs.fed.us/BlueSky.

Contact: Sue Ferguson, sferguson@fs.fed.us, Managing Disturbance Regimes Program

BioSum model is in demand for analyzing biomass plant opportunities in several states

Recent proposals for large-scale fuel treatment have renewed interest in biomass-based energy generation as a way to use substantial volumes of small-diameter wood. Scientists have developed BioSum, a computer model that can be used in any geographical area to evaluate the area's potential to supply wood for a biomass cogeneration plant or any other type of wood processing plant. BioSum uses data from the established forest inventory plots, which offer an unbiased and statistically representative sample of all forested lands in Western States.

BioSum can be used to determine whether areas proposed for these types of plants have the right mix of resources, terrain, and transportation infrastructure to make the proposed operation economically feasible. The first BioSum analysis was done for southwestern Oregon. Biomass operators in northern California's Shasta County realized from that pilot study, that biomass recovery opportunities in southwest Oregon would be less enticing than they had hoped. Proponents of biomass plant construction in New Mexico and Arizona are very eager to have BioSum analysis conducted for their regions, to objectively assess the opportunities.

County commissioners and the New Mexico state forester are among the people requesting BioSum analyses. They recognize that the BioSum model provides an objective method to identify the most fruitful places to use wood product recovery to support hazardous fuels reduction activities. The model gives decisionmakers a tool for sorting through the constant stream of proposals to fund studies of these types of facilities.

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Partners: National Fire Plan, Joint Fire Science Program

Framework is being developed for cost-benefit analysis of fuel treatments

Hazardous fuels reduction treatments, such as prescribed burning and thinning, are advocated to reduce the threat of wildfires. The economics of these treatments are often unclear. A cost-benefit analysis involves how much the probability, size, and intensity of fires are reduced; whether marketable wood products can be generated; the costs of fuel treatments; and balancing the costs and benefits of wildfires vs. fuel treatments on other forest values. Costs and benefits are long term, and many factors are involved. Scientists are

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New tools analyze the economics of fuel treatments.

developing a conceptual framework for cost-benefit analysis of fuel treatments, including an assessment of existing Forest Service research.

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New tools speed up economic analysis of fuel treatment plans

To meet National Environmental Policy Act (NEPA) requirements, fire managers need to provide information on the economics of their planned fuel treatments, including whether or not wood products can be generated to offset costs. Scientists are developing a synthesis of economics and wood use information, in products convenient for fire manager needs. One product is a series of fact sheets on key points that need to be addressed in NEPA planning.

The second product is a fuel treatment planner tool that provides a series of linked calculators that do much of the financial analysis required in a NEPA document for fuel treatment. The planner tool is linked to a broad synthesis of information needed for fuel treatment planning, including stand structure, fire behavior, fire effects, and social interactions.

Contact: Roger Fight, rfight@fs.fed.us, Human and Natural Resources Interactions Program
Partners: Focused Science Delivery Program; Rocky Mountain and North Central Research Stations, USDA Forest Service Fire and Aviation Management (Washington Office)

User-friendly system helps nonexperts use geographic information systems (GIS)

Maps with digital data layers, also known as GIS, are now vital tools in managing resources. Although many maps and supporting data layers are rapidly becoming available, decisionmakers have few user-friendly tools for interpreting these maps.

Scientists are developing the Spatial Resource Support System (SpaRSS), an evaluation system that accounts for human needs, ecological conditions of forests, and fire threat. SpaRSS focuses on three areas: (1) assembly of relevant multidisciplinary digital data layers and maps, (2) estimates that integrate the data as support for objective decisionmaking, and (3) comparison of results arising from different approaches to integrating GIS layers and from different management alternatives. The system features a user-friendly interface, does not require an extensive background in GIS, and will be available for installation on personal computers or via the Internet.

Scientists used the new GIS tool and existing information on forest inventories, population density, and fire threat to demonstrate a method for allocating funding to various state and private forestry programs. The system was used to

allocate National Fire Plan thinning funds from the national to the regional level in fiscal year 2003 and will be used with other cooperative forestry programs in fiscal year 2004.

Contact: Jamie Barbour, jbarbour01@fs.fed.us, Focused Science Delivery Program
Partners: North Central and Rocky Mountain Research Stations, USDA Forest Service State and Private Forestry

New decision-support system is a promising tool to set restoration priorities and strategies

The landscape patterns and disturbance regimes of interior Columbia basin forests have been dramatically changed by the past two centuries of settlement and land use. Scientists have developed a decision-support tool that helps forest managers understand how changes they see in individual stands affect the larger landscape, and how changes in landscapes affect the larger ecoregion.

Scientists first mapped and quantified the patterns of forest structure and species composition, down wood, and fire behavior attributes of one ecoregion from the earliest available historical (1930s) aerial photography. Then they reconstructed the vegetation characteristics of any stand showing evidence of early selective cutting or management. The reconstructed estimates of the range and variation of historical vegetation patterns (reference variation, RV) were then programmed into the ecosystem management decision-support system (EMDS) to evaluate the landscape conditions at varying scales.

At the ecoregion scale, the decision-support system gave a rapid and strategic view of conditions and estimated relative priorities and feasibility for watershed restoration. At the watershed scale, RV estimates were used to identify changes in landscape patterns beyond the typical, historical range of variation. The system is also used to evaluate the benefits and tradeoffs of different restoration scenarios. Benefits of the decision-support system include accounting for many factors and complex relationships in forests, all while tracking planning logic, assumptions, and important tradeoffs.

Tom Iraci

New decision-support tools help managers evaluate benefits and tradeoffs of restoration scenarios for interior Columbia basin forests.

Forest managers in the Pacific Northwest and Northern Regions are beginning to use decision-support tools to develop restoration strategies and priorities and to track the tradeoffs associated with their decisions. The new system described here is a valuable addition to existing decision-support tools.

Contact: Paul Hessburg, phessburg@fs.fed.us, Managing Disturbance Regimes Program

Fuel reduction work in Blue Mountains has limited commercial potential

Federal forests and rangelands cover 5.5 million acres in the Blue Mountains of northeastern Oregon. Many of the forested acres have heavy fuel loads. At the request of Oregon's governor, Station

scientists helped with a major analysis of Blue Mountains forests, fuels, and potential timber removals associated with fuel reduction.

The analysis found that only 29 percent of the acres are available for timber management activities. Timber harvest is not permitted in areas such as the Eagle Cap and North Fork John Day River Wilderness Areas. Further analysis suggests that only about one-fourth of the accessible, heavily stocked acres on federal lands have commercial potential, defined as more than 400 cubic feet per acre of trees larger than 7 inches in diameter at breast height. (The analysis assumed that no trees larger than 21 inches in diameter would be harvested.) Of the federal forest acres with commercial potential, only about 10 percent, or about 40,000 acres, would have enough timber value to offset the costs of fuel reduction treatment. If restrictions on harvesting large trees were removed, the acres that could be treated without a subsidy might increase to about 80,000.

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Partners: Oregon Department of Forestry, USDA Forest Service Pacific Northwest Region

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In the Blue Mountains of northeastern Oregon, only about one-fourth of the accessible, heavily stocked acres on federal land have commercial potential.

New tools are being developed to assist with fuel hazard reduction

The Interior Northwest Landscape Analysis System (INLAS) is a tool to analyze the effects of forest succession, disturbances such as fires, and forest management, on forests in the interior Columbia basin. Of specific interest is the measurement of long-term cumulative effects of fuels management. Scientists have developed two alternative methods to create the model framework. The INLAS framework will be linked to other models on wildlife habitat, stream conditions, and socioeconomic values.

The first analyses with INLAS suggest that returning east-side forests to single-story, more open, old forests through passive management could take several hundred years and would need a higher fire frequency than is now common. On the other hand, thinning and fuel treatment could create more acres of single-story old forests in 100 years than passive management would in that same time. Thinning also would produce some merchantable timber and create more habitat for some wildlife species.

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Partners: Blue Mountains Demonstration Area, Wallowa-Whitman National Forest, Boise Cascade, Oregon State University, Oregon Department of Forestry

New system being developed to track the costs of fighting wildfires

Fire managers are concerned with tracking and controlling the costs of fighting wildfires. The Forest Service's long-time wildfire budgeting model has been the National Fire Management Analysis System (NFMAS), which is based on a cost plus net value change model. Scientists found two errors in the NFMAS model formulation, errors with serious implications for the model's capacity to identify the most efficient level of fire management expenditure. The scientists are now developing a corrected model, still using the cost plus net value change framework. This model architecture will be used to develop a replacement for NFMAS and should be a useful tool for controlling wildfire costs.

Contact: Geoffrey Donovan, gdonovan@fs.fed.us, Human and Natural Resources Interactions Program

Managers can use DecAID Advisor to prescribe snag and down wood sizes and amounts needed for wildlife.

Timely results from long-term thinning research in Douglas-fir

The Douglas-fir levels-of-growing-stock (LOGS) study, begun in the 1960s, continues to yield results. The LOGS stands are already 40 to 50 years old, older than the planned rotations on some intensively managed plantations, and the LOGS study is of most interest to managers who plan to manage young forests under long, extended rotations. The LOGS study has shown that thinning will produce larger trees quickly but also can reduce stand volume production over short rotations, depending on the intensity of the treatment and the productivity of the site. In the 40 years since the study began, forest landowner goals have expanded from wood production to include wildlife habitat, recreation, and aesthetics. The LOGS study is yielding unexpected positive outcomes related to these goals, showing the role of thinning in accelerating stand structure development that can benefit aesthetics and many wildlife species.

Contact: David Marshall, dmarshall@fs.fed.us, Resource Management and Productivity Program
Partners: Washington State Department of Natural Resources, Canadian Forest Service, British Columbia Ministry of Forests, Oregon State University, Weyerhaeuser Company

Conifer seedlings respond strongly only when both overstory and understory vegetation reduced

In a new phase of research for the overstory density study at Capitol State Forest in western Washington, competing vegetation was removed in 2002 and 2003 with herbicides around seedlings of Douglas-fir, western hemlock, and western redcedar growing in clearcuts, shelterwoods, and thinned stands of mature Douglas-fir. First-year results indicate that soil water increased strongly only when densities of both overstory and understory vegetation were reduced. Seedling growth also increased as the density of competing vegetation was reduced, but the rate of growth increase leveled off as the density of competing vegetation approached zero. In shelterwoods and thinned stands, western hemlock and Douglas-fir had little response to removal of competing vegetation because overstory trees had already limited the amount of soil water available to the seedlings.

Contact: Tim Harrington, tharrington@fs.fed.us, Resource Management and Productivity Program
Partner: Washington State Department of Natural Resources

Thinning and underplanting increase structural diversity in stands previously managed intensively for wood production

Nearly a million acres of 30- to 50-year-old forests in western Oregon were previously managed intensively for wood production. Many landowners now wish to expand their objectives for the young forests and add more tree species, increase structural complexity, grow large-diameter trees, and develop understories and large down wood.

Tom Iraci

New silvicultural studies tend to focus on what is left behind in the forest, rather than on what is taken out.

Tom Iraci

DecAID Advisor helps managers meet snag and down wood needs for wildlife from bluebirds to bats.

Station scientists and their partners are finding that heavy thinning and underplanting can lead to improved structural and biological diversity in young forests within 8 years. After the heavy thinning, overstory trees grow faster, develop deeper crowns, and keep their lower branches alive longer. Hardwoods and conifers regenerate under the thinned stands, with underplanted trees growing nearly five times taller than naturally regenerated trees. In sum, the treatments promote development of multilayered, diverse stands, a good foundation for future old-forest habitats. Forest managers are already using the information, and the findings are being used to improve models of stand development.

Contact: Samuel Chan, schan@fs.fed.us, Resource Management and Productivity Program
Partners: Siuslaw National Forest, Oregon State University

New tool advises forest managers on snag and down wood prescriptions

The many ecological roles of dead and decaying wood have been recognized in recent years. Scientists developed the "DecAID Advisor" from data and research in Oregon and Washington forests. DecAID Advisor is a planning tool that managers can use as they conserve and manage snags, partially dead trees, and down wood.

Managers can use DecAID Advisor to prescribe snag and down wood sizes and amounts needed for wildlife, and to evaluate the effects of current conditions and proposed activities on wildlife species that use snags and down wood. The name "DecAID" can be read as decayed wood advisor and management aid ("decay-aid" or "decision-aid"). Or, the name can signify long-term planning advice, as over "decades" of time.

Contacts: Bruce Marcot, bmarcot@fs.fed.us, and Janet Ohmann, johmann@fs.fed.us, Ecosystem Processes Program
Partner: USDA Forest Service Pacific Northwest Region, U.S. Fish and Wildlife Service

PNW Research Station strengthens Agenda 2020 partnerships

The Agenda 2020 program was established several years ago as a research partnership among the forest products industry, the U.S. Department of Energy, and the USDA Forest Service. Agenda 2020 represents the industry-supported research agenda to ensure substantial forest resources and sustainable management for the future. National projects are in areas such as biomass gasification and new forest products.

Last year, the PNW Research Station's Resource Management and Productivity Program (RMP) established a regional template for others to use in competing for regional projects from the Agenda 2020 program. The RMP process for competing, selecting, and funding Agenda 2020 research has been emulated by other research stations. In March 2003, RMP hosted a workshop where principal investigators and management from all three western Forest Service research stations met with the Western American Forest and Paper Association executive

committee to present the science content and progress, discuss funding commitments, and collect all the study plans for statistical review. RMP also collaborates in the Fall River long-term site productivity study, funded through the national Agenda 2020 program.

Contact for Agenda 2020 program: Charley Peterson, cepeterson@fs.fed.us, Resource Management and Productivity Program

New seed orchards are established with Swiss-needle-cast-tolerant Douglas-fir

Swiss needle cast, a native fungal disease of Douglas-fir needles, has intensified in the Oregon Coast Range since the early 1990s. The disease leads to needle loss, reduced photosynthesis, and severely reduced growth for infected trees. Scientists made progress on two fronts to help foresters manage the disease's effects.

Genetic research has determined that some families of Douglas-fir can tolerate Swiss needle cast infection, able to grow even with moderate levels of defoliation. New seed orchards have been established to develop a Douglas-fir seed source that can be used in species mixes where moderate levels of the disease are present. Douglas-fir is still not recommended in areas of high disease pressure.

In the second project, scientists are developing a risk assessment model that can identify sites in the northern Oregon Coast Range where Swiss needle cast effects will be minimal. The model is based on research into Douglas-fir carbon assimilation and correlations between reduced carbon assimilation and tree growth. The risk assessment model uses these data, in conjunction with a fungal epidemiology model currently being tested. Forest managers can use the model to identify planting sites where Douglas-fir may be suitable. An updated version of the model, compatible with common software, is currently available from the contact scientist.

Contact for Swiss-needle-cast-tolerant Douglas-fir: Randy Johnson, randyjohnson@fs.fed.us, Resource Management and Productivity Program
Partners: Swiss Needle Cast Cooperative; Northwest Tree Improvement Cooperative; Oregon State University
Contact for model to assess risk of Swiss needle cast damage: Daniel Manter, dmanter@fs.fed.us, Managing Disturbance Regimes Program
Partners: Swiss Needle Cast Cooperative (interagency); Oregon State University

Genetically improved Douglas-fir show early gains in growth over unimproved trees

Considerable work and funds have been invested in Douglas-fir tree improvement programs in the Pacific Northwest, and seed orchards are now producing large amounts of improved seed. Despite the large investment, fundamental questions remain unanswered about the growth of genetically improved trees and the interactions of genetics and silviculture. Station geneticists have been working with the Northwest Tree Improvement Cooperative to establish large-plot trials comparing genetically improved and unimproved trees.

Jeff Riddle

Genetically improved trees, such as this Douglas-fir in western Oregon, are growing faster than unimproved trees.

Initial results show that genetically improved trees are growing at the rates predicted from earlier testing. Five years after planting, improved trees gained 6 percent more height, 8 percent more diameter, and 28 percent more stem volume, than genetically unimproved trees. Results provide a high level of confidence in the first-generation testing and selection procedures despite some limitations in those procedures.

Contact: Brad St.Clair, bstclair@fs.fed.us, Resource Management and Productivity Program
Partners: Northwest Tree Improvement Cooperative
More information: Science Findings 52, April 2003. *Conserving and Managing the Trees of the Future: Genetic Resources for Pacific Northwest Forests*. www.fs.fed.us/pnw/sciencef/scifi52.pdf.

Soil disturbance is not always bad

For many years foresters and soil scientists have seen soil disturbance from heavy equipment, and many have been concerned that soil compaction or top-soil displacement could reduce future tree survival or growth. Those who have seen stunted trees growing on log landings or other high-traffic areas have often generalized that all equipment impacts were bad.

Several recently completed studies compared tree growth with and without soil disturbance. Results were mixed; the studies found negative, neutral, and positive effects of soil disturbance on tree growth. Soil disturbance can positively influence tree growth if it reduces competition from other vegetation, increases soil temperature that may favor root growth, or increases soil water-holding capacity. Soil disturbance can hurt tree growth if it removes fertile topsoil or reduces soil aeration, affecting tree roots.

At this point, the effects of soil disturbance on tree growth cannot be predicted perfectly. Tree reactions differ under specific site conditions, and long-term effects are different from short-term effects. For resource managers concerned about the effects of soil disturbance on trees, the best course of action may be to measure tree growth directly.

Contacts: Connie Harrington, charrington@fs.fed.us, Resource Management and Productivity Program
Partners: Weyerhaeuser Company, Colville National Forest

James McIver

In northeastern Oregon, cost per metric ton of using a skyline yarding system was nearly double that of using a forwarder yarding system.

Mechanical harvesting techniques can reduce fuel loads and protect large, live, retention trees

Alternative mechanical harvesting techniques can reduce fuel loads and protect large, live, retention trees, but differ in environmental effects and economic efficiency. Two log extraction systems were tested in three paired, mixed-conifer stands in northeastern Oregon. A single-grip harvester was coupled with either a forwarder or a skyline yarding system. Economics, fuel reduction, stand damage, soil disturbance, effects on soil biota, and down woody material were all measured.

Both systems reduced fuels and protected residual large trees, but the forwarder yarding system caused slightly more damage to trees than the skyline yarding system. Fire risk was lowered in all stands, but large woody material for wild-life also was reduced. Light displacement of soil resulted in a short-term increase in the abundance of soil microarthropods, but forest litter compaction resulted in litter microarthropods being reduced for at least 1 year after harvest.

WestPro will help managers predict growth and yield for uneven-aged stands.

Revenue was similar for both systems, but total operational costs were $81/metric ton in the skyline units, nearly double the $46/metric ton costs in the forwarder units. Information is needed on the effects and efficiencies of harvesting systems for fuel reduction; already over 65 managers have requested information from this study.

Contact: James McIver, jmciver@fs.fed.us, Managing Disturbance Regimes Program
Partners: Oregon State University, University of California, Wallowa-Whitman National Forest, and Andy Munsey, logging contractor, Pendleton, Oregon

Free software estimates the costs of harvesting small-diameter timber

In the Western United States, the number of small-diameter trees is at a historic high, and managers plan to thin many of these small trees. The costs of small-tree harvest are generally higher than costs for harvesting larger trees, however, and cost can be a major issue in getting thinning work done.

Scientists developed STHARVEST, a Windows-based, public-domain software used to estimate costs of small-tree harvest, either in pure small-tree stands or as one part of a mixed-size stand. The free software can be used by planners with little background in forest engineering to get reasonable estimates of harvest costs, in U.S. dollars per 100 cubic feet or per green ton, for clearcutting or partial cutting. Costs can be estimated for six harvesting systems over a wide range of stand conditions: two ground-based systems and one cable system with manual felling; and two ground-based systems and one cable system with mechanical felling.

STHARVEST runs under Windows 98 and newer operating systems and is documented in PNW-GTR-582. It can be downloaded for free, along with a users guide, from the Web page http://www.fs.fed.us/pnw/data/stharvest/stharvest_home.

Contact: Roger Fight, rfight@fs.fed.us, Human and Natural Resources Interations Program

Tom Iraci

The STHARVEST software can be used to estimate harvest costs for small-diameter trees.

Partner: University of California Davis
(The use of trade or firm names is for reader information only and does not imply any endorsement by the U.S. Department of Agriculture of any products or service.)

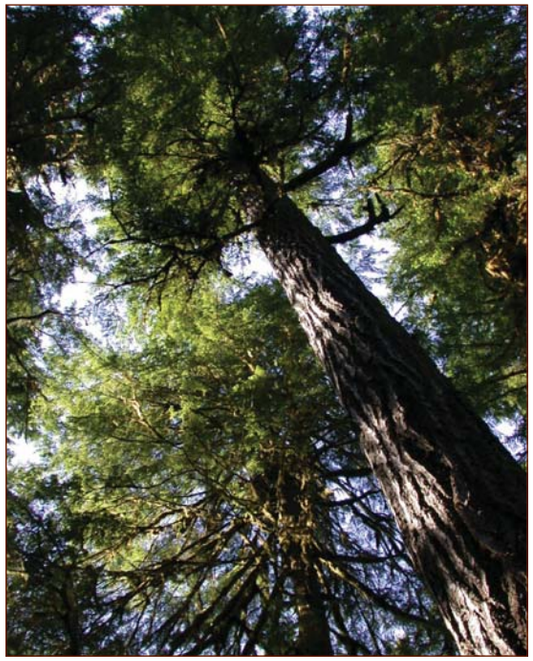
Simulations estimate the effects of thinning on development of late-successional forest structure

Many forest managers are interested in accelerating the development of late-successional forest characteristics in young forests through silvicultural practices. However, experiments that produce data on what works take years to complete and are costly. Scientists developed a simulation model that uses existing findings to estimate the effects of different thinning intensities on development of late-successional forest attributes.

In general, the model estimated that heavy thinnings at stand ages 40 and 60 would promote rapid development of large boles, vertical diversity, and tree-species diversity, but would provide the

least amount of timber volume and require artificial creation of snags and dead, down logs. Thinning may accelerate the development of some late-successional characteristics by several decades, but additional management may be needed to generate snag densities comparable to late-successional forests. Ecosystem scientists can use the model to simulate other silvicultural prescriptions and estimate some likely outcomes for the treatments.

Contact: Tom Spies, tspies@fs.fed.us, Ecosystem Processes Program



Tom Iraci

Analysis of tradeoffs between wildfire threat and old-forest structure is being used in planning for Gotchen Late-Successional Reserve in the Washington Cascade Range.

New software provides growth and yield information for uneven-aged Douglas-fir stands

Many silvicultural prescriptions today are developing uneven-aged Douglas-fir stands, and traditional growth and yield programs cannot model these stands very well. A recently developed program, WestPro, can be used to predict growth and yield for these uneven-aged stands. WestPro uses the initial stand state, defined as the number of softwood and hardwood trees per acre by diameter class, and defines management regimes by a target stand distribution of age classes and a planned cutting cycle. The software can predict the growth of the stand each year, for a set number of years into the future. Performance indicators include diversity of tree sizes and species, timber yield, and net present value of harvest over the given number of years. More information can be found in PNW-GTR-574.

Contact: Jeremy S. Fried, jsfried@fs.fed.us, Forest Inventory and Analysis Program

Findings on silviculture, fire threat, and late-successional forests are used in management planning

Under the Northwest Forest Plan, late-successional reserves are managed to maintain and enhance late-successional forests. Some forest characteristics that are desirable for wildlife habitat, such as canopy layering and dead wood, also create conditions favorable for wildfires and insects in the drier part of the plan area. Tradeoffs between wildfire threat and old-forest structure were examined in simulations for a 30-year period for one 15,000-acre reserve in the Gifford Pinchot National Forest in Washington.

The study compared variable-intensity silvicultural treatments on how well they would reduce the threat of large, severe wildfires and maintain late-successional forest structure. Ecological and economic factors were considered. Simulation results indicate that a combination of variable-intensity treatments would be most efficient for meeting multiple landscape objectives. Fire threat was reduced the most by treating more acres of structurally simpler forest; treatments of existing late-successional forest structures contributed less to reducing fire threat in the simulations. The USDA Forest Service and USDI Fish and Wildlife Service planning team used the study results in a draft environmental impact statement on reserve management that is currently available for public review and comment.

Contact: Susan Hummel, shummel@fs.fed.us, Human and Natural Resources Interactions Program
Partner: Gifford Pinchot National Forest

Three approaches to calculating log values compared

Appraisals of log values start with the gross value of products that can be manufactured from a tree. Scientists evaluated three log appraisal systems. Logs used for the comparison included ponderosa pine, Douglas-fir, western hemlock, and true fir species. The three systems were used to estimate volumes and grades of lumber, and volumes of chips and residues, produced from the logs. Scientists found that if users wish to make a simple calculation of value of a forest stand, a simple method would suffice. If information is needed also on the recovery proportions of chips and residues, and price in dollars per board foot, then a more complex method is needed. The most detailed method provides extensive information on the volumes of different lumber grades as well as a means to do a complete analysis of forest management activities; the other two methods do not. However, the detailed method results in slight losses of accuracy on the gross values of logs.

Dean L. Parry

Timber scalers develop lumber recovery data used in calculating log values.

Contact: Roger Fight, rfight@fs.fed.us, Human and Natural Resources Interactions Program

First postharvest results are available from the Alternatives-to-Clearcutting study

The Alternatives-to-Clearcutting (ATC) study began with a retrospective study in the old-growth forests of southeastern Alaska. The operational-scale silviculture experiment, a major part of the study, will test the effects of harvesting intensity, retention patterns, and patch size on forest development. The 5-year assessment of the first block of nine units was completed in 2002, with data gathered on the postharvest responses of overstory and understory vegetation to the varying retention levels. The 5-year assessment of the second block is scheduled for 2004. The third and final block of nine units will be harvested within the next 2 years. To date, 25 publications have been produced from the ATC study. Recent publications include discussions of the social acceptance of alternative harvesting practices, bird community ecology, headwater stream ecology, harvesting costs and production rates, and disturbance regimes in old-growth temperate rain forests.

Contact: Mike McClellan, mmcclellan@fs.fed.us, Resource Management and Productivity Program
Partners: USDA Forest Service Alaska Region, University of Alaska

In southeast Alaska, red alder in young-growth forests has several benefits

Southeast Alaska has vast stands of young-growth forests. Scientists are studying ways to produce wood, wildlife habitat, and fisheries simultaneously from these even-aged, young-growth forests. Of particular importance is the establishment of thriving understory vegetation to support deer populations. Two approaches were

tested for promoting diverse and abundant understory vegetation in these young stands: the inclusion of red alder in the overstory canopy, and commercial thinning for the older young-growth stands. Both approaches were much more successful than silviculture treatments attempted previously. Potential benefits include more wood products, improved wildlife habitat, and better fish habitat. The Tongass National Forest is including red alder in young-growth stands in a large-scale adaptive management study.

Contact: Tom Hanley, thanley@fs.fed.us, Ecosystem Processes Program

Progress is made toward modifying kiln-drying guidelines for western hemlock in southeast Alaska

Western hemlock is an important commercial tree in southeast Alaska, making up nearly 60 percent of the region's timber. Alaska western hemlock, however, is sometimes characterized by localized regions of high-moisture-content wood, referred to as wet pockets. Wet pockets, or wetwood, develop in western hemlocks as a result of bacterial infections. When freshly milled lumber is kiln dried, wet pockets can cause uneven drying and defects such as warping and checking, lowering the value of the boards.

Scientists evaluated moisture content in western hemlock lumber from trees harvested near Sitka, Alaska. Preliminary results suggest that great variation occurred in the samples, ranging from 50 to 100 percent. This work was a first step in developing kiln-drying schedules for western hemlock in southeast Alaska. Scientists may be able to develop modified kiln-drying guidelines that group lumber batches by green moisture content and prevent uneven drying and defects. Properly kiln-dried hemlock lumber will have a significant price premium over undried or defective wood, and the dry lumber can potentially be used for value-added made-in-Alaska products.

Contacts: David Nicholls, dlnicholls@fs.fed.us, and Eini Lowell, elowell@fs.fed.us, Human and Natural Resources Interactions Program
Partners: Flagstaff Partnership, USDA Forest Service Pacific Northwest Region and Alaska Region
More information: Science Update 5, September 2003. *Alaska Forest Products: Using Resources Well.* www.fs.fed.us/pnw/pubs/science-update-5.pdf.

Bob Szaro

Special kiln-drying guidelines may be needed for western hemlock, which makes up about 60 percent of southeast Alaska's timber.

Standard southeast Alaska growth and yield model found to be biased

Forest growth-and-yield models can be valuable tools for predicting stand growth under different management alternatives, but model predictions must be reliable and unbiased to be useful. Models are rarely validated adequately, however. FVS-SEAPROG is the growth model commonly used in southeastern Alaska, and Station scientists recently used data from two long-term silvicultural trials—dating from the early 1920s and mid 1970s—to evaluate the model's performance. The actual growth on 259 plots across southeastern Alaska was compared with FVS-SEAPROG predictions for the same periods.

The Chugach National Forest is heavily used as a scenic resource where road access is critical for recreation activities; this and many other findings will be used in revising the forest management plan.

Bob Szaro

The study found large differences between observed and predicted values for several key stand characteristics and provided evidence of significant bias in FVS-SEAPROG. The results validated people's concerns about the model's predictions and showed where the model can be improved.

Contact: Mike McClellan, mmcclellan@fs.fed.us, Resource Management and Productivity Program

Subsistence deer hunting remains important to residents on southeast Alaska island

In rural Alaska, the average annual harvest of all subsistence food, including game, seafood, and berries, is 375 pounds per person, with deer the most common animal hunted in southeast Alaska. Scientists studied factors influencing hunter demand for deer on Prince of Wales Island, a large island with several small communities, not far by floatplane from Ketchikan, Alaska.

The cash-based market economy on Prince of Wales Island has declined in recent years as logging and commercial fishing have declined, and the subsistence economy has assumed greater importance. Despite this change, overall hunter demand for deer has not changed significantly on the island in the last 10 years (1989-99). In communities with a smaller percentage of Native Alaskans, deer were a larger component of the subsistence harvest. As the percentage of Native Alaskans in a community increased, the dependence on deer decreased and use of other resources such as halibut increased.

Although overall hunter demand did not change, the pounds of deer eaten annually per capita did increase in five communities on the island with declines in household median income. Thus this study, published in PNW-GTR-581, found a correlation between increased deer harvests and increased poverty for Prince of Wales Island residents.

Contact: Rhonda Mazza, rmazza@fs.fed.us, Human and Natural Resources Interactions Program
Partner: Alaska Department of Fish and Game

Social and economic reports tell Chugach planners about the human environment of the south-central Alaska region

The Chugach National Forest extends south and east of Anchorage along the south-central Alaska coast, encompassing most of the Prince William Sound area, northeast Kenai Peninsula, and the Copper River Delta. The Chugach National Forest is revising its forest management plan, and Station scientists did social, economic, and recreation assessments of the area for the planning team's use. Results were published in PNW-GTR-561.

Bob Szaro

The scenic Seward Highway gives tourists easy access to Alaska's Kenai Peninsula.

Although parts of the Chugach are remote, much of the forest is easily accessible to tourists via Seward Highway on Kenai Peninsula, cruise ships or Alaska state ferries, and highways to Valdez. The Chugach National Forest is heavily used as a scenic resource where road access is critical for recreation activities such as fishing, camping, hiking, and wildlife viewing. Active forms of recreation and "soft adventure" activities are growing faster than other types of recreation. The assessment found that entrepreneurial efforts to provide short-duration recreation and tourism experiences would lead to increasing use of the Chugach National Forest.

The Chugach area has three main population areas: Anchorage, Kenai Peninsula, and the Valdez-Cordova area. Of the three areas, the Valdez-Cordova area shows the most economic volatility and has the least economic diversity. Resident population is increasing and aging in south-central Alaska, especially on the Kenai Peninsula. Total employment is growing at a faster rate in south-central Alaska than in the United States as a whole, and growing fastest in the Kenai Peninsula Borough. Many of the new jobs are in services and retail trade sectors.

Public lands are highly important to residents' quality of life in this area. Results of a mail survey showed that residents both near the Chugach National Forest and in other parts of Alaska rate the amenity values of the Chugach higher than the commodity values. People rely on public lands to maintain their quality of life, especially clean air and water, beauty of surrounding area, and open undeveloped areas. People generally favored "no change" in their community's current level of economic activity in forest-resource-related sectors.

Contact: Richard Haynes, rhaynes@fs.fed.us, Human and Natural Resources Interactions Program
Partner: Chugach National Forest

Fire on the mountain—what it means for fish

Wildfires, floods, and landslides can be destructive in the short term, but long term these disturbances are natural processes that help to create and renew diverse and healthy stream habitats and ecosystems. After wildfires, burned mountain slopes are often susceptible to accelerated erosion, water runoff, and landslides for the next few years.

Wildfires will continue to burn. Research suggests, however, that active management of fire and fuels could influence the timing, severity, and pattern of wildland fires to achieve ecological management goals such as renewal of stream habitats. Fire management for stream restoration goals is most effective when a full spectrum of ecological patterns and processes is considered. An adaptive management approach tests alternative management treatments, each based on different assumptions about how ecosystems function and how they will respond to treatment. This approach requires (1) well-articulated hypotheses of how ecosystems will behave, (2) commitment to monitoring and rigorous data gathering, (3) creative, yet rigorous analytical approaches to provide inferences based on data.

One part of the research challenge is understanding how ecosystems respond after wildfires. People sometimes assume that wildfires pose a short-term risk to endangered fish. Research shows, however, that local and regional factors affect

The Applegate Partnership established specific criteria to measure change, and a decade later they can point to major, positive changes in their watershed. This and other keys to success offer lessons for other collaborative groups.

Tom Iraci

Burned forests pose risks such as erosion—and benefits such as future large wood—for streams and fish

the actual risk level, including factors such as watershed geology and topography, prevailing climate, difference in the degree that original vegetation modified erosion, and differences in fire severity and fire regime. The likelihood of postfire erosion can only be ascertained in the context of these factors. This work is a context for better understanding of what drives erosion and sedimentation, how these processes are influenced by fire, and what the short and long-term risks—and benefits—are for streams and fish, when there's fire on the mountain.

Contacts for managing fire to restore stream ecosystems: Peter A. Bisson, pbisson@fs.fed.us, and Gordon Reeves, greeves@fs.fed.us, Aquatic and Land Interactions Program; Paul Hessburg, phessburg@fs.fed.us, Managing Disturbance Regimes Program
Partners: Rocky Mountain and Pacific Southwest Research Stations
Contacts for postfire erosion: Michael J. Furniss, mfurniss@fs.fed.us, and Steven M. Wondzell, swondzell@fs.fed.us, Aquatic and Land Interactions Program

New stream assessment methods are tested in upper Grande Ronde basin

In the arid lands of the interior Columbia basin, streamside areas are a geographically minor part of the landscape, showing up as only thin lines on landscape-scale maps. But in this dry land, streams and streamsides are the primary habitat for 71 vertebrate species, and source habitats for at least 90 terrestrial species and perhaps more. Landscape-scale management could miss not only the streams but the many variations in stream types and conditions, critical information for protecting and restoring these ecosystems while allowing other management activities.

Scientists developed new methods to characterize stream bottom types and tested them in the highly variable streams found in the upper Grande Ronde subbasin in northeastern Oregon. The new methods use GIS, watershed analysis, and landscape simulation modeling, to assess streamside conditions across large landscapes. Eventually these methods will be a module in the Interior Northwest Landscape Analysis System (INLAS).

Managers can use these new methods as they design plans to protect and restore riparian ecosystems, and they can link the information to landscape-level wildlife and aquatic habitat planning. For example, management needs are different for steep, high-gradient, cascading step-pool (Type A) streams, and low-gradient, meandering, riffle-pool (Type E) streams, which are highly sensitive to vegetation change along their banks.

Contact: Miles Hemstrom, mhemstrom@fs.fed.us, Focused Science Delivery Program

Tom Iraci

Rafters float by anglers on the popular Kenai River in Alaska. Both groups may come in conflict with grizzly bears fishing for salmon.

Scientists develop tools to help land managers understand recreation and tourism on federal lands

The growing American population loves to get outdoors and loves to visit their national forests. Scientists are asking managers what they could use from science to help them manage recreation and tourism compatibly with other national forest resources valued by the public.

Managers have said they urgently need information on exactly where conflicts are occurring between recreation user groups and activities, and effects of both authorized and unauthorized recreation on the forest resources. Scientists have summarized the current state of knowledge and propose to integrate recreation data and analysis with extensive, existing GIS data. The result will be GIS map layers backed up by extensive databases on recreational use, information that should be useful for teams revising forest plans. This work is aimed to help managers efficiently target where they can improve recreation capacity within budget constraints, and to help planners look at the forest-wide picture of recreation use and its effects.

Contacts: Sue Alexander, salexander@fs.fed.us, and Linda Kruger, lkruger@fs.fed.us, Human and Natural Resources Interactions Program
Sponsoring program: Focused Science Delivery Program

Applegate Partnership is a good example of a successful collaborative group

Scientists evaluated the effectiveness of collaborative groups by using the Applegate Partnership as a case study. Results were published in PNW-GTR-565. The Applegate watershed, in southwestern Oregon's Siskiyou Mountains, has more resident environmental activists than most rural areas in the Pacific Northwest. The Applegate Partnership was formed by residents of the Applegate River watershed in 1992 to address forest management, forest health, and fire risk issues.

Since then the partnership has moved through a series of successes, failures, and more successes. An early goal, ecosystem health, was hard to measure. But by establishing specific criteria to measure change, a decade later the group can point to major changes in their watershed: a shift from clearcutting to selective cutting, a shift from cutting large-diameter trees to small-diameter trees, development of a small-diameter materials program, more attention to fire risk on private lands, and an increase in number and mix of people on field trips. From the beginning the partnership worked to be as open and inclusive as possible. Among other techniques, the partnership used skilled facilitators to get diverse viewpoints expressed and still make progress as a group.

The partnership has found that specific measures of progress, and revisions as the group evolves, are the best answers to criticism. Other results in the Applegate watershed include securing grants to reduce fire danger and accomplishing the

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