

2001

*Science Accomplishments*

of the **PACIFIC NORTHWEST RESEARCH STATION**



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March 2002





## *Vision and Mission*

WE ARE HIGHLY SOUGHT FOR  
OUR SCIENTIFIC LEADERSHIP  
AND IMPARTIAL KNOWLEDGE.

OUR MISSION IS TO GENERATE  
AND COMMUNICATE SCIENTIFIC  
KNOWLEDGE THAT HELPS  
PEOPLE UNDERSTAND AND  
MAKE INFORMED CHOICES  
ABOUT PEOPLE, NATURAL  
RESOURCES, AND THE  
ENVIRONMENT.

*We are  
committed to  
providing science  
that informs  
important  
natural resource  
decisions.*

The mission of the PNW Research Station is to *"...generate and communicate scientific knowledge that helps people understand and make informed choices about people, natural resources, and the environment."* There is a lot packed into that one statement. We believe that new scientific knowledge can affect how we see and understand the natural world. New understanding leads to changed decisions, which affect not only today's generation but generations to come. We believe that these decisions can be informed and improved when people have up-to-date scientific knowledge. That is why we are committed to developing and communicating that knowledge.

After discussions with clients, partners, and employees, we found that although our research programs are productive and highly valued, we could make some changes that would be more responsive to people's changing needs. Our new strategic plan articulates our mission and goals, which are guiding incremental changes in our programs.

We are committed to the following goals:

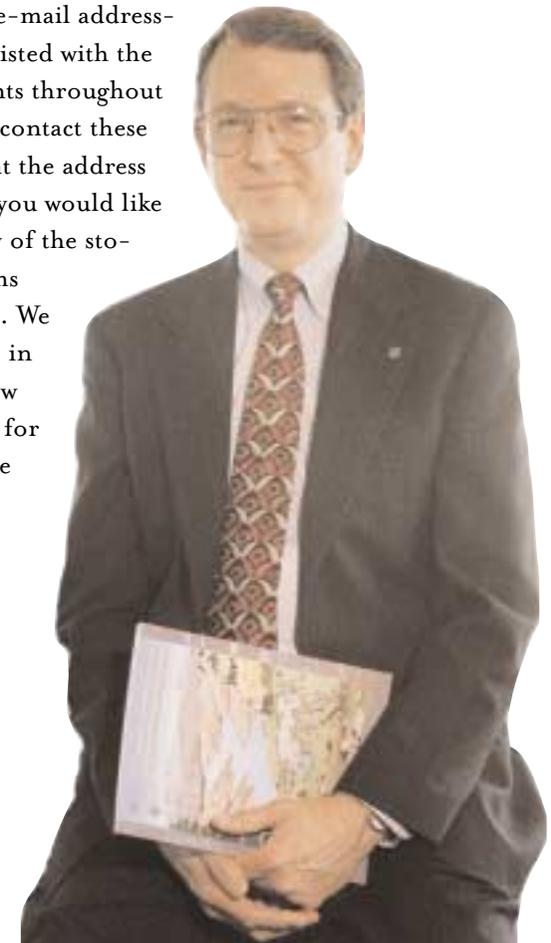
- Develop fundamental scientific knowledge about aquatic and riparian ecosystems, terrestrial ecosystems, and social and economic processes—we will continue to focus on the significant long-term, basic research for which the Station has long been recognized.
- Assess the status and trends of resources and their uses—for example, we have expanded our Forest Inventory and Analysis Program.
- Develop science-based options for resource management—these options can help inform the choices that resource managers and the public make about resources and their uses.
- Communicate our science findings to a wider audience—we want to be sure that people understand what we are learning so that decisions about land stewardship are well-informed.

We will continue to publish our science discoveries in technical peer-reviewed outlets to contribute to the body of science and validate our findings. We also will do more to put our science findings in the hands of our key audience, people who make or influence decisions about land management. We plan to deliver more science information in formats that are still precise but are more reader-friendly than technical publications.

This publication is an example of improvements we will be making. We are replacing our "Year In Review" with this shorter, more readable description of our work. I hope you find our *Science Accomplishments* helpful as you play your role in natural resource management in the Pacific Northwest. Names and e-mail addresses of lead scientists are listed with the research accomplishments throughout this publication. Please contact these scientists or contact us at the address inside the back cover if you would like to learn more about any of the stories or research programs described in these pages. We would also be interested in your response to this new publication. Thank you for your support and for the privilege of serving you.



THOMAS J. MILLS  
Station Director



# Strategic Highlights

We made small but important changes to our mission statement and strategy. We recognize that the role of the Pacific Northwest (PNW) Research Station is to offer science information that can help resource managers make choices about how people use natural resources.

We are setting new priorities on what we are studying after talking with our clients, partners, and employees. For example, we are now doing research on both recreation and production forestry. On biodiversity issues, we are focusing less on a

few specific threatened and endangered species and more on habitats that will meet the needs of all species.

We will emphasize:

- **INTERDISCIPLINARY AND INTEGRATED SOLUTIONS.** Form interdisciplinary teams that can develop integrated solutions.
- **RESEARCH THAT IS A BALANCED PORTFOLIO OF LONG- AND SHORT-TERM RESEARCH.** Balance immediate responses to policy issues with the need to improve basic understanding, the kind of results that come only from long-term research.

- **WORKING AT MULTIPLE SCALES AND OWNERSHIPS** to solve increasingly complex natural resource issues that society faces. Conduct research that cuts across biophysical, social, and economic dimensions, and that ranges in scale from microscopic to large watersheds.
- **CONTRIBUTING TO INFORMING THE DEBATE** about controversial natural resource policy issues. Develop links between scientists and managers, and scientists and policymakers.



*We have listened to people, and we have written, shared, and revised our strategy for the future.*



## *PNW Research Station: The Setting*

- 10 laboratories in Alaska, Oregon, and Washington
- 10 active experimental forests, watershed, and range
- Research also conducted in more than 20 research natural areas (RNAs)
- Headquarters in Portland, Oregon
- PNW is 1 of 6 research stations in the U.S. Department of Agriculture (USDA), Forest Service
- 536 Station employees (266 permanent, 270 temporary)



## THE SETTING

- Alaska, Oregon, and Washington:  
21 percent of the U.S. land area  
24 percent of the U.S. forest land  
5 percent of the U.S. rangeland  
but only 3.5 percent of the U.S. population

- Forest trends:  
Only 3-percent loss in total area of forest land since 1630  
Endangered Species Act affected management strategies on all lands  
Increasing concern over forest health  
Reduction in timber harvest from public forest lands  
Increasing demand to use forest land for purposes other than timber harvest

- Socioeconomic trends:  
Increasing population is culturally diverse with a wider array of demands for forests  
Increasing diversification of economies in Oregon and Washington (only 2.7 percent of employment is in forest products)  
Alaska's economy has not grown as fast or diversified as much as that of Oregon and Washington  
Communities have become more service oriented, changing their relations with the natural world



# Goal Accomplishments

The range of possible research questions is nearly endless, and the PNW Research Station has limited resources. So, working together with clients, scientists, and science managers, the Station established four goals, with priorities under each goal. The research described in this report is organized under these goals and priorities.

Contact information includes the name, e-mail address, and program of the lead scientist. The icons are hyperlinks on this publication's electronic version, on the Web at [www.fs.fed.us/pnw](http://www.fs.fed.us/pnw). The programs are the organizational units by which most Station research is conducted, and the programs and program managers are listed on page 51 of this publication.



## Goals and Priorities

- Goal 1: Develop a fundamental understanding of ecological, social, and economic systems and their interactions.*
- Priority 1.1 Advance the understanding of structure, function, and processes of terrestrial ecological systems.*
  - Priority 1.2 Advance the understanding of structure, function, and processes of aquatic and riparian ecological systems.*
  - Priority 1.3 Improve the understanding of social and economic processes and their interaction with natural resource values and uses.*
- Goal 2: Assess the status and trends of ecosystems and natural resources and their uses.*
- Priority 2.1 Conduct inventories of forest resources and use.*
  - Priority 2.2 Analyze and assess resource trends.*
  - Priority 2.3 Develop monitoring protocols and data analysis techniques.*
- Goal 3: Develop science-based options for informed management.*
- Priority 3.1 Manage riparian and aquatic areas for multiple values.*
  - Priority 3.2 Restore ecosystems at risk and reduce the risks people face.*
  - Priority 3.3 Develop recreation and tourism options for diverse populations.*
  - Priority 3.4 Produce wood within sustainable frameworks.*
  - Priority 3.5 Create operational strategies for conservation of biodiversity.*
- Goal 4: Communicate science findings and enhance their application.*
- Priority 4.1 Respond to emerging issues.*
  - Priority 4.2 Bridge the gap between information generation and use.*

## Goal 1: Develop a Fundamental Understanding of Ecological, Social, and Economic Systems and Their Interactions

Only fundamental research answers basic questions about the structures and dynamics of ecosystems. These findings provide information that suddenly becomes vital in addressing immediate issues. The Station's long-term research on old-growth forests, started decades ago, has provided scientific information for debates about forest management in recent years. We expect basic research going on now to provide crucial information for emerging issues, unanticipated problems, and options for new answers to old problems.

### Key Findings:

- Roots of Pacific Northwest forest trees redistribute soil water during summer drought. As the summer drought intensifies, Douglas-fir and ponderosa pine roots take up water in the deep, moist levels of the soil profile, lift the water, and release it back into dry soil near the surface. This process may play a key role in the establishment and survival of tree seedlings near large trees.
- The survival and reproductive rates of spotted owls are influenced by many factors, including the amount and distribution of old forest, the amount of precipitation, age of the owl, and presence of barred owls.
- In rain forests on southeast Alaska's Alexander Archipelago, total soil saturation occurs more often than previously recognized. Because landslides do not occur that frequently, other factors, such as root strength or windthrow, are likely more important to slope stability here than in drier climates.
- In the Oregon Coast Range, scientists found that 3 years after a big storm, juvenile coho salmon populations, fish habitat, and large wood had all increased significantly in a stream hit by 20 landslides during the storm. Juvenile coho populations and fish habitat decreased in another stream hit by only a few landslides; large wood increased somewhat. Research continues to suggest that landslides are an important ecological process for creating and maintaining fish habitat.
- In the Oregon Coast Range, debris flows help maintain plant diversity in riparian ecosystems. Riparian plant species are well adapted to debris flows, and plant diversity in riparian zones is created in part by debris flow deposits.
- International policies, trade, and investment are increasingly affecting domestic forest policies and management. The United Nations criteria and indicators for forest sustainability (Montreal Process) are being adopted in the United States in policies on sustainable forest management.

*Station scientists  
and cooperators  
from Oregon State  
University develop  
molecular methods  
for extracting  
DNA from  
mycorrhizal fungi  
and identifying  
difficult-to-identity  
species.*

## DEEP ROOTS OF LARGE TREES MAY BENEFIT SEEDLINGS

Summer droughts are common in Pacific Northwest forests. How do trees survive these long dry spells? In Oregon's ponderosa pine forests and southern Washington's Douglas-fir forest, scientists studied how the deep roots of large trees bring up water from deeper underground levels and release it through their shallower roots into the dry soil near the surface. This process, called hydraulic lift, brings water closer to the surface where other plants can absorb it, and it is particularly important during summer droughts. It also may help fine roots near the surface absorb nutrients. By using isotopically distinctive water, scientists are getting better insight into how much hydraulic lift occurs and how it benefits other plants. They estimate that hydraulic lift supplies about 25 to 35 percent of the total daily water taken up from the upper 6 feet of the soil profile during summer. The isotopically distinctive water was found in tree seedlings distant from the application site, suggesting that hydraulic lift may play a role in seedling survival and establishment.

As summer drought progresses, it becomes increasingly difficult for trees to extract water in the upper 19 inches of the soil profile, where more than 90 percent of the fine root biomass is typically located. Scientists tested to see if trees

Photo: Jane E. Smith



*Yana Valachovic obtains a soil core with mycorrhizal tree roots.*

were using water from this upper soil layer in the upper parts of their boles. The scientists found that during August, water stored in the upper soil layer contributed less than 20 percent to the total daily water used in the upper 6 feet of tree trunks, in both an old-growth ponderosa pine stand and a 20-year-old Douglas-fir stand. Related work implied that about 50 percent of the water used in the upper tree trunks was supplied by deep roots that extract water from more than 6 feet underground. These results suggest that trees with deep roots are able to tap dependable sources of soil water during summer droughts and are less affected by droughts.

### Contacts:

Tree roots lift soil water in summer droughts:  
Rick Meinzer, [fmeinzer@fs.fed.us](mailto:fmeinzer@fs.fed.us), Ecosystem Processes Program  
Tree roots and forest canopy transpiration:  
Rick Meinzer, [fmeinzer@fs.fed.us](mailto:fmeinzer@fs.fed.us), Ecosystem Processes Program

## WAYS TO IDENTIFY HUNDREDS OF FUNGI

Mycorrhizal fungi, which colonize the fine roots of trees, provide essential nutrients to forest trees and are a food resource for large and small mammals, mollusks, and arthropods. In Oregon's Blue Mountains and much of the inland West, these fungi seldom produce fruiting bodies (mushrooms and truffles), which makes it difficult to identify species and understand these beneficial fungi communities. However, Station scientists and cooperators from Oregon State University have developed molecular methods for extracting DNA from mycorrhizal fungi and identifying the species. With these new immunoassay methods, scientists were able to identify as many as 300 fungi species from one sampling of tree roots at the Hungry Bob site in northeast Oregon. Scientists will be able to use the techniques to answer questions about the dynamics of underground fungi communities.

### Contact:

Identifying mycorrhizal fungi through DNA analysis: Jane Smith, [jsmith01@fs.fed.us](mailto:jsmith01@fs.fed.us), Ecosystem Processes Program



Soil disturbed by windthrow allows water flow into mineral-rich soil.

### BENEFITS OF WIND THROW

In southeast Alaska, scientists learned that the soil disturbance from wind-thrown trees may have some benefits for soil productivity. In watersheds where significant windthrow occurred 80 years ago, the soil had a higher percentage of labile soil carbon, and the stream water had higher pH and calcium concentrations and lower dissolved organic carbon and aluminum concentrations, than was found in watersheds with little windthrow history. Windthrow appears to improve soil mixing by allowing water to penetrate mineral soil and bedrock before emerging in the stream. It appears that in watersheds without the soil mixing from windthrow, soil humus and water-flow are confined mostly to thick organic horizons. In southeast Alaska, forest and stream productivity appear to benefit from periodic wind-throw disturbance.

Contact for Windthrow and soil productivity, southeast Alaska: Bernard Bormann, [bbormann@fs.fed.us](mailto:bbormann@fs.fed.us), Ecosystem Processes Program

### GENETIC RESOURCES WELL-REPRESENTED IN CONSERVATION AREAS

Genetic diversity in tree species is of concern to resource managers as they sustain forests. Genetic variation can be protected in natural populations and also in offsite collections or plantings. Scientists explored the extent to which genetic diversity in conifers is conserved on protected lands in western Oregon and Washington. They compared maps of protected areas with maps of tree species distribution, and also used information on genetic variation in each species. The results show that the distribution of conservation lands in western Oregon and Washington include much of the genetic diversity for conifer species. This assessment was supported by the Pacific Northwest Forest Tree Conservation Group, including government agencies and forest industries.

Contact for genetic diversity in tree species: Brad St. Clair, [bstclair@fs.fed.us](mailto:bstclair@fs.fed.us), Resource Management and Productivity Program

### NEST PREDATION FOUND NEAR FOREST EDGES

Little is known about bird nesting success in coastal Alaska. Scientists studied patterns of nesting success in southeast Alaska's conifer forests and adjacent Canadian forests. They found that nest predation rates were higher in bird nests near forest edges than in nests farther from edges. This finding was true for nests near both natural and human-

made forest edges. Red squirrels, jays, crows, and ravens were the main predators attacking bird nests near forest edges. Nests in edges near suburbs, where jays and crows were especially abundant, were most susceptible to predation. Southeast Alaska, however, has large forests, and the current level of forest fragmentation is not limiting bird populations. Edge-related predation is likely a significant problem at the local level, where urban development encroaches on the forest.

Contact for predation on bird nests, southeast Alaska: Tom Hanley, [thanley@fs.fed.us](mailto:thanley@fs.fed.us), Aquatics and Land Interactions Program

### SPOTTED OWLS AND THEIR PREY

Scientists are learning how the northern spotted owl survives throughout its range. Complex factors are emerging that differ with place.



Photo: Tim Fox

Juvenile spotted owl in western Oregon's Cascade Range.



A study in the Oregon Coast Range indicates that the survival and reproductive rates of spotted owls are influenced by factors including the amount and distribution of old forest, amount of precipitation, age of the owl, and presence of barred owls. This study is being expanded to the Oregon Cascade Range and other regions in Oregon and Washington. Scientists are developing tools that estimate survival and reproductive rates of spotted owls based on landscape attributes. Simulation models will predict how spotted owls would be affected by different landscape management scenarios.

In western Washington, scientists studied spotted owl diets in 242 owl territories, identifying a total of 6,743 prey items. They found that flying squirrels were the most common prey in most areas, but wood rats, snowshoe hares, deer mice, red-backed voles, and gophers were important prey as well. Spotted owl diets differed among regions and even among owl territories within regions. These data may lead to a better understanding of factors that affect the distribution and abundance of spotted owls.

On the east side of the Cascade Range in Washington, scientists are working to understand the relations among spotted owls, flying squirrels, and forest disturbances. The spotted owls typically avoid the more open pine stands, even though these stands have almost as many flying squirrels

as the stands that owls do use. Scientists are determining factors other than prey abundance that influence the spotted owl's use of pine stands. Forest managers will use the findings to assess the potential effects of projects for reducing fuel and fire hazards in low-elevation forests on the east side of the Cascade Range.

In western Oregon and northern California, little was known about the actual distribution and abundance of tree voles. The only way to observe tree voles directly was to climb their nest trees. Researchers found, however, that they could identify prey remains in owl pellets. Scientists examined pellets from 965 owl territories in western Oregon, and identified 16,601 prey items, of which 12 percent were tree voles. The data suggest that tree voles are most common in the

Photo: Gila Fox



Adult spotted owl in western Oregon.

central and southern Coast Ranges and western Klamath Mountains. In the Cascade Range, tree voles are found mostly in lower elevation forests (below 3,200 feet). The results will help managers identify forests occupied by tree voles and priority areas for protecting tree voles.

The USDA Forest Service Pacific Northwest Region was a partner on all four spotted owl studies. The Washington Department of Wildlife and the Olympic National Park were partners on the owl diet in Washington study, and the Bureau of Land Management was partner on the first three owl studies described.

**Contacts:**

Tree voles and spotted owl diets: Eric Forsman, [eforsman@fs.fed.us](mailto:eforsman@fs.fed.us), Ecosystem Processes Program  
 Spotted owl diets, and spotted owl survival and landscape attributes: Eric Forsman, [eforsman@fs.fed.us](mailto:eforsman@fs.fed.us), Ecosystem Processes Program  
 Prey dynamics and disturbance in eastern Washington: John Lehmkuhl, [jlehmkuhl@fs.fed.us](mailto:jlehmkuhl@fs.fed.us), Managing Disturbance Regimes Program

**SLOPE STABILITY AND SOIL SATURATION: A SURPRISING WEAK LINK**

Site conditions and forest management practices affect stream ecology in various ways and are key factors in the occurrence of many landslides. Scientists are learning the many ways these conditions interact.

Mass soil failures are a key disturbance process affecting riparian areas and streams. These events can occur naturally or as a result of forest management. In rain forests on southeast Alaska's Alexander Archipelago, groundwater levels on mountain slopes respond more rapidly to precipitation than previously recognized, and soil saturation also occurs more frequently. Because total soil saturation occurs frequently but landslides do not, other factors, such as root strength or windthrow, are likely more important to slope stability here than in drier climates. Root strength can be affected by timber harvest and other forest management activities.

Contact for soil saturation and hillslope stability, southeast Alaska: Richard T. Edwards, [rtedwards@fs.fed.us](mailto:rtedwards@fs.fed.us), Aquatics and Land Interactions Program

#### LANDSLIDES: THEIR ROLE IN CREATING FISH HABITAT

Scientists examined the ways that landslides change, create, and maintain fish habitat in southeast Alaska and Oregon. In the southeast Alaska study, researchers examined how management of young upland forests affects landslides, streams, and fish. Natural site conditions include hill slope position, geology, drainage patterns, blowdown, and forest health. These factors largely determine where landslides start, where they go, how much material is deposited, and the related effects on larger

streams. Coarse-level modeling indicates that in wide, U-shaped valleys, bank erosion is the dominant process that moves large wood to mainstem channels. The relative contribution of landslides and windthrow depends on topographic and climatic factors.

Photo: Richard Woodsmith



*Headwater channel processes maintain and modify salmon habitat.*

In the Oregon study, researchers compared fish populations and habitat conditions in two central Oregon coastal streams in 1999, 3 years after the February 1996 storm, to conditions found in 1989 and 1990. During the 1996 storm, 20 landslides occurred in

one watershed, but only a few landslides in the other watershed. After the storm, the amount of large wood increased in both streams, but increased more than 200 percent in the stream with 20 landslides, and only 50 percent in the second stream. Fish habitat increased 50 percent in the stream with more landslides and decreased by 50 percent in the stream with fewer landslides. In 1999, the stream with more landslides had 200 percent more juvenile coho salmon than it had in 1989-90, but the stream with fewer landslides had 30 percent fewer juvenile coho salmon. Landslides are a critical process for creating and maintaining fish habitat in the central Oregon coast, but their impacts differ considerably depending on the size and composition of the slide.

In Oregon's Elk River watershed, scientists examined how forest landscape characteristics affect fish populations, in particular juvenile salmon. This long-term study has found that the distribution and abundance of each salmonid species can be explained by geomorphic attributes and stream habitat. For example, juvenile chinook salmon prefer unconstrained valleys, nearby valley segments, and valley segments with larger, deeper pools that contain more wood. The number of large wood pieces in streams was related to the subwatershed's rock type and how much area was in mature to old-growth forests. Looking at larger areas in watersheds,

*Fish habitat increased 50 percent in the stream with more landslides and decreased by 50 percent in the stream with fewer landslides*



*Successful partnerships integrate local knowledge with scientific knowledge, recognize that local communities are part of larger ecosystems and societies, and respect individual differences.*

scientists were able to identify source areas most likely to supply future large wood to streams. Managers can use these findings to identify stream reach characteristics important for juvenile salmon habitat and also to identify areas important for contributing large wood to fish-bearing streams.

**Contacts:**

Young forest management and landslides, south-east Alaska: Tom Hanley, [thanley@fs.fed.us](mailto:thanley@fs.fed.us), Aquatics and Land Interactions Program  
Landslide effects on streams and fish habitat, Oregon: Gordon Reeves, [greeves@fs.fed.us](mailto:greeves@fs.fed.us), Aquatics and Land Interactions Program  
Stream habitat characteristics that affect juvenile salmonids, Elk River, Oregon: Gordon Reeves, [greeves@fs.fed.us](mailto:greeves@fs.fed.us), Aquatics and Land Interactions Program

**RIPARIAN PLANT SPECIES WELL-ADAPTED TO DEBRIS FLOWS**

Scientists also tracked vegetation changes for 10 years on a new debris flow deposit in an Oregon Coast Range riparian area. In the first 2 years, a diverse assemblage of herbs, grasses, shrubs, and trees colonized the deposit. Red alder outcompeted salmonberry and effectively captured the site after 10 years. The patterns of plant succession were affected by changes in the substrate, timing of plant establishment, seed and root sources, and shade toler-

ance. The scientists found that riparian plant species are well-adapted to debris flows and that plant diversity in riparian zones is created in part by debris flow deposits.

Contact for riparian vegetation changes after debris flows, Oregon: Tom Spies, [tspies@fs.fed.us](mailto:tspies@fs.fed.us), Ecosystem Processes Program

**PLACE-BASED COLLABORATIONS ARE PRAGMATIC**

In many communities, local people have built partnerships with their local resource managers in recent years. Research finds significant differences between these place-based collaborations and more formal traditional planning approaches. These place-based collaborations tend to be pragmatic. Often, people are able to work through conflicts on resource management, and these collaborations are more likely to produce on-the-ground actions supported by more people in the communities. To be successful, these partnerships must integrate local knowledge with scientific knowledge, recognize that local communities are part of larger ecosystems and societies, and respect individual differences.

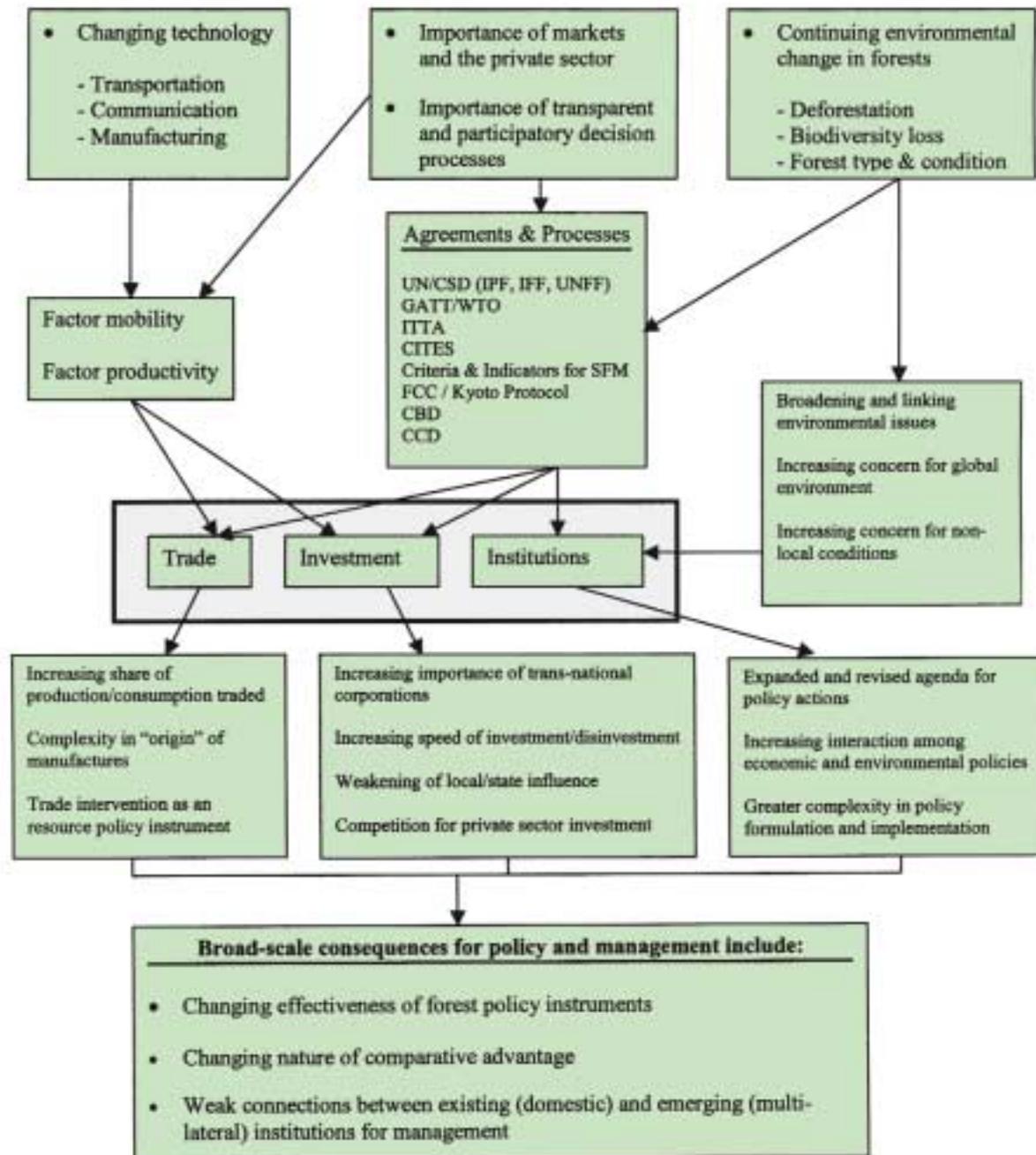
Contact for place-based collaboration: Linda Kruger, [lkruger@fs.fed.us](mailto:lkruger@fs.fed.us), Human and Natural Resource Interactions Program

**LOCAL FOREST MANAGEMENT POLICY AFFECTED BY INTERNATIONAL AGREEMENTS**

International policies, trade, and investment are increasingly affecting domestic forest policies and management. Some international agreements have been motivated by global concern for the environment and recognition of the need to sustain environmental services such as carbon sequestration and biodiversity. Local forest management policies are being affected by international agreements on large-scale natural resource issues. One example is the international forest sustainability process. A United Nations working group established criteria and indicators for evaluating forest sustainability; these are known informally as the Montreal Process criteria. These criteria are being adopted domestically in the United States in policies on sustainable forest management.

Contact for international issues affecting forestry in the United States: David Brooks, [dbrooks01@fs.fed.us](mailto:dbrooks01@fs.fed.us), Human and Natural Resource Interactions Program

GLOBAL  
ISSUES  
AFFECTING  
THE  
FOREST  
SECTOR



## Goal 2: Assess the Status and Trends of Ecosystems and Natural Resources and Their Uses

### Key Findings:

■ Preliminary results show that over the last 50 years, California had a 26-percent decline in forest area, Washington a 15-percent decline, Oregon 3 percent, and Alaska only 1 percent. The most dramatic change was in the structure of forests. The number of acres covered by large trees (equal to or greater than 29 inches in diameter) declined by nearly 40 percent in Alaska, Oregon, and Washington over the past 50 years.

■ In Oregon's nonfederal forests (state, private, and tribal), tree growth exceeded timber harvest and tree mortality over the last 10 years. West of the Cascade Range, tree mortality and harvest were equal to 62 percent of the total volume of tree growth. East of the Cascade Range, tree mortality and harvest were 19 percent greater than the total growth.

■ Timber product output has declined for Alaska, Oregon, Washington, and California. Since the last assessment 5 years ago, total timber output for these four states declined by 37 percent to 2.6 billion cubic feet.

■ The CLAMS project findings suggest that growing population densities in the Willamette Valley have had little impact on the productivity of private forest lands in western Oregon. (CLAMS is the coastal landscape analysis and modeling study.)

■ Scientists mapped the stand-replacement disturbances that occurred on about 11.4 million acres of western Oregon forests between 1972 and 1995. Modern disturbance regimes, dominated by forest management, are different from the historical disturbance regimes in western Oregon.

■ In forest health monitoring programs, researchers found that balsam woolly

adelgid has a significant impact on the distribution of tree species. It seems that balsam woolly adelgid is eliminating grand fir from low-elevation landscapes in the Willamette Valley, Puget Sound trough, and coastal streams. The insect also seems to be eliminating subalpine fir as a pioneer species in alpine meadows, avalanche tracks, and old lava beds.

■ Scientists developed a monitoring system for the Porcupine caribou herd in far northern Alaska and Canada. The monitoring system brings hunters and biologists together, so they can cooperate on long-term sustainable management of the caribou herd.

Photo: Tom Iraci



Field crew from Forest Inventory and Analysis (FIA) Program measure live and dead trees.

CRITERIA AND INDICATORS MEASURE FOREST CHANGE AT THE REGIONAL SCALE

The United Nations criteria and indicators for forest sustainability (Montreal Process) are being evaluated at regional, state, bioregional, and county levels, in the Pacific Northwest. When inventory information is reported in ways consistent with these criteria, national and international comparisons are possible.

Historical inventory data are being used to chart changes in forest condition over the last 50 years. Preliminary results from the Resource Planning Act Assessment show that over the last 50 years, California had a 26-percent decline in forest area, Washington a 15-percent decline, Oregon 3 percent, and Alaska only 1 percent. The most dramatic change, however, was in the structure of forests. The number of acres covered by large trees (equal to or greater than 29 inches in diameter) declined by nearly 40 percent in Alaska, Oregon, and Washington over the past 50 years.

In the Pacific Coast States of California, Oregon, and Washington, timber harvest has dropped 40 percent since the late 1980s. This trend is expected to change, and timber harvest in these states stay near the level of 2.5 billion cubic feet annually for the next several decades. Currently, the three Pacific Coast States

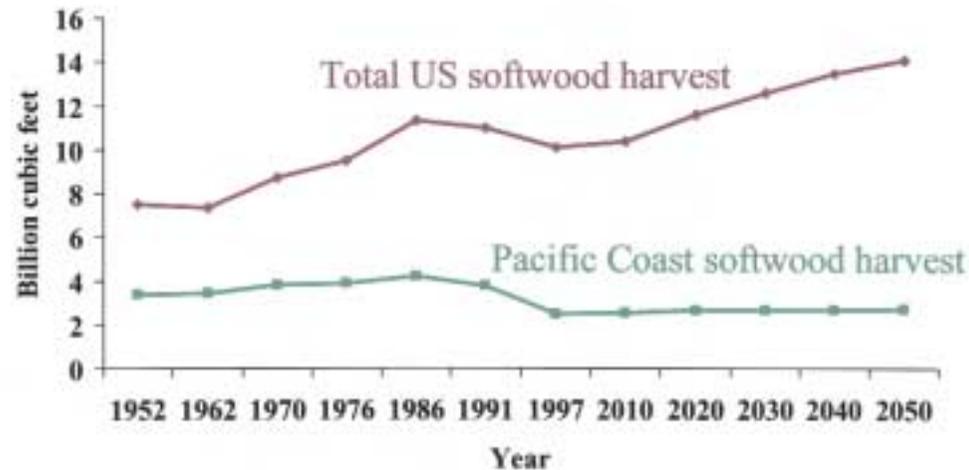
Photo: Tom Inaci



Data collected by FIA crews showed changes in forest structure for the region.

supply 24 percent of the total U.S. timber harvest, but this proportion is expected to decline to less than 20 percent by 2050. This trend indicates that production forestry is shifting to the Southern United States. The Western forest products industry will be less important nationally and is likely to be less significant regionally also, as far as its total contributions to state and local economies. This shift has far-reaching implications for western land managers, regulatory agencies, and the research community.

Contact for study of timber industry in Alaska, Oregon, California, and Washington: Bert Mead, bmead@fs.fed.us, Forest Inventory and Analysis Program



Softwood harvest in Pacific Coast states becoming small proportion of national total.

*Production forestry is shifting to the Southern United States. California, Oregon, and Washington are projected to supply less than 20 percent of the Nation's total timber harvest by 2050.*

*On Pacific Northwest national forests, the proportion of stands older than 150 years is expected to increase from 15 to 35 percent between 1997 and 2050.*

#### NEW OREGON FOREST LAND STATISTICS AVAILABLE

Researchers looked at the size classes for Oregon's nonfederal (state, private, and tribal) forest lands. They found that 25 percent of the acres had stands with an average diameter of less than 5 inches (seedlings and saplings), 21 percent were between 5 and 9 inches, 47 percent were between 9 and 20 inches, and only 3 percent had stands with an average diameter greater than 20 inches.

Scientists also found that in Oregon's nonfederal forests, tree growth exceeded timber harvest and tree mortality over the last 10 years. For the entire state, timber harvest and mortality were only 68 percent of the growth. The trends are different, however, for moist west-side forests and dryer east-side forests. West of the Cascade Range, tree mortality and harvest were equal to 62 percent of the total volume of tree growth. East of the Cascade Range, tree mortality and harvest were 19 percent greater than the total growth.

Contact for Oregon nonfederal forest land statistics: Dave Azuma, [dazuma@fs.fed.us](mailto:dazuma@fs.fed.us), Forest Inventory and Analysis Program

#### PROJECTED INCREASE IN OLDER FORESTS ON FEDERAL FOREST LANDS

Looking at only federal forest lands in Oregon (USDA Forest Service and USDI Bureau of Land Management),

Photo: Tom Iract



researchers assessed how much federal timber harvest had declined over the last 30 years. Between 1970 and 1989, harvest from federal forest lands in Oregon averaged about 4 billion cubic feet per year. In the early 1990s, that number dropped to about 1.3 billion cubic feet annually, and by the late 1990s, it had dropped to 0.5 billion cubic feet annually.

In 1997, only 15 percent of the forest land on Pacific Northwest national forests had stands older than 150 years, but this proportion is expected to increase to 35 percent by 2050. The shift toward older age classes means that

mature forests, some with old-growth characteristics, will occupy a larger area, and there will be fewer young stands. Although the trend to older forests means that there will be more big trees on national forests in the Pacific Northwest, the overall proportion of big trees on all forest lands may not change much, because most trees on private forest lands are likely to be harvested well before they reach 150 years.

Contact for projected national forest inventories: Richard Haynes, [rhaynes@fs.fed.us](mailto:rhaynes@fs.fed.us), Human and Natural Resource Interactions Program

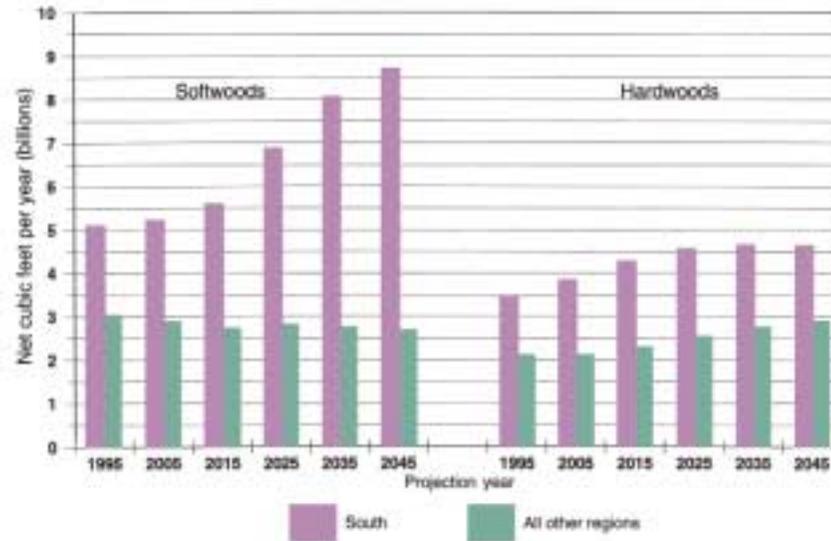
## CHANGING TIMBERLAND BASE ON THE TONGASS NATIONAL FOREST

Final results are available from the 1995-2000 inventory of unreserved lands in the Chatham, Stikine, and Ketchikan areas of the Tongass National Forest.

Photo: Dave Gregovich



Tongass National Forest.



*On private forest lands, timber harvest will be higher in the South than in all other regions combined.*

Researchers found that there are 3.8 million acres of forest land available for timber harvest, a reduction of 0.4 million acre from the 4.2 million acres available in 1985. Increases in wilderness area account for much of this change. Pure stands of Sitka spruce are rare, covering about 8 percent of the timberland area, but have the highest volumes per acre, averaging about 7,600 cubic feet per acre. Stands of mixed Sitka spruce and western hemlock average about 1,700 cubic feet per acre. On all federal timberland in southeast Alaska, Sitka spruce trees account for over 28 percent of the total net cubic volume.

Contact for study of southeast Alaska's changing timberland base: Bill van Hees, [bvanhees@fs.fed.us](mailto:bvanhees@fs.fed.us), Forest Inventory and Analysis Program

### REGIONAL AND NATIONAL TRENDS FOR TIMBER

For more than a century, the federal government has done periodic national assessments of the future supply and demand for timber. For the 2000-2001 Resource Planning Act timber assessment, projections were done for the next 50 years. Timber harvest in the United States is predicted to increase 30 percent.

National trends indicate that some private timberland will be converted to other land uses over the same time, and that timber harvest is unlikely to increase significantly on public forest lands. This means that the increased timber harvest will come from the same amount or

*By 2050, about two-thirds of the national softwood timber harvest will come from intensively managed plantations that occupy less than 20 percent of the total timberland base.*



*Over 75 percent of wood imports and 30 percent of softwood lumber are projected to come from Canada over the next 50 years.*

smaller area of forest land, much of it private timberland. But the productivity of U.S. forest lands is steadily increasing also, with more trees and ultimately more wood volume growing on forest lands. Analysts believe that the Nation's forests can both accommodate the increased harvest levels and have larger inventories of softwood timber in 50 years. Softwood timber inventories are projected to increase 58 percent over the next 50 years, and hardwood timber inventories to increase 25 percent.

Almost all the increased softwood harvest in the United States will come from the South. By 2050, about two-thirds of the national softwood timber harvest will come from intensively managed plantations that occupy less than 20 percent of the total timberland base. These tree plantations will be found both in the South and in the Pacific Northwest west of the Cascade Range.

Over 75 percent of wood imports will come from Canada, and most Canadian wood imports will be softwood lumber. Canada is expected to provide about 30 percent of U.S. softwood lumber over the next 50 years. Wood imports from other countries also are expected to increase over the next 50 years. Softwood sawtimber stumpage prices increased in the 1990s but are expected to stabilize in the future.

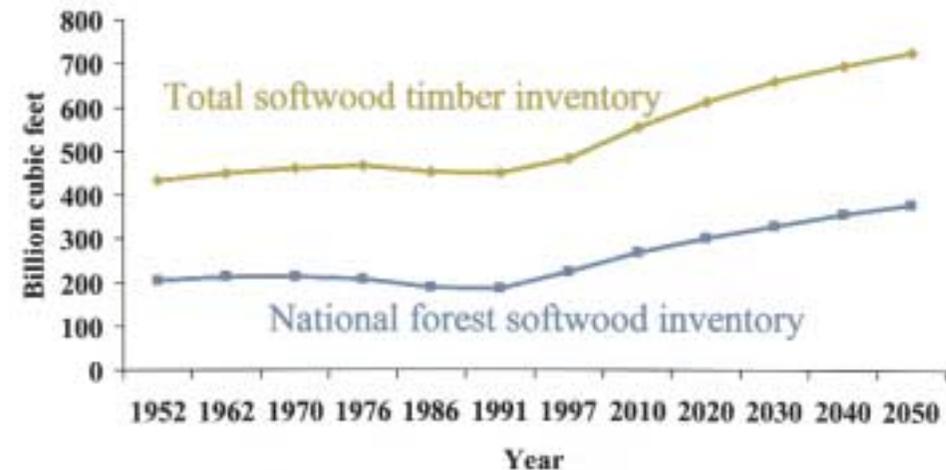
Timber harvest scenarios were projected for national forest lands also. For the first time in 30 years, future timber inventories on national forests across the country were projected by using the same method used for private timberlands, giving a consistent view across ownerships. These projections were based on aggregated plot-level data, by using empirical yield functions. Five different timber harvest scenarios were projected. Under all five scenarios, national forest inventories are projected to increase about 70 percent between 1997 and 2050. During this same period, the percentage of the country's total softwood inventory found on national forests is expected to grow from 46 to 52 percent.

Contact for projections of softwood harvest in the United States: Richard Haynes, [rhaynes@fs.fed.us](mailto:rhaynes@fs.fed.us), Human and Natural Resource Interactions Program

### TIMBER INDUSTRY OUTPUT DECLINES IN PACIFIC COAST STATES

Researchers reviewed the timber industry in Alaska, Washington, Oregon, and California. Since the last assessment 5 years ago, total timber output for these four states declined by 37 percent to 2.6 billion cubic feet. Sawlogs and veneer made up 80 percent of the total output. Washington harvested the most timber, followed by Oregon, California, and then Alaska. Although Washington led the region in total timber harvest, it was only the sixth state nationally. Oregon produced 57 percent of the veneer from the region.

Forest industry lands contributed 46 percent of the total output, nonindustrial private lands 30 percent, and public



Softwood inventories on national forests are projected to increase 69 percent by 2050.

lands 24 percent. Douglas-fir was the most common tree species harvested, at 45 percent of the total output, followed by hemlock (12 percent) and ponderosa pine (11 percent).

#### OREGON'S GROWING POPULATION HAS LITTLE EFFECT ON PRIVATE FOREST LANDS

The CLAMS project evaluates the potential outcomes for alternative forest management policies. The first phase of the research describes the changing patterns in where people live in western Oregon. It also examines the effects that growing populations, urbanization, and land use changes may have on forests. In particular, as more people move into rural areas, private forest lands could be affected in many ways. The Oregon Natural Heritage Program is using the work to identify forest lands most at risk from urban encroachment.

The population density projections are one input into CLAMS and will be used with other information to examine the effects of western Oregon's growing population on private forest lands. The research suggests that growing population densities in the Willamette Valley have had little impact on the productivity of private forest lands in western Oregon.

Contact for CLAMS: Tom Spies,  
tspies@fs.fed.us, Human and Natural  
Resource Interactions



#### COMPETITIVE POSITION OF THE SOUTHEAST ALASKA TIMBER INDUSTRY

A recent study assessed the competitive position of the southeast Alaska timber industry compared to that of the U.S. Pacific Northwest and British Columbia. Southeast Alaska has long been recognized as a high-cost producer that operates at the margin of profitability for wood products. Data for the period 1985-94 confirmed this reality. Some species and log grades harvested in southeast Alaska can sell for high prices in some market cycles, thereby offsetting the higher production costs. The end-market analysis focused on Japan's market for softwood sawlogs and lumber. The study has important implications for forest policy questions such as initiatives to increase the value-added processing in the region and the more general debate over appropriate harvest levels for the Tongass National Forest.

Contact for the study of the competitiveness of Alaska timber industry: David Brooks,  
dbrooks01@fs.fed.us, Human and Natural  
Resource Interactions Program

#### MODERN DISTURBANCE REGIMES ON WESTERN OREGON FOREST LANDS

Scientists mapped the stand-replacement disturbances that occurred on about 11.4 million acres of western Oregon forests between 1972 and 1995. Clearcut harvest and wildfire occurred over 19.9 and 0.7 percent of the study area, respectively. For all land ownerships, harvest rates were lowest in the early 1970s, peaked in the late 1980s and early 1990s, and then decreased to near-1970s levels by the mid-1990s. Throughout the study period, private industrial landowners harvested timber at about 2½ times the rate of public owners. On public forest lands and nonindustrial private lands, logging units were usually small and dispersed through the forest. On industrial forest lands, logging units were usually larger and often bordered each other, forming larger open areas over time. Modern disturbance regimes, dominated by forest management, are different from the historical disturbance regimes in western Oregon.

Contact for modern disturbance regimes in western Oregon forests: Warren Cohen,  
wcohen@fs.fed.us, Ecosystem Processes Program

*Five different harvest scenarios show national forest inventories to increase by about 70 percent between 1997 and 2050.*

*The population is growing rapidly even in areas of the Pacific Northwest that used to be sparsely populated.*

#### ASSESSMENT OF SPECIAL FOREST PRODUCTS BECOMES PRIMARY REFERENCE

Researchers are working on their first national assessment of trends in special forest products, which are nontimber products such as mushrooms, medicinal plants, huckleberries, floral greens, and others. The commercial and recreational gathering of these products has increased in recent years and is expected to become even more important in the future. The work is often done as a family business or family hobby, and frequently the gatherers are people who have limited job or language skills for other work, and people who value the lifestyle or work environment. The national assessment will summarize current knowledge, identify information gaps, and provide a starting point for developing better information. It will be the primary reference on this topic for the United States' first national report on forest sustainability. The national forest sustainability report will be an important step to implementing an international agreement about forest sustainability, first adopted by the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil, in 1992.

Contact for national assessment of trends in special forest products: Richard Haynes, [rhaynes@fs.fed.us](mailto:rhaynes@fs.fed.us), Human and Natural Resource Interactions Program

#### POPULATION GROWTH AND CHANGING COMMUNITIES

The Pacific Northwest population grew rapidly during the 1990s. Although growth rates have slowed recently, the state of Washington is projected to grow from 5.9 million people in 2000 to 7.8 million people by 2025, a gain of almost 2 million people. Over half this growth will come from net immigration. The growing population will likely increase the demand on water supplies and increase recreation pressures on forests and streams. The urban-wildland interface will likely increase, with wildland fires becoming even more of a concern than they are today.



*Growing populations affect national forests and rural communities.*

A recent study analyzed the population changes at the regional and subregional levels. The population is growing rapidly even in areas that used to be sparsely populated. In the interior Columbia Basin, the population was growing in 94 of 100 counties surveyed during the early 1990s.

A high proportion of the population growth comes from people moving into the region, and the newcomers often bring new sets of values, uses, expectations, and knowledge. Public land managers need to respond to these changing values. In Washington, a study is examining the extent to which national forest management policies reflect the changing values of an increasingly urban society. Resource managers need to know how to communicate with the region's newcomers and involve them in land management planning.

It was long assumed that the well-being of rural communities in Washington and Oregon depended directly on a stable timber harvest level. Research shows, however, that these communities have become more diverse over the past 20 years. There are now subcommunities with different concerns within the traditional geographic communities, and many people drive back to urban areas for work, education, and services. Some subcommunities are thriving, whereas others are in decline. Because of these

larger socioeconomic changes, it is difficult to discern exactly how these rural communities have been affected by the reduced timber harvest from federal forest lands. Many observers and community members believe that the migration of people from cities to the countryside is having a bigger effect on rural communities than reduced timber harvest.

Outside the Pacific Northwest, researchers completed a comprehensive atlas of social and economic change in southern California. The atlas is part of a socioeconomic assessment that supports ecosystem management planning for the Angeles, Cleveland, Los Padres, and San Bernardino National Forests in southern California. The 26-county region has been changing from a manufacturing-based economy to a service and knowledge-based economy. From 1987 to 1997, the fastest growing sectors in most counties were services, finance and related work, and state and local government. Wages in the region's 3 rural counties have consistently been lower than wages in the region's 23 metropolitan counties, and the gap has been increasing steadily. The poverty rate increased in all the counties except San Francisco County. Many people moved into the region from the early 1970s to the end of the 1980s, but the region had a net loss of population from 1988 to 1996, owing to people moving out.

Contacts for study of population growth and changing communities in the Pacific Northwest and southern California: Ellen Donoghue, edonoghue@fs.fed.us, Richard Haynes, rhaynes@fs.fed.us, Human and Natural Resource Interactions Program

## FOREST HEALTH MONITORING

The forest health monitoring program conducts aerial and ground surveys to assess insects, diseases, and other risks to forests. Surveyors look not only at the trees but also at other plant species and lichens. West coast field operations were officially combined with the Station's Forest Inventory and Analysis Program.

Aerial surveys covered over 100 million acres of forests in Alaska, California,

Oregon, and Washington, surveying for defoliation and tree mortality. These surveys were done in partnership with state forestry agencies, the national forests, and the Bureau of Land Management. Three additional projects, conducted primarily by state agencies and the USDA Forest Service Pacific Northwest Region, looked closely at specific problems.

In the Oregon Coast Range, aerial surveys have detected a steady increase in Swiss needle cast infection in Douglas-fir forests. The infected area has more than doubled from 1996 to 1999. This year, the surveyors found Swiss needle cast as far as 30 miles inland, a troubling



USDA FS photo

*Aerial surveys provided critical forest health information on over 100 million acres.*



expansion of a disease that used to be found only within 18 miles of the coast, where Douglas-fir had been planted in the Sitka spruce zone.

Balsam woolly adelgid (BWA) is an introduced insect that has had significant effects on fir species in the Pacific Northwest. Ground surveys found BWA in all northeast Oregon counties with forest lands. Although Shasta fir and red fir have some resistance at higher elevations, subalpine fir is susceptible to this insect in all locations. For most fir species, mortality from BWA is higher in wet sites and at lower elevations. It appears that grand fir is being eliminated from low-elevation landscapes in the Willamette Valley, the Puget Sound trough, and along coastal streams. Subalpine fir is being lost as a pioneer species in alpine meadows, avalanche tracks, and old lava beds.

Port-Orford-cedar's natural range is limited to southwest Oregon and northwest California. Throughout most of its range, the tree is highly susceptible to an

introduced root disease. Trees killed by the root disease typically turn a cinnamon color and are easily detected during aerial surveys. In a project to determine the reliability of this aerial survey information, field crews found that 65 percent of ground-checked areas contained Port-Orford-cedar root disease. All areas with dead cedars had mortality from the root disease, but some cedar mortality also was because of damage by black bears. The crews also found that in about 20 percent of the areas classified as Port-Orford-cedar root disease mortality, the dead trees were actually Douglas-fir, which turned the same cinnamon color. Crews observed that the crown shape and texture of Douglas-fir are different from Port-Orford-cedar, and aerial surveyors will be able to use these distinctions to improve survey accuracy.

Contact for forest health monitoring: Sally Campbell, [scampbell01@fs.fed.us](mailto:scampbell01@fs.fed.us), Forest Inventory and Analysis Program



## BUILDING MANAGEMENT COOPERATION THROUGH CARIBOU MONITORING

The Porcupine caribou herd is an internationally famous, shared resource important to the subsistence economies of rural communities in far northern Alaska and Canada. As part of a U.S. man and the biosphere study, scientists modeled the role of hunting in herd population dynamics. They designed a monitoring system to track changes in herd size and its vulnerability to hunting. The easy-to-use system requires information from both local hunters and biologists. Hunters provide data on the body condition of adult female caribou, and biologists provide total population size estimates. The monitoring system brings hunters and biologists together, so they can cooperate on long-term sustainable management of the caribou herd. The hunters are more likely to comply with harvest limitations when they are involved in the management decisions.

Contact for caribou monitoring: Tom Hanley, [thanley@fs.fed.us](mailto:thanley@fs.fed.us), Aquatics and Land Interactions Program

## Goal 3: Develop Science-Based Options for Informed Management

### Key Findings:

- Fire regimes in riparian areas and adjacent upland areas were about 75 percent similar on the east slope of the Oregon Cascade Range. Elimination of all disturbance from riparian areas may be a departure from the historical disturbance patterns of these areas.
- With just small amounts of global warming, the forests in the Northwest and Southeast United States could improve their growth rates and extend their ranges. With higher levels of global warming, however, droughts could occur in these regions, and the forests, especially in the Southeast, could lose many trees.
- In second-growth forests on southeast Alaska's forested wetlands, scientists found that trees are growing fast enough to exceed USDA Forest Service standards for productive forest land. Resource managers used this finding to evaluate the suitability of forested wetland soils for timber harvest in the Tongass National Forest.
- In the initial stages of stand development in southeast Alaska, dense conifer stands block most sunlight from the ground. Understory plant growth, and thus forage for Sitka black-tailed deer, is limited. Long-term commercial thinning trials showed that commercial thinning can improve summer forage for Sitka black-tailed deer.
- Log grade is more closely related to tree age than tree size. Tree diameter is not always the most important factor controlling log grade. Landowners who choose to manage for structural diversity by growing large trees may find that their financial returns are reduced.
- When 50-year-old Douglas-fir stands were thinned, the productivity of chanterelle mushrooms was reduced for 4 years after thinning. The more trees per acre that were removed, the greater was the decline in mushroom productivity.
- Scientists found that green trees retained in patches on harvest units act as refugia for mature and old-growth plant species that are lost or reduced in adjacent harvest areas.

### MANAGEMENT EFFECTS ON RIPARIAN FORESTS

Managers are uncertain about how to manage young forests in riparian areas. In one study in western Oregon's Coast and Cascade Ranges, scientists studied microclimate in riparian forests. They found that for both thinned and unthinned riparian forests in western Oregon, the greatest changes in temperature and humidity occur in the first 50 to 100 feet (15 to 30 meters), as measured from the stream center. Early findings also suggest that headwater riparian areas provide diverse environments for a wide range of plants and animals. These studies are part of a larger research project that should help resolve issues related to riparian areas and the management of young forests in the Douglas-fir region.

In the dry forests of the interior Northwest, fire exclusion has changed landscape patterns and processes. Scientists have found that in these forests, historical fire regimes in riparian and adjacent upland areas were about 75 percent similar. This finding indicates that riparian areas on the east slope of the Cascade Range burned frequently, and suggests that elimination of all disturbance from riparian areas may be a departure from the historical disturbance patterns of these areas.



*Green trees retained in patches on harvest units give refuge to mature and old-growth plant species.*



Photo: Johnny Grady



*Riparian buffer width affected the organic matter reaching streams after timber harvest.*

Scientists are studying the effects of timber harvest on mature riparian forests and adjacent headwater streams in Washington's Green River watershed. In 2001, research was completed on the effects of timber harvest on organic matter inputs to streams. Clearcuts outside a narrow riparian buffer (less than 75 feet) resulted in large inputs of organic matter into a stream during the first autumn after logging. Apparently wind was able to penetrate the riparian buffer and purge dead needles and other organic matter from the forest canopy. In a nearby stream with a riparian buffer wider than 100 feet, inputs of organic matter stayed at pretreatment levels after timber harvest was finished, suggesting that the wider buffer provided greater protection against wind entry.

**Contacts:**  
Microclimate in managed riparian forests: Sam Chan, [schan@fs.fed.us](mailto:schan@fs.fed.us), Resource Management and Productivity Program.  
Fire ecology on the Oregon Cascade Range east slope: Walt Thies, [wthies@fs.fed.us](mailto:wthies@fs.fed.us); Andy Youngblood, [ayoungblood@fs.fed.us](mailto:ayoungblood@fs.fed.us); Managing Disturbance Regimes Program  
Organic inputs and riparian buffer widths, Washington: Pete Bisson, [pbisson@fs.fed.us](mailto:pbisson@fs.fed.us), Aquatics and Land Interactions Program

### SCIENCE SYNTHESIS FOR FOREST ROADS

This year, scientists published a synthesis of what is known about the science of forest roads. *Forest Roads: A Synthesis of Scientific Information* (PNW-GTR-509) pulls together current information about road issues, risks, and management. Also, tools have been developed to evaluate roads and develop best management approaches at regional and national levels.

**Contact for the science of forest roads:** Pete Bisson, [pbisson@fs.fed.us](mailto:pbisson@fs.fed.us), Aquatics and Land Interactions Program

### SURVEY ASSESSES ATTITUDES OF HOMEOWNERS ABOUT REDUCING FIRE RISK

Homeowners in California, Florida, and Michigan were interviewed about their attitudes on fire risk, fuel treatments, and willingness to pay for actions that would reduce fire risk to their homes by 50 percent. These homeowners lived in zones where homes are at high risk from wildfires. Most homeowners (75 percent) were willing to pay over \$57 annually in

increased property taxes for fire risk reduction. Analysis confirmed the hypothesis that homeowners made separate decisions on whether to participate in risk reduction, and how much they were willing to spend. Homeowners decide to participate based on how much risk they see, and they decide how much they're willing to pay based on their property value and household income.

Homeowners did not support strategies that they thought might lead to escaped and catastrophic fires, were not cost-effective, would result in extensive smoke exposure, or would ruin the surrounding landscape aesthetically. Homeowners did support strategies that they thought were well planned, included citizen participation, were conducted by a responsible agency equipped to deal with contingencies, and were a manageable size.

Homeowners preferred to see mechanical treatments used close to developed areas. Everywhere, homeowners' trust in the agency was a major factor in what was acceptable.

Using these findings, scientists designed a survey that managers anywhere can use to assess the attitudes of local homeowners toward fire risk and fuel treatments. The survey relates attitudes of homeowners to demographic and geographic factors, in order to develop models that will predict social responses. As these models are

developed, they will include both human factors and physical factors—people’s attitudes and fuel assessments. Eventually, managers will be able to use these models to identify where their best opportunities are for reducing fire risk through fuel treatments.

Contact for study of homeowners’ attitudes toward fire risk and fuel treatments: Jeremy Fried, jsfried@fs.fed.us, Forest Inventory and Analysis Program

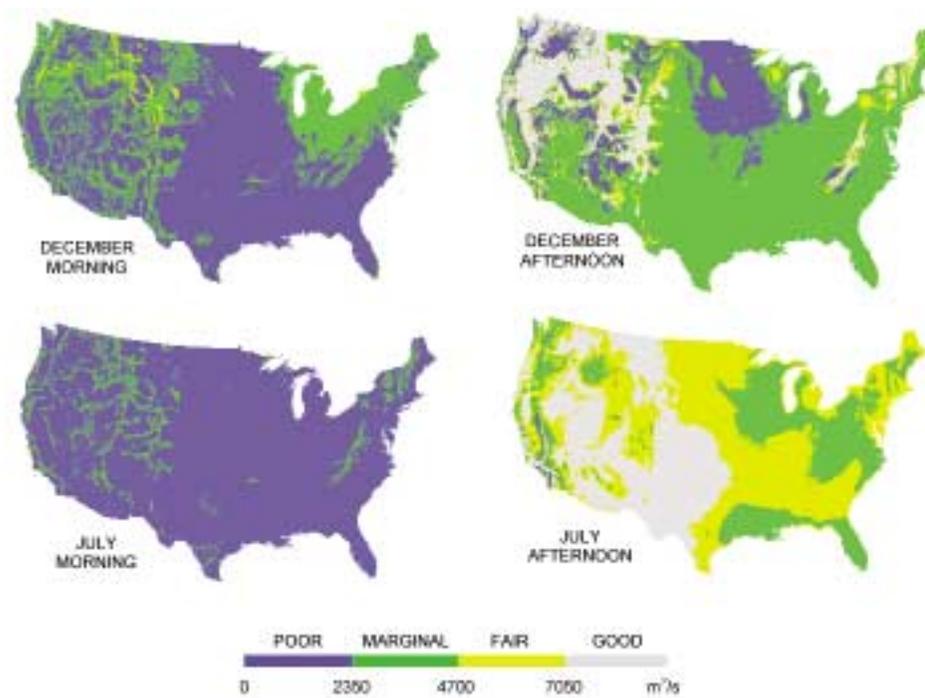
### NATURAL FUELS PHOTO SERIES AVAILABLE

Photo series are a quick and easy way to estimate fuel loading, which is a key factor in fire behavior, fuel consumption, smoke emissions, and fire effects. There

Photo: Diana Olson



Measuring fuel consumption after wildfire near Fairbanks, Alaska.



New database shows areas where poor ventilation may worsen the effects of smoke.

were, however, no fuel series for unmanaged areas, where all fuels are the result of natural events.

A new photo series for natural fuels is now available. The six volumes represent the Southeast (long-leaf pine, grasses, pocosin, oak-hickory), Midwest (white and red pine, grasses), Southwest-Rocky Mountains (chaparral, pinyon-juniper, aspen, gambel oak, sage, lodgepole pine), Pacific Northwest (diseased mixed conifer, sage, grass, juniper), and Alaska (black and white spruce) regions of the United States. The Pacific Northwest and

Alaska volumes were printed in 1999, the Midwest volume in 2000, and the final two volumes (Southwest-Rocky Mountains and Southeast) in 2001.

Contact for natural fuels photo series: Roger Ottmar, rottmar@fs.fed.us, Managing Disturbance Regimes Program

### DATABASE FOR EVALUATING SMOKE DISPERSAL AND WEATHER PATTERNS

Smoke from wildfires or prescribed fires can affect people over a considerable area. Scientists have generated a national database that shows where poor smoke

Ecosystems  
might "greenup"  
with early global  
warming, but  
would later  
"brown down"  
if global  
temperatures  
continued to  
increase.

dispersal is likely. The database uses information from the last 40 years on surface winds, atmospheric level where smoke mixes, and ventilation potential, to show regional patterns. For example, the Great Basin has many spring and summer afternoons with good to excellent smoke ventilation, but has poor ventilation during spring and summer mornings and often all day during fall and winter. People can go to the Web site <http://www.fs.fed.us/pnw/seattle/vent4/>, and select data to create various maps. The maps can show monthly average values and statistical summaries such as the ventilation index frequency by day of the month, and for months of the year. The Web site allows people to add features such as roads, rivers, airports, schools, and wildernesses to the maps, so the viewer can evaluate the potential for poor smoke ventilation in a specific area.

Contact for study of smoke ventilation and weather patterns: Sue Ferguson, [sferguson@fs.fed.us](mailto:sferguson@fs.fed.us), Managing Disturbance Regimes Program

#### CONTRIBUTIONS TO NATIONAL ASSESSMENT OF GLOBAL WARMING

The mapped atmosphere-plant-soil system (MAPSS) team analyzed how ecosystems would respond to global warming, for the new U.S. assessment of potential impacts from climate change. The team analyzed how the Nation's forests would

respond, and also played key roles in the regional assessments for the Pacific Northwest, Alaska, and the Southwest.

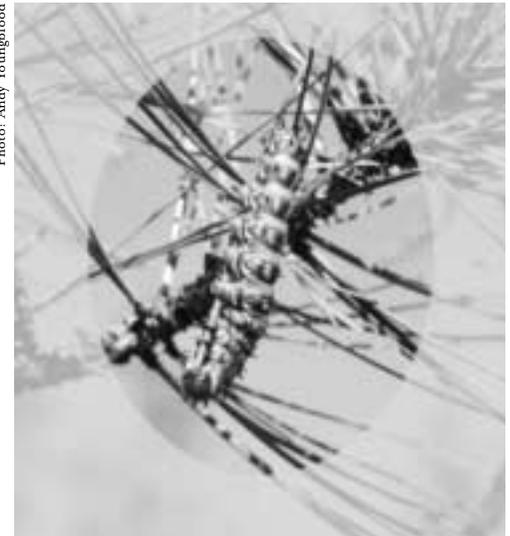
The team developed the hypothesis, which got wide media coverage, that ecosystems might "greenup" with early global warming, but would later "brown down" if global temperatures continued to increase. The book, *Our Changing Planet*, featured the team's simulations of how wildfire patterns might change under global warming. Finally, the team's work was presented to Congress by the director of the Intergovernmental Panel on Climate Change and across the world by members of the federal Office of Science and Technology Policy.

Contact for contributions to national assessment of global warming: Ron Neilson, [rneilson@fs.fed.us](mailto:rneilson@fs.fed.us), Managing Disturbance Regimes Program

#### SCIENTISTS RECONSTRUCT PANDORA MOTH OUTBREAKS

Pandora moth larvae eat the needles of ponderosa pine, Jeffrey pine, and lodgepole pine. A major pandora moth outbreak can lead to landscape-scale defoliation. Yet little was known about long-term patterns of moth dynamics. Scientists reconstructed a 622-year record of pandora moth outbreaks, using evidence from the tree rings of old-growth ponderosa pines. The pandora moth record covers 1374 to 1995, and is

Photo: Andy Youngblood



*Pandora moth larvae: recent outbreaks are typical.*

the longest reconstruction of forest insect population dynamics yet developed for North America.

There were 22 pandora moth outbreaks over those 622 years, with an average 27-year interval between outbreaks and an average 10-year duration of outbreaks. The recurrence of outbreaks at 20- to 40-year intervals suggests that pandora moth population dynamics are influenced by climatic oscillations. Although some people have suggested that forest management practices, particularly fire suppression, have caused recent insect outbreaks to be worse than in the past, the pandora moth history does not support this argument. Instead, the record showed that recent pandora moth outbreaks have not been any more extensive,

severe, or longer-lasting than outbreaks in previous centuries.

Contact for Pandora moth population dynamics: Andy Youngblood, [ayoungblood@fs.fed.us](mailto:ayoungblood@fs.fed.us), Managing Disturbance Regimes Program

## LINKS BETWEEN BEETLES AND DROUGHT

Another study investigated factors that attracted bark beetles to Douglas-fir branches. Scientists found that *Scolytus unspinosus*, a nonaggressive bark beetle, selectively attacked only individual branches with severe water stress. Chemical analysis confirmed that the attacks coincided with the synthesis and accumulation of ethanol in needles and woody tissues. This finding shows that the ethanol released from water-stressed tissues is a signal to some bark beetles that the tree is weakened and less resistant to their attacks. If a similar scenario occurs in trees exposed to severe drought, then monitoring ethanol concentrations might be useful for predicting susceptibility to bark beetle attacks.

Contact for Ethanol in Douglas-fir, and bark beetle attack: Rick Kelsey, [rkelsey@fs.fed.us](mailto:rkelsey@fs.fed.us), Managing Disturbance Regimes Program

## NEW BARK BEETLE TRAPPING TECHNIQUE

Scientists had success with a new technique for trapping Douglas-fir bark beetles. For many years, the most common

technique was to cut a few trees, bait them with pheromone, and then remove the trap trees when they were full of bark beetles and their larvae. In a test of the new technique, beetle traps baited with pheromone were compared to trap trees for effectiveness. The new traps captured significantly more Douglas-fir bark beetles than the trap trees. More male beetles were caught in the traps than in the trap



Photo: Gary Daterman

Bark beetle traps baited with pheromone proved to be effective devices.

trees, but significantly more female beetles were caught in the beetle trap trees. The traps should be effective devices for removing more bark beetles, are easily deployed, inexpensive, kill fewer beneficial insects, and do not require the loss of valuable trees.

Contact for Trap trees vs. pheromone traps for bark beetles: Gary Daterman, [gdaterman@fs.fed.us](mailto:gdaterman@fs.fed.us), Managing Disturbance Regimes Program

## FOREST MANAGERS CAN MINIMIZE BLACK STAIN HAZARD

Scientists evaluated the incidence and severity of black stain root disease in young Douglas-fir plantations in southwest Oregon. Black stain was found more often in precommercially thinned plantations than in unthinned plantations. The root disease was also more common near roads and major skid trails than it was in other areas of the plantations. Although black stain occurred more often than other root diseases, it had minimal effect on precommercial stand management. In areas with high levels of black stain, forest managers can minimize the black stain hazard by minimizing site disturbance and tree injury during timber harvesting, road building, and road maintenance. Also, managers can time precommercial thinning to avoid the times of year when insects that carry black stain to new areas emerge and fly.

Contact for Black stain root disease: Paul Hessburg, [phessburg@fs.fed.us](mailto:phessburg@fs.fed.us), Managing Disturbance Regimes Program

## SWISS NEEDLE CAST

Swiss needle cast is a foliage disease that affects Douglas-fir along the Oregon and Washington coast. Genetic studies have shown that certain families of Douglas-fir tolerate the disease better than others, but none show true resistance. All Douglas-fir tested had similar

*Genetic studies show certain families of Douglas-fir tolerate Swiss needle cast—but none are resistant.*

*The fastest growing interests are wildlife and scenery viewing and "soft adventure" activities that combine comfort and outdoor recreation.*

concentrations of the disease inside their needles, but the more tolerant trees shed their needles as the infection level increased. The least tolerant families tended to hold onto needles that were no longer effective. Scientists are examining other traits in trees with the disease, including growth rates, foliage color, and crown density. As the mechanisms of Swiss needle cast resistance are better understood, researchers can breed trees with improved resistance to the disease. In other work, studies indicate that Swiss needle cast reduces the moisture content of sapwood in trees on severely affected sites. Additional work will investigate the implications of this reduced moisture.

Contact for Swiss needle cast resistance: Randy Johnson, [randyjohnson@fs.fed.us](mailto:randyjohnson@fs.fed.us), Resource Management and Productivity Program

#### "SOFT ADVENTURE" RECREATION INCREASINGLY POPULAR IN SOUTHEAST ALASKA

For more than two decades, tourism has been the fastest growing component of the Alaska economy, and an important export sector. Researchers have developed information about outdoor recreation trends in Alaska, and how national forest management might respond to those trends. Alaska residents have much higher rates of participation in outdoor recreation than people in the lower 48 states, and outdoor recreation is an important part of quality of life in Alaska. Although

the rapid growth rate of the early 1990s is expected to slow down, both visitor and resident demands for outdoor recreation are expected to increase. The fastest growing interests are wildlife and scenery viewing and "soft adventure" activities that combine comfort and outdoor recreation, such as fishing trips that offer a comfortable lodge at the end of the day.



Much of the outdoor recreation occurs in national forests in Alaska. Both large firms and many small businesses will depend on national forests for some of the services that they are packaging and selling to visitors. Because the preferences of the public and business offerings are all changing rapidly, however, it is not possible to anticipate all of the changes that will occur in outdoor recreation.

As recreation and tourism become more important economically to Alaskan communities, certain social challenges are

presented. As towns become more dependent on tourism and services instead of extractive industries and manufacturing, both local economies and social conditions will change in fundamental ways.

Other research findings with implications for national forest management include the likelihood of more interaction—and possible conflicts—between residents and visitors, and between wildlife and both residents and visitors engaged in outdoor recreation. All these changes mean that new approaches may be needed to recreation management.

Contacts for study of recreation and tourism in southeast Alaska: David Brooks, [dbrooks01@fs.fed.us](mailto:dbrooks01@fs.fed.us); Lee Cerveny, [lcerveny@fs.fed.us](mailto:lcerveny@fs.fed.us); Human and Natural Resource Interactions Program

#### SOUTHEAST ALASKA'S FORESTED WETLANDS MEET PRODUCTIVITY STANDARDS

During the land management planning process for the Tongass National Forest, questions were raised about timber harvest on forested wetland soils. The four soil types in question cover only about 100,000 acres, but these soils typically occur as small inclusions within more productive forest lands. As part of its scientific support for the Tongass land management plan, the Station evaluated forested wetlands that had been clearcut

over the past 50 years. Researchers found that these forested wetlands regenerated naturally into densely stocked stands that grew slowly but steadily. Trees are growing fast enough to exceed the USDA Forest Service standard for productive forest land, which is 20 cubic feet per acre per year.

Contact for study of forested wetlands in southeast Alaska: Dave D'Amore, [ddamore@fs.fed.us](mailto:ddamore@fs.fed.us), Resource Management and Productivity Program

### THINNING CAN IMPROVE DEER FORAGE

Station scientists have found that in the initial stages of stand development in southeast Alaska, dense conifer stands block most sunlight from reaching the ground. Sparse understories are common for 25 to 100 years after clearcutting or other major disturbances, limiting forage for Sitka black-tailed deer. Recently, scientists examined understory plant biomass, nutritional quality, and available light on the forest floor, in commercial thinning trial areas established on the Tongass National Forest in the mid-1980s. They found that unthinned stands had only 110 pounds of understory plant biomass per acre, and thinned stands had 1,400 to 2,300 pounds per acre. Individual-tree-selection units had less total biomass but yielded better forage for deer because the understory had more shrubs, ferns, and forbs, which are

more nutritious for deer. The results show that thinning can improve deer forage and that individual-tree-selection thinning can provide summer forage for deer at levels comparable to old-growth forest.

Contact for Understory plant response to commercial thinning, southeast Alaska: Mike McClellan, [mmcclellan@fs.fed.us](mailto:mmcclellan@fs.fed.us), Resource Management and Productivity Program



Photo: Mike McClellan

*Sitka black-tailed deer in southeast Alaska.*

### SILVICULTURAL OPTIONS FOR MANAGING YOUNG-GROWTH PRODUCTION FORESTS

The first site is on the Capitol State Forest near Olympia, Washington, managed by the Washington Department of Natural Resources. The second and third sites are now being developed; the second site is also on the Capitol State Forest and the third is in British Columbia, managed by the British Columbia Ministry of Forestry. This large, long-term study examines issues related to

regeneration, stand growth, wildlife, harvest rates and effects, and public attitudes about forest management. Another study at Capitol State Forest is examining how Douglas-fir, western redcedar, and western hemlock will grow underneath six different densities of overstory retention.

Silvicultural options for young-growth production forests: David Marshall, [dmarshall@fs.fed.us](mailto:dmarshall@fs.fed.us), Resource Management and Productivity Program  
Silviculture and genetics in Douglas-fir, western redcedar, and western hemlock, Capitol State Forest: Brad St. Clair, [bstclair@fs.fed.us](mailto:bstclair@fs.fed.us), Resource Management and Productivity

### THINNING TO DEVELOP OLD FOREST STRUCTURE AND HABITAT

Studies that were started decades ago, intended to test silvicultural options for managing young-growth production forests, are particularly valuable, often in ways not imagined when the studies began. For example, the Douglas-fir levels-of-growing-stock (LOGS) study, which was started in 1962 to study factors related to tree growth, is providing data about the development of older forest structure and wildlife habitat as well. The LOGS study sites were established at nine places in Oregon, Washington, and British Columbia.

The LOGS study has provided evidence of the enormous influence thinning can have on stand development in just a few years. Various thinning treatments have



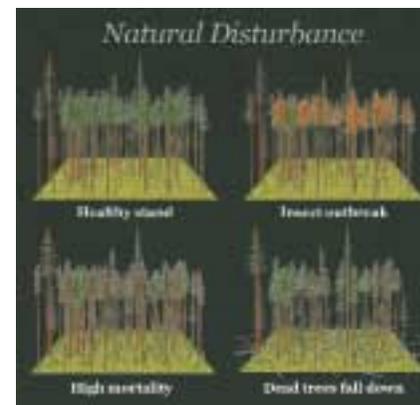
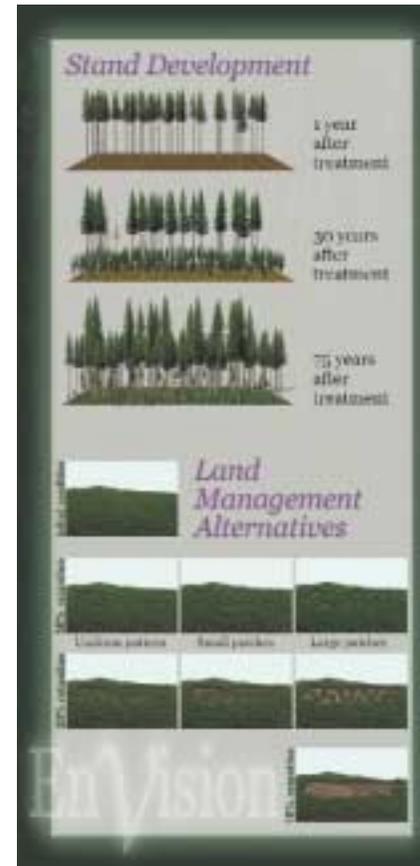
*These findings suggest that if the goal is to grow wood volume, rotation length and the length of time between thinnings are important factors in thinning decisions.*

resulted in stands with different appearances, average tree sizes, understories, and crowns. New results, which are consistent with past findings, indicate that (1) the average annual growth rate has not yet slowed down in these stands; (2) heavy thinnings produce trees with larger diameters, but also reduce total stand volume growth rates (because there are fewer trees per acre); and (3) after light thinnings, diameter gains are not as dramatic, but more trees per acre are growing—so the total volume growth per acre is often similar when compared for thinnings at various spacings. These findings suggest that if the goal is to grow wood volume, rotation length and the length of time between thinnings are important factors in thinning decisions.

Contact for Douglas-fir LOGS study: David Marshall, dmarshall@fs.fed.us, Resource Management and Productivity Program

### ENVISION

Few people—even forestry professionals—can look at a data table describing trees and other plants in a stand and imagine exactly how that stand looks. The stand visualization system (SVS) and EnVision computer programs, developed by Station scientists, help people to see what forests would look like in the future under different management scenarios. Private, state, and federal planners are using SVS and EnVision in public meet-



ings. The visual simulations are helpful in discussions about riparian forests and wildlife habitat. Technical planning teams also are using the models. More information about this research can be found on the Web at <http://www.fs.fed.us/pnw/svs> and <http://www.fs.fed.us/pnw/envision>.

Contact for Stand visualization system (SVS) and EnVision computer model: Bob McGaughey, bmcgaughey@fs.fed.us, Resource Management and Productivity Program

### WOOD PRODUCTS

Many studies examine factors that affect wood quality and product yields. Scientists are looking beyond traditional wood products such as dimension lumber, and examining the yield of specialty products from small-dimension pine, the production of noble fir boughs, and value-added wood products in Alaska, among others.

In one recent study, scientists compared wood quality in 20- to 100-year-old Douglas-fir from thinned and unthinned stands. They found that log grade is more closely related to tree age than it is to tree size, and that diameter is not always the most important factor controlling log grade. From the perspective of a grower, thinning might be a good way to improve average log grade, because poor quality



*Thinning operations in a Douglas-fir forest, in western Oregon's Cascade Range.*

trees are removed early. Processors, on the other hand, might want to know the history of the logs they purchase so they can choose those from less intensively managed stands. These findings are useful to landowners who choose to manage for structural diversity by growing larger trees but still want to produce the highest value timber possible.

In another study, scientists examined the wood products produced from restoration treatments done in the urban-wild-

land interface around Flagstaff, Arizona. They found that small-diameter ponderosa pine from densely stocked stands yielded wood more suitable for appearance-grade lumber (moldings, trims, etc.) than for dimension lumber (such as two-by-fours).

Other scientists are finding new ways to use Alaska forest resources for primary and secondary wood products industries. Researchers found that it was feasible to

use local forest and sawmill residues to supply a small wood-fired thermal system that meets part of local heating needs on the Kenai Peninsula in Alaska. Working with the Alaska Railroad and the Forest Products Laboratory in Wisconsin, researchers are testing the suitability of railroad ties treated with the new double-diffusion method or with new formulations of creosote. Also, a comprehensive evaluation is underway of mill capacity and use in southeast Alaska.

In new projects, scientists will look at how forest products companies develop new products, options for Alaska softwood lumber drying, value-added opportunities for sawmills in Alaska, opportunities for special forest products, and additional strength testing for Alaska tree species.

**Contacts:**

Wood quality and product yields from managed and unmanaged forests: Eini Lowell, [elowell@fs.fed.us](mailto:elowell@fs.fed.us), Human and Natural Resource Interactions Program

Wood byproducts from restoration treatments in Arizona: Eini Lowell, [elowell@fs.fed.us](mailto:elowell@fs.fed.us), Human and Natural Resource Interactions Program

Value-added wood products in Alaska: Ken Kilborn, [kakilborn@fs.fed.us](mailto:kakilborn@fs.fed.us), Human and Natural Resource Interactions Program



*Scientists developed a model that can be used to estimate the harvestable volume of noble fir boughs from a given stand.*

### BOUGHS: ESTIMATING NOBLE FIR VOLUMES

Most conifer boughs used for holiday wreaths and decorations are cut from forests managed primarily for timber production. In the Pacific Northwest, large volumes of noble fir boughs are harvested from federal, state, and private forest lands. Scientists developed a model that can be used to estimate the harvestable volume of noble fir boughs from a given stand, using measurements of the tree and a count of competing trees in the stand. With the model, forest managers can consider the value of boughs as they plan management regimes for noble fir stands.

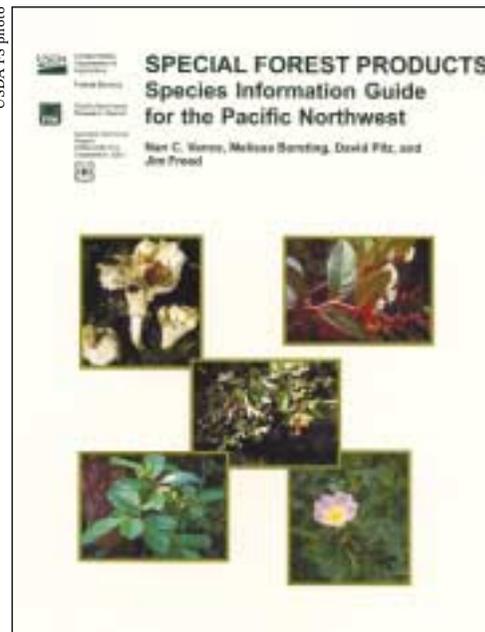
Contact for harvestable volume of noble fir boughs: Roger Fight, [rfight@fs.fed.us](mailto:rfight@fs.fed.us), Human and Natural Resource Interactions Program

### SPECIAL FOREST PRODUCTS GUIDE EMPHASIZES SUSTAINABLE USE OF NATIVE PLANTS

The Station has published a special forest products information guide, a synthesis of scientific and practical information on over 60 species found in the Pacific Northwest. The guide is already being used by the wide range of people interested in the biotic resources of the region, including native plant landscapers, forest managers, botanists, conservationists, herbalists, and recreational gatherers. It includes information on

fungi, lichens, mosses, herbs, and trees that provide resources for various medicinal, edible, decorative, and wood products. These plant species are increasingly important because of their use in restoration and native plant landscaping. Several species are used to rehabilitate disturbed lands; for example, some are planted after wildfires.

USDA FS photo



*New guide has information on over 60 species used for special forest products.*

About 78 percent of these plants are commercially available as plants or seed, suggesting multiple options for sustaining these species through cultivation. But 24 species in the guide are classified as vulnerable, based on criteria including

rarity, under severe pathogenic attack, difficult to cultivate, high harvest pressure, and several other factors. Of the 24 vulnerable plant species, 9 species are not cultivated or commercially available as seed or plants.

Contact for special forest products guide: Nan Vance, [nvance@fs.fed.us](mailto:nvance@fs.fed.us), Resource Management and Productivity Program

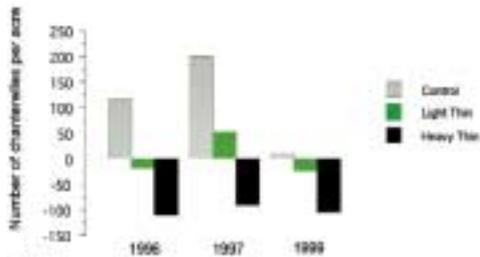
### PREDICTING EDIBLE FOREST MUSHROOM PRODUCTIVITY

The young stand thinning and diversity study, on the Willamette National Forest, has produced a finding on edible mushrooms. Many prized species of edible forest mushrooms are ectomycorrhizal, meaning that they have a symbiotic dependence on tree roots for their carbohydrate nutrition. The forests where these mushrooms are commercially harvested also are managed for timber and other uses. To manage these forests for all their resources, including timber, commercially valuable edible mushrooms, and other resource values, managers need more information about how stand conditions and silvicultural choices affect mushrooms.

Scientists found that when 50-year-old Douglas-fir stands were thinned, the productivity of chanterelle mushrooms was reduced for 4 years after thinning. The various thinning treatments ranged



White chanterelle mushrooms.



Declines in chanterelle productivity after thinning treatments.

from 45- to 80-percent reductions in the number of trees per acre, with dominant trees left, and reductions in mushroom productivity were proportional to the number of trees removed. The reduced mushroom growth appeared to be correlated with the reduced photosynthetic capacity of host mycorrhizal trees in the stand.

Contact for effects of thinning on productivity of edible mushrooms: David Pilz, [dpilz@fs.fed.us](mailto:dpilz@fs.fed.us), Ecosystem Processes Program

## DEMO STUDY FINDS GREEN TREE PATCHES ARE PLANT REFUGIA

In 1993, Congress directed the USDA Forest Service to establish a large-scale silvicultural experiment in the Pacific Northwest. The demonstration of ecosystem management options (DEMO) study was designed to help develop new timber harvest strategies that will retain some species and ecological characteristics of mature and old-growth forests in western Oregon and Washington, or accelerate their recovery after harvest. The six harvest treatments in DEMO were completed in 1998, and the first round of postharvest sampling completed in summer 2001. In their preliminary results, the scientists found many effects on species diversity.

When green trees were left in patches on harvest units, these patches were large enough to act as refugia for many plant species that were lost from or greatly reduced in the adjacent harvest areas. In general, herbs and ground-level mosses and liverworts were more sensitive to the creation of forest edges than were shrubs. The greatest changes in plant abundance and diversity occurred at the lowest tree retention levels (15 percent of the trees left standing, in patches or clumps). Responses differed among blocks and

plants, suggesting that initial forest composition and structure may strongly affect how plants respond.

Fungal biodiversity stayed high in the untreated forest stands and in the units where 40 percent of the trees were left standing, evenly dispersed throughout the harvest unit. The biodiversity of ectomycorrhizal fungi decreased strongly, however, in the units where 15 percent of the trees were left standing, evenly dispersed throughout the harvest unit. In these 15-percent dispersed retention units, each individual green tree will be important for the maintenance of beneficial root fungi onsite as a new forest gets established.

In the tree canopies, several individual taxa of arthropods, as well as arthropod functional groups, decreased significantly from the northernmost study sites in Washington to the southernmost sites in Oregon, and from wetter to drier sites.

A few taxa increased in numbers. In general, no one site or forest had all the potential invertebrate species of the region, thereby suggesting that the conservation of arthropod biodiversity could require a regional approach. The DEMO study is a collaborative research among the Pacific Northwest Region, PNW Research Station, Washington State Department of Natural Resources,

*Each green tree will be important for the maintenance of beneficial root fungi onsite as a new forest gets established.*



University of Washington, Oregon State University, and the University of Oregon.

Contact for DEMO study: Charley Peterson, [cepeteron@fs.fed.us](mailto:cepeteron@fs.fed.us), Resource Management and Productivity Program

### OLD-FOREST REMNANT PATCHES PROVIDE REFUGIA

Scientists studied remnant patches of old forest on the Cispus Adaptive Management Area, Gifford Pinchot National Forest. The patches ranged from 0.01 to 113 acres, averaging 29 acres. The scientists found that these patches provide refugia habitat for many species of terrestrial lichens, bryophytes (mosses and liverworts), vascular plants, and invertebrates closely associated with old forest conditions. The patches did not, however, have all the old-forest species found in the control plots, which were large areas of old forest. Still other species were found mostly in second-growth plantations next to the remnant patches; these young stands were from 4 to 47 years old, averaging 18 years old.

Several rare insect taxa (and some new forms) that are usually found on glaciers and ice fields were captured in the old-forest remnants, including the orthopteran gryllablatra, the rare and primitive flightless fly *Chionea*, and the



uncommon snow scorpionfly *Boreus*. The presence of these rare insects suggests that the Cispus high country may be a post-Pleistocene refugium where insects adapted to postglacial conditions survive. Some of these insects, and other invertebrates picked up in the surveys, will likely be identified by experts as newly described species.

Many species are specialized to old-forest conditions or plantation conditions. At least six "survey and manage" lichen and moss species are closely associated with old forests. Even the smallest remnant patches of old forests serve as refugia and

dispersal sources for some species of terrestrial lichens, bryophytes, vascular plants, and invertebrates.

Other species can live in both old forests and plantations. The presence of substrates such as down wood, moss cover, bare soil, rocks, and litter cover may account for the presence of many species in both old forests and plantations. The species correlations with these substrates suggest testable guidelines for maintaining old-forest habitats in younger stands.

Contact for old-forest remnant patches study: Bruce Marcot, [bmarcot@fs.fed.us](mailto:bmarcot@fs.fed.us), Ecosystem Processes Program

## SMALL FOREST CANOPY GAPS CREATE MICROCLIMATES IN FORESTS

Small openings in forest canopies create diversity in mature forests. Forest managers are interested in creating gaps to increase forests with old-growth characteristics, but the effects of gaps on the forest are not well-understood. Scientists created small forest canopy gaps ranging from 0.01 to 0.5 acre. Not surprisingly, they found that solar radiation and soil temperatures were higher in gaps, especially on the north edges where sunlight was most likely to reach the ground. But air temperature differed little among gaps. Soil moisture was higher in gaps than in control areas, was highest in mid-sized gaps, and declined during summer in small gaps and on the north edges of large gaps. Forest managers can use these results to plan optimum gap sizes for promoting wildlife habitat and vegetation growth.

Contact for microclimate response in forest canopy gaps: Andrew Gray, [agray01@fs.fed.us](mailto:agray01@fs.fed.us), Forest Inventory and Analysis Program

## SILVICULTURAL RESEARCH EXPANDED TO INVESTIGATE LOSS OF OAK HABITAT

In the last 150 years, the acreage in oak woodlands, oak savannas, and associated prairies has plummeted, because Native American burning ended and fire suppression programs began. Oregon white

Photo: Connie Harrington



*New research on Oregon white oak may help stabilize or reverse habitat loss.*

oak is a fire-dependent species. Without fire, conifers grow in the understories of oak woodlands or savannas and eventually shade out the oaks.

New research on Oregon white oak may help stabilize or reverse the habitat loss. The research includes a bibliography on all aspects of the species; a survey of factors affecting acorn productivity; development of a management plan for oak woodlands, prairies, and conifer forests at Fort Lewis; and a study of how oak responds to release from overtopping conifers. The oak project includes natural resource agencies, the Fort Lewis Military Reservation near Tacoma, Washington, and volunteers for the acorn survey. The Web site for the Oregon

white oak project is:  
<http://www.fs.fed.us/pnw/olympia/silv/oaksurvey/oak.htm>.

Contact for management of Oregon white oak:  
Connie Harrington, [charrington@fs.fed.us](mailto:charrington@fs.fed.us),  
Resource Management and Productivity Program

## SNOWSHOE HARES USE THINNED UNITS

Scientists studied the effects of two thinning treatments on snowshoe hares in the Anthony Burn and Indian Creek areas of Oregon's Blue Mountains. In one treatment, islands were left in thinned stands. In the other treatment, about half of each stand was left unthinned in islands or corridors and the remainder thinned at various spacings. Radio-collared snowshoe hares were monitored weekly from October 2000 through August 2001.

Photo: Evelyn Ball



*Snowshoe hare in Oregon's Blue Mountains.*



*The presence  
of rare insects  
in old-forest  
remnants suggests  
that the Cispus high  
country may be a  
post-Pleistocene  
refugium where  
insects adapted  
to postglacial  
conditions  
survive.*

*Big game  
habitat capability  
has declined by  
35 percent across  
the interior  
Columbia basin.*

Preliminary analysis shows significant differences in summer and winter habitat use by the hares. In winter, hares moved to more open habitats (old thinning units) and sat on lookouts watching for predators. During summer, hares hid in dense cover. Hares continued to use the modified thinning units throughout winter and summer.

Contact for effects of thinning on snowshoe hares; implications for lynx: Evelyn Bull, ebull@fs.fed.us, Managing Disturbance Regimes Program

ECOSYSTEM MANAGEMENT, ELK,  
AND DEER IN THE INTERIOR  
COLUMBIA BASIN

In the interior Columbia Basin, a team of state, federal, and tribal biologists developed a model to analyze the effects of management alternatives for federal lands on elk, mule deer, and white-tailed deer habitat. The team estimated that big game habitat capability has declined by 35 percent across the basin, mainly because of agricultural conversions of grass and shrub land, loss of forest foraging areas, and loss of security because of extensive road networks. The model projected that all management alternatives considered would increase big game habitat capability by about 5 percent over the next 100 years.

Photo: Mike Wisdom



Bull elk in Oregon's Blue Mountains.

At the Starkey Experimental Forest and Range in Oregon's Blue Mountains, scientists studied forage competition among elk, mule deer, and cattle. The elk and mule deer were free-ranging, whereas cattle were moved through a three-pasture deferred rotation system. Scientists used an automated telemetry system to monitor elk, mule deer, and cattle locations from 1993 to 1996.

The scientists found that when cattle were present, fewer elk used the pasture. Elk used the plant community under ponderosa pine/Douglas-fir forests less in early summer and more in late summer. Mule deer use increased or decreased in the opposite direction from elk use in three out of four season-year combinations.

Contacts:  
Effects of management alternatives on big game habitat capability in the interior Columbia basin: Michael Wisdom, mwisdom@fs.fed.us; Marty Vavra, mvavra@fs.fed.us; John Kie, jkie@fs.fed.us; Managing Disturbance Regimes Program  
Competition among elk, deer, and cattle in the Blue Mountains: Michael Wisdom, mwisdom@fs.fed.us; John Kie, jkie@fs.fed.us; Marty Vavra, mvavra@fs.fed.us; Managing Disturbance Regimes Program



Radio telemetry was used to study forage competition among elk, mule deer, and cattle.

## Goal 4: Communicate Science Findings and Enhance Their Application

Photo: Rod Meade, Weyerhaeuser



Station scientists are engaged in delivering science to high-profile policy issues.

As part of its mission, the PNW Research Station delivers scientific information to high-profile management and policy issues. This work includes providing scientific support to federal land management planning projects and providing syntheses of research relevant to policy issues.

The involved scientists learn by being exposed to real-world issues. They feel that the experience adds to the breadth and depth of their future research, and they develop a better understanding of the role of scientists in decisionmaking. The Station added a new program, Focused Science Delivery, this past year,

in order to focus more resources on this part of its mission.

### STATION PROVIDES SCIENTIFIC INFORMATION FOR LAND MANAGEMENT PLANNING

Station scientists have provided support for two major planning projects on federal lands: one project in the interior Columbia basin and the other in southeast Alaska.

The interior Columbia basin includes eastern Oregon and Washington, most of Idaho, and small parts of Montana, Nevada, and Wyoming. The purpose of the Interior Columbia Basin Ecosystem Management Project (ICBEMP) is to provide ecosystem management direction for national forest and Bureau of Land Management lands in this area. A Station team has provided scientific support for the land management planning process since 1994.

The team's information could lead to significant changes in federal land management in the interior Columbia basin.

Major findings include:

- There are multiple risks in ecosystems, and the risks interact with each other. Management that tries to isolate single components will not be effective.

*Science effort describes interaction of multiple risks in ecosystem and associated management challenges in the interior Columbia basin.*



- It may be more effective to identify groups of species with similar ecological functions and manage for these groups, rather than manage for individual species.
- Human uses of land have changed natural succession and disturbance regimes. These altered regimes have led to a series of cascading effects that make it difficult for resource managers to improve the ecological health of these lands.
- Key salmon, steelhead, and trout species have declined because of multiple factors, including dams, agriculture and rangeland conversion, past management, and competition with introduced fish species. Habitat protection and restoration alone will not ensure healthy populations.
- There are connections among human values, ecosystem conditions, and the use of natural resource products. People are an integral part of the ecosystem. Stewardship must resolve the challenge of how to meet multiple demands with finite resources.
- Some local economies rely heavily on products and services from lands managed by the USDA Forest Service and the USDI Bureau of Land Management.

Photo: Tom Ince



The Tongass National Forest sprawls across almost 17 million acres of south-east Alaska. In 1997, the PNW Research Station committed to a 5-year research program to provide sound scientific information for the Tongass land management planning process.

Station scientists developed scientific information in five high-priority areas:

- Stand management and silviculture (alternatives to clearcutting, second-growth management, young-growth utilization)

- Wildlife (small mammals, wolves, goshawks)
- Aquatic issues (world-class fisheries including all five salmon species)
- Social issues (subsistence living, community issues)
- Economic issues (timber demand, economic changes, recreation and tourism)

Currently, scientists are developing an overall synthesis of the work. This final product will summarize the state of current knowledge in the five areas and discuss the implications for forest management.

**Contacts:**  
ICBEMP scientific support: Becky Gravenmier, [bgravenmier@fs.fed.us](mailto:bgravenmier@fs.fed.us), Managing Disturbance Regimes Program  
Tongass land management plan scientific support: Douglas A. Boyce, [daboyce@fs.fed.us](mailto:daboyce@fs.fed.us), Alaska science coordinator



Thinned stand in Gravelly Creek watershed, southeast Alaska.

## WOOD COMPATIBILITY INITIATIVE FINDING—MANAGEMENT STRATEGIES CAN OFFER OPPORTUNITIES FOR MUTUAL GAINS

Initiatives are integrated programs of research and development that produce findings to address specific policy issues, within 3 to 5 years. Because of the short timeline, initiatives focus on development and synthesis products rather than fundamental research. The Station currently has several initiatives in various stages, one of which is the wood compatibility initiative.

The wood compatibility initiative examines the central question: Can we as a society produce wood commodities and other forest values in an environmentally acceptable and sustainable manner? The science question revolves around the possibility that people may be able to manage the forests in a way that creates jobs, supplies wood, and benefits the environment. Scientists looked for opportunities for mutual gain and compatible changes, rather than direct tradeoffs, among timber harvest and other forest values such as wildlife and clean water.

The key finding is that some forest management strategies may provide opportunities for compatible changes that are mutually beneficial to forests and human communities. Alternative silviculture uses active management to increase structural and compositional diversity in forests

Photo: Ellen Anderson



Science-based options may be able to provide wood and maintain other forest values.

regenerated after timber harvest or wild-fires. Stand-level studies showed that there is a science-based mix of options for providing wood products while maintaining or enhancing wildlife habitat, water quality, and aesthetics. The finding suggests that sustainable forest management is compatible with healthy communities.

Contact for wood compatibility initiative:  
Richard Haynes, [rhaynes@fs.fed.us](mailto:rhaynes@fs.fed.us), Human and Natural Resource Interactions Program

## FINDING WAYS TO MAKE ADAPTIVE MANAGEMENT WORK

Adaptive management is an important strategy to improve learning and make better decisions. Adaptive management is based on a simple premise: policies are experiments, learn from them. Through careful problem identification and documentation of assumptions, actions, and

*Some forest management strategies may provide opportunities for compatible changes that are mutually beneficial to forests and human communities.*

*To be  
successful, adaptive  
management  
requires  
organizational  
commitment and  
leadership, and a  
willingness to  
embrace risk and  
uncertainty.*

results, management actions can become the source of new knowledge, which then can subsequently inform future actions and policies. This approach is critical to the long-term success of the Northwest Forest Plan. The plan designated 10 adaptive management areas (AMAs) in Washington, Oregon, and northern California.

A recent study examined four AMAs in the state of Washington and two adaptive management projects in British Columbia, to see how well adaptive management has worked and what problems have occurred. The scientists found that efforts to manage adaptively have not been successful in either country. The findings were similar across borders, even though the British Columbia forests are managed under a different system of laws than national forests in the United States. In both countries, there was a lack of institutional commitment to funding and personnel for the AMAs, although the Canadian situation was better than the American one. Existing laws and regulations constrained experimentation, and top-down, expert-driven planning systems constrained more locally based, site-specific initiatives.

Scientists involved with adaptive management could either help or hinder the approach. Traditional scientists tended to place a lower value on collaborative approaches and limited their interactions



Photo: Roger Otumar

*Successful adaptive management requires permission to experiment, among other factors.*

with nonscientists, thereby increasing the chances of alienating people. Relationships and collaboration are keys to adaptive management.

To be successful, adaptive management requires organizational commitment and leadership, a willingness to embrace risk and uncertainty, a willingness on the part of scientists, managers, and the public to work together, and permission to experiment in an otherwise constrained statutory environment.

In a separate study on the Siuslaw National Forest, Station scientists worked

with the forest interdisciplinary team to design the largest, replicated management experiment in the Pacific Northwest (16,000 acres). The management experiment will compare three methods to implement the Northwest Forest Plan, with four replications of each method. The three methods are passive management (removing all road culverts, no thinning in plantations or riparian areas), continuous management (keeping roads open, thinning stands lightly and repeatedly), and pulsed management (thinning stands heavily, then removing culverts for 30 years before reentering for additional thinning).

As one part of the study, the team is using an experimental form of adaptive management. They streamlined their approach to writing environmental impact statements. The new style requires more precise analysis from specialists, and the document is only 85 pages long (before appendices). The traditional approach would have required about eight environmental assessments over the next 10 years.

**Contacts:**

Adaptive management evaluation in Washington and British Columbia: George Stankey, gstankey@fs.fed.us, Human and Natural Resource Interactions Program  
 New form of adaptive management, Siuslaw National Forest: Bernard Bormann, bbormann@fs.fed.us, Ecosystem Processes Program

Photo: R. Alan Hoffmeister, BLM



*Dense plantations of Douglas-fir in the Oregon Coast Range.*

**THINNING SECOND-GROWTH STANDS TO ACCELERATE THE DEVELOPMENT OF OLD-GROWTH CHARACTERISTICS**

Currently, dense plantations of Douglas-fir, established after clearcutting, cover extensive areas of the Pacific Northwest. Many acres of young stands are in the late-successional reserves established under the Northwest Forest Plan. Management objectives for these reserves emphasize the development of old-growth attributes.

Station scientists developed a synthesis of over 30 studies of vegetation, wildlife, and other topics in young stands. The

synthesis suggests ways that the development of old-growth characteristics can be accelerated as young stands grow. Retrospective analyses of the early stages of old-growth development indicate that some of these stands began with low stocking levels—much lower than in today’s plantations of the same age. The alternative futures of today’s dense plantations are being examined through various modeling studies and long-term, multidisciplinary silvicultural experiments. Although the field experiments are in early stages, at this point some evidence indicates that thinning may encourage the development of old-

growth forest characteristics, such as large live and dead trees and multistory stands with shade-tolerant tree species.

Accelerating the development of old-growth characteristics: Andrew Carey, acarey@fs.fed.us, Ecosystem Processes Program

**STATION PRODUCTS COMMUNICATE SCIENTIFIC KNOWLEDGE**

Scientists and communication staff at the Station are reaching out to more people than ever before. Our goal is to explain what we are learning and describe how information is relevant, particularly to people who make and influence decisions about land management.

The Station’s audiences include the scientific community, federal and state land managers, private land managers, Congressional delegations, state and local policymakers, tribal governments, non-profit groups, and interested people. We are also reaching out to children—elementary students, high school students, and city kids not as familiar with federal lands and natural resources.

Peer-reviewed publications are the foundation of Station products. Professional peers of the author examine an article for scientific merit, before publication. Once published, an article becomes part of the scientific literature that other scientists draw on, take in new directions, or challenge. All Station publications receive peer review.

*Synthesis suggests ways that the development of old-growth characteristics can be accelerated as young stands grow.*



## 2001: COMMUNICATION HIGHLIGHTS

The Station publishes information for broad, nonscientific audiences as well as scientists and technical experts. For example, in 1998, the Station began publishing *PNW Science Findings* to highlight research topics with implications for resource management. The newsletter-size publication is free and reader-friendly. Some issue titles this year were "Benefits of Hindsight: Reestablishing Fire on the Landscape," "Absorbing the Shock: Helping Communities When Change Erupts," and "Food for Fish, Food for Thought: Managing the Invisible Components of Streams."

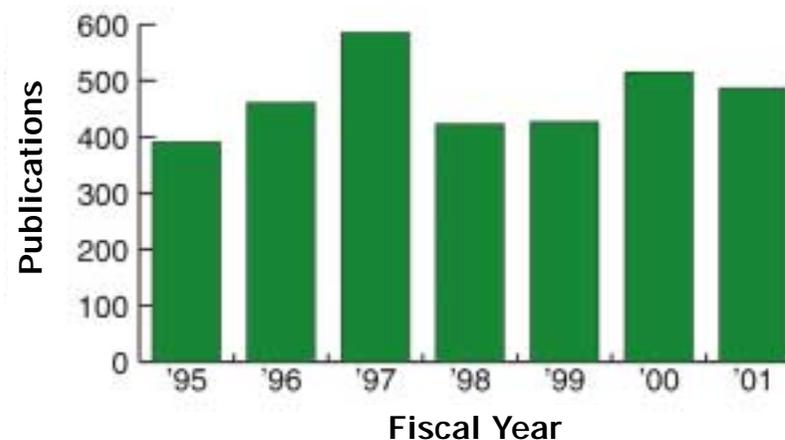
To receive *PNW Science Findings*, contact:  
PNW Research Station  
P.O. Box 3890,  
Portland, OR 97208-3890  
E-mail: [desmith@fs.fed.us](mailto:desmith@fs.fed.us);  
phone: 503-808-2127  
Web site: <http://www.fs.fed.us/pnw>

Production and distribution for 2001:

- 487 publications total
- 150,000 copies of Station series publications distributed in response to requests
- 8,000-12,000 journal article reprints distributed by scientists in response to requests

*The Station now places all new Station series publications online; soon journal articles also will be online. See [www.fs.fed.us/pnw](http://www.fs.fed.us/pnw) for a complete list of publications produced in 2001.*

## TOTAL PUBLICATIONS

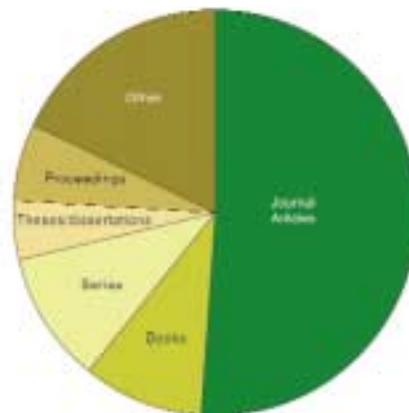


- 432 publications available online; all new Station publications are placed online
- 10 issues of *PNW Science Findings* published; about 10,000 copies distributed each issue
- 2 CD-ROMs

## ONLINE

Electronic publications and electronic information are becoming increasingly important. The Station now places all new publications online, generally as PDF (Portable Document Format) files. These publications can be accessed by going to the Station's Web site at <http://www.fs.fed.us/pnw>, clicking on one of the choices listed under "Publication Information," and selecting a publication to download. All available files are free of charge. The Station's Web site also provides updated information on research projects and personnel and their areas of expertise. It is part of a network that includes program, laboratory, and team pages, with links to the Web sites of partners. In fiscal year 2001, there were over 25,000 visits to our Web site.

## TYPES OF PUBLICATIONS



## 2001 TECHNOLOGY TRANSFER EVENTS

- 2,360 people participated in workshops and symposia
- 1,700 people went on field tours
- 1,500 people participated in conservation education

## SYMPOSIA AND WORKSHOPS

The following are just some of the technical and scientific events sponsored by the PNW Research Station with partners, including universities, colleges, and other federal agencies, during fiscal year 2001. Over 2,360 people participated in these events, including resource managers, landowners, policymakers, and interested citizens.

**Survey and manage salamander training workshops** — A total of 100 people attended the three workshops on the general ecology, management, and survey protocols of rare and uncommon plethodontid salamander species within the range of the Northwest Forest Plan. The workshops were held in Orleans, California; Wenatchee, Washington; and Mount Rainier, Washington. Biologists from the USDA Forest Service and USDI National Park Service and contractors attended.

**Young stand development workshop** — This half-day session, held in Eugene, Oregon, presented new science findings related to young stand development into forests with late-successional characteristics. The workshop was attended by 40 people, including agency silviculturists, biologists, and interested people.

**Community response to change along the Interstate 90 greenway** — Thirty people attended this Seattle, Washington, workshop. The workshop presented survey work completed along the I-90 greenway to a group of landscape architecture students and faculty, asking, "Can communities grow and still retain the values that make them special?"



**Bringing the community into the planning process** — This 3-day workshop on tribal integrated resource management planning was held in San Carlos, Arizona. The 80 participants learned together about how to involve community members in planning and conducting a community study. People shared stories of their experiences in working with community groups and building community capacity for involvement.

**International conference on restoring nutrients to salmonid ecosystems** — This conference, held in Eugene, Oregon, examined the values of salmon carcasses in aquatic ecosystems and the potential role of carcasses in restoration of salmon populations. A total of 380 people attended.

**Adaptive management area restoration workshop** — This workshop covered a wide range of approaches to watershed and road restoration. In Eugene, Oregon, the presenters discussed restoration at site-specific, watershed, and regional scales. The 210 participants included federal and state agency personnel, watershed council representatives, students, and interested people.

**Klamath Basin fish and water management symposium** — This symposium, held in Arcata, California, aimed to increase local and national understanding of the Klamath River Basin's biological,

*Over 2,360 people attended symposia and workshops, including resource managers, landowners, policymakers, and interested citizens.*

*When people visit research sites in forests, they often get a particularly clear understanding of scientific concepts.*

legal, and social environment and to enhance cooperation and collaboration among policymakers, management agencies, and local communities. It was attended by 450 resource professionals, educators, and interested people.

**Developing an integrated and adaptive management approach for addressing fire and fuels issues in dry forests of eastern Washington** — This workshop brought together 200 researchers and managers from the interior Pacific Northwest and Canada, in Wenatchee, Washington. The participants discussed past and current fire and fuels projects and worked at building a science-management partnership to go forward.

#### TOURS

When people visit research sites in forests, they often get a particularly clear understanding of scientific concepts, new findings, and key issues facing resource managers and society. The Station scientists try to meet the great demand for field trips in the forests where the research is done. In 2001 about 1,700 people attended Station tours. Some of these tours are listed below.

**Capitol Forest tours** — In the past year, the Westside Silviculture Team hosted eight tours, with a total of 225 people, to the first replication of the silvicultural

options study, in the Capitol Forest near Olympia, Washington.

**H.J. Andrews Experimental Forest tours and workshops** — Over 25 tours and workshops were conducted at the H.J. Andrews Experimental Forest in Blue River, Oregon, on ecosystem research and stand and landscape management. A total of 1,000 people attended.



**Density management studies tours** — These tours showed alternative silvicultural treatments and riparian buffer widths in 30- to 50-year-old managed forest stands and reported research findings on multiple resource production. A total of 63 people from federal agencies

went on the three tours, held at various locations near Mount Hood, Eugene, and Coos Bay, Oregon.

**First international precision forestry symposium** — Scientists from many countries presented papers at the University of Washington in Seattle, showing how advanced technologies are being adapted to allow forest operations to be planned, implemented, and monitored more effectively. The symposium field tour featured presentations by Station researchers that showed how remote sensing, global positioning systems, computer visualization, and automated data-logging systems are being used in forest research. A total of 94 people who are not Station employees attended.

**Annual levels-of-growing-stock (LOGS) tour** — The annual LOGS tour was hosted by the Westside Silviculture Team and was attended by people from Oregon, Washington, British Columbia, and Alaska. Held in the Forks, Washington area, the tour took the 30 participants to Station-maintained research sites and other research sites for western hemlock, western redcedar, red alder, and Douglas-fir.

**Young stand thinning and diversity study field tours** — Held on the Middle Fork Ranger District, Willamette National Forest, these field tours took a

total of 165 people to all four treatments in the young stand thinning and diversity study, showing results of third-year post-treatment measurements.

**Fall River long-term site productivity study (LTSP) tours** — Four tours had a total of 65 participants, including university administrators and faculty from the University of Washington and from other parts of the country, members of the Western Forest and Paper Association and Washington Forest and Conservation Association, and USDA Forest Service and Weyerhaeuser Company scientists and administrators.



*Inner City Youth Camp. Station employees teach young people about science careers.*

## CONSERVATION EDUCATION

Kids are naturally interested in science—when it is hands-on. If they get a chance to have fun with science, they may stay interested in it for a lifetime. Many adults are interested in science but have

not had the chance to read publications. Last year over 1,500 people participated in conservation education projects that the Station helped support. The highlights of these projects are described below.

- **Forest Camp Outdoor School** — Scientists from the Corvallis Forestry Sciences Laboratory participated in this program, which provides environmental education to sixth grade students. The camp was an intensive 5-day, 4-night hands-on experience where 160 students learned about natural resources.
- **Inner City Youth Institute** — This project encourages young people to learn about the environment and related careers. Station employees reach out to groups who have not traditionally been as involved with natural resource management. Last year the employees helped to establish ecology clubs in inner city schools, made presentations at schools, and helped at the summer Inner City Youth Camp in Corvallis.
- **Portland Urban Tree House** — The PNW Research Station helped to revitalize the Urban Tree House in Portland. The program's goal is to expand conservation education programs for minority youth and to build relations with inner-city communities. The Station contributed funds for supplies and equipment to the Urban Tree House. With these funds, the program was able to sponsor week-long summer camp sessions that provided 100 inner city youths with conservation education (Alberta Nature Team). This is a collaborative effort with Oregon State University and the Audubon Society of Portland, Oregon.
- **Lincoln Tree Farm Natural Resource Program** — Staff from the Seattle Laboratory helped in the Lincoln Tree Farm Natural Resource Program, sponsored by the Tacoma School District. The program for elementary and middle school students takes place on a 400-acre site.
- **Nature talks** — In this popular series of summer talks, various scientists give presentations at Forest Service campgrounds on the McKenzie River Ranger District, Willamette National Forest. The talks are about research projects on the nearby H.J. Andrews Experimental Forest. Last year about 500 people attended the talks over the summer.
- **Wolfree** — Station employees participated in ecology programs with Portland and Vancouver area middle and high schools. About 100 students were involved. The Station also contributed funds for supplies and equipment.



*Kids are  
naturally interested  
in science—  
when it is hands-on.*



## Honors and Awards

### FULBRIGHT SCHOLAR

Given by the J. William Fulbright Program

Recipient: **Ching-Yan Li**, research microbiologist, was named a Fulbright Scholar for the 2001-2002 academic year. Li used the 3-month grant to conduct research at the Department of Microbiology at Nicholas Copernicus University in Turan, Poland.

### SUMMIT AWARD

Given by the Pacific Peaks Girl Scout Council

Recipient: The **employees of the Olympia Forestry Sciences Laboratory** received this award for 10 years of involving girls in science through the Water Detective program and other projects. Station Program Manager **Deanna Stouder** coordinated the Water Detective program along with **Keith Aubry**, **Dean DeBell** (retired), **Cathy Raley**, **Connie Harrington**, **Mary Jane Bergener**, and others.

### FOREST SCIENCE AWARD

Given by the Society of American Foresters

Recipient: **Richard W. Haynes**, Program Manager, earned this award for distinguished research leading to the advancement of forestry. He was recognized for his leadership in the development of bioeconomic models used to assess forestry conditions at the local, regional, and national levels.

### USDA SECRETARY HONOR AWARD

Given by the USDA Secretary

Recipient: **Tom Quigley**, Program Manager, earned the Secretary's Award in the category, "maintaining and enhancing the nation's natural resources and environment," for his work in leading the Interior Columbia Basin Ecosystem Management Project. The 10-year project examined land management effects on 144 million acres across seven Western states. He was cited for leading the development of science underpinning the management of the Columbia basin natural resources, enabling an informed debate about fish, riparian, old-growth, and forest health issues.

### CHIEF'S SUPERIOR SCIENCE AWARD

Given by the Forest Service Chief

Recipient: **Marty Raphael**, a science team leader, for sustained contributions in wildlife research and its application to critical land management issues in the Pacific Northwest. This award recognizes the creative efforts and contributions of the USDA Forest Service Research and Development scientists.

### CHIEF'S MULTICULTURAL ORGANIZATION AWARD

Given by the Forest Service Chief

Recipient: **Marty Santiago**, Director of Station operations, for outstanding contributions to achieve a multicultural organization. She was recognized for many actions including supporting and nurturing new employees, assisting the Station in achieving a diverse workforce, and initiating innovative recruitment and retention activities.

#### CHIEF'S RETIREE VOLUNTEER SERVICE AWARD

Given by the Forest Service Chief

Recipients: **Robert Curtis** and **William Stein**, Emeritus Scientists; Don Gedney, retired research forester. Curtis was cited for providing historical perspective on current forest resource issues and helping to establish new research trials to develop silvicultural options. Stein was recognized for completing research on long-term regeneration and site preparation studies in the Oregon Coast Range.

#### RISE TO THE FUTURE—GROUP RESEARCH ACHIEVEMENT

Given by the Washington Office, USDA Forest Service

Recipients: **Gordon H. Reeves**, research fishery biologist; **Mark S. Wipfli**, research aquatic ecologist; and **Maria Lang**, bioscience technician. These three people were cited for their special contribution to aquatic resource protection and restoration and exceptional accomplishment on the Copper River delta nutrient study.

#### 2000 ALASKA REGION SILVICULTURIST OF THE YEAR AWARD

Given by the Alaska Region,  
USDA Forest Service

Recipient: **Mike McClellan**, a research ecologist, for his leadership and innovation in the field of silviculture. He is only the second research scientist to be honored with this award. As team leader for silviculture and ecology in southeast Alaska, McClellan initiated and contributed to research projects such as the alternatives to clearcutting study, young-growth wood quality, commercial thinning, data analysis for the second-growth management program, and many others. McClellan was also instrumental in organizing sessions of the Alaska Region resources workshop held in Sitka in April 2000.

#### OUTSTANDING CUSTOMER SERVICE AWARD

Given by the Pacific Northwest Research Station

Recipients: **Ralph Alig**, a research forester, and **Jamie Barbour**, a research forest products technologist, for consistently responding to research requests from the public and fellow employees; **Ilean Butler**, **Lynn Black**, and **Glenda Kuhn** for providing reprints of publications on request; **Janet Jones** for maintaining Web pages; and **Lynn Starr** for representing the Station and the La Grande Forest and Range Sciences Laboratory at client meetings.



# Finances and Workforce

The PNW Research Station is supported by two funding sources. The largest part of our funding comes from federal appropriations. Our other funding source is direct client support, which comes from various organizations needing scientific information.

## 2001: PNW Research Station Finances and Workforce, by the Numbers

Fiscal year 2001: October 1, 2000, to September 30, 2001

### FUNDING SOURCES

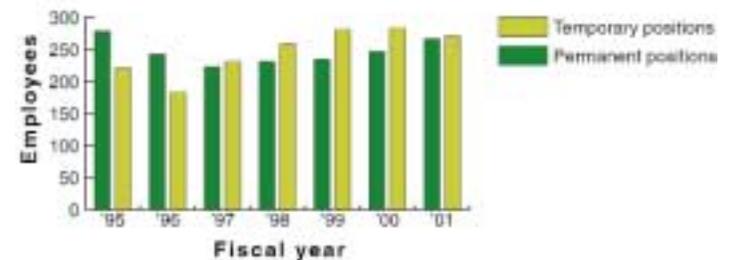
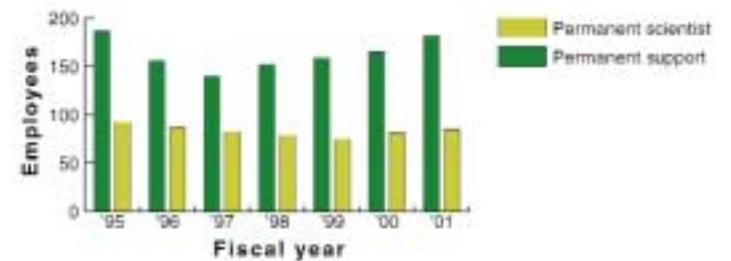
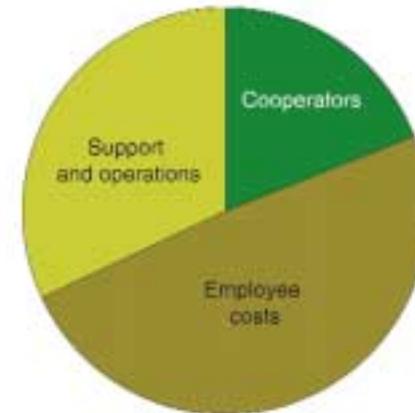
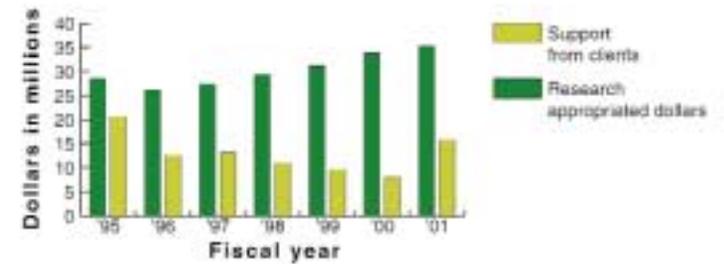
- Federal appropriations .....\$35.3 million
- Direct client support .....\$15.8 million
- Total funding .....\$51.1 million

### DISTRIBUTION OF FUNDS

- Employee costs .....49 percent
- Support and operations .....32 percent
- Distributed to cooperators .....19 percent
- Of \$9.2 million that went to cooperators, 95 percent went to educational institutions

### WORKFORCE STATISTICS

- Permanent workforce .....266 employees
- Scientists .....32 percent of the permanent workforce
- Temporary workforce .....270 employees
- Station total workforce.....536 employees



## *Cooperators Who Receive Funding for Studies from PNW Research Station*

In 2001, the Pacific Northwest Research Station distributed about \$9.2 million to its cooperators.

### EDUCATIONAL INSTITUTIONS

Auburn University  
California State University, Chico  
Colorado State University  
Earth Systems Institute  
Eastern Oregon University  
Humboldt State University Foundation  
Iowa State University  
Michigan State University  
Oregon State University  
Portland State University  
Purdue University  
San Diego State University  
University of Alaska, Fairbanks  
University of Alaska Southeast, Sitka  
University of Arizona  
University of California Berkeley  
University of Georgia  
University of Idaho  
University of Leeds, United Kingdom  
University of Massachusetts  
University of Montana  
University of New Mexico  
University of Oregon  
University of Tennessee  
University of Washington  
University of Wisconsin  
University of Wyoming  
Utah State University  
Washington State University



### OTHER FEDERAL AGENCIES

National Park Service  
U.S. Department of Energy  
U.S. Department of Agriculture, Foreign  
Agriculture Service  
U.S. Department of Agriculture,  
National Wildlife Research Center  
U.S. Department of the Interior, Bureau  
of Land Management  
U.S. Geological Survey, FRESC

### NONGOVERNMENT ORGANIZATION

Wildlife Conservation Society

### PRIVATE INDUSTRY

The Alaska Manufacturers Association



## *Clients Who Provide Funding for Studies to PNW Research Station*

In 2001, the PNW Research Station received about \$2.2 million in support from clients other than the National Forest System and State and Private Forestry.

### OTHER FEDERAL AGENCIES

Bonneville Power Administration  
Bureau of Land Management  
Environmental Protection Agency  
National Aeronautics and Space Administration  
U.S. Department of Defense  
U.S. Department of the Interior  
U.S. Fish and Wildlife Service  
U.S. Geological Survey

### PRIVATE INDUSTRY

Boise Cascade Corporation  
Columbia Basin Fish and Wildlife Foundation  
Northwest Power Planning Council  
Simpson Timber Company  
Western Forestry and Conservation Association  
Weyerhaeuser Company

### STATE AGENCIES

Oregon Department of Fish and Wildlife  
Washington Department of Natural Resources  
Washington Department of Transportation

### UNIVERSITIES

Oregon State University  
University of Alaska, Fairbanks



# Research Programs

## AQUATIC AND LAND INTERACTIONS (ALI PNW-4261)

### Program Manager:

Deanna Stouder  
Olympia Forestry Sciences Laboratory  
3625-93d Ave. SW  
Olympia, WA 98512  
Phone: 360-753-7652  
E-Mail: dstouder@fs.fed.us

## ECOSYSTEM PROCESSES (EP) PNW-4362

### Program Manager:

John Laurence  
Corvallis Forestry Sciences Laboratory  
3200 SW Jefferson Way  
Corvallis, OR 97331  
Phone: 541-750-7357  
E-Mail: jalaurence@fs.fed.us

## FOCUSED SCIENCE DELIVERY PROGRAM

### Program Manager:

Jane Hayes (Acting)  
La Grande Forestry & Range Sciences Lab  
1401 Gekeler Lane  
La Grande, OR 97850  
Phone: 541-962-6549  
E-Mail: jlhayes@fs.fed.us

## FOREST INVENTORY AND ANALYSIS (FIA) (PNW-4869)

### Program Manager:

Sue Willits  
Portland Forestry Sciences Laboratory  
P.O. Box 3890  
Portland, OR 97208-3890  
Phone: 503-808-2066  
E-Mail: swillits@fs.fed.us

## HUMAN AND NATURAL RESOURCES INTERACTION PROGRAM (PNW-4865)

### Program Manager:

Richard Haynes  
Portland Forestry Sciences Laboratory  
P.O. Box 3890  
Portland, OR 97208-3890  
Phone: 503-808-2002  
E-Mail: rhaynes@fs.fed.us

## MANAGING DISTURBANCE REGIMES (MDR) (PNW-4577)

### Program Manager:

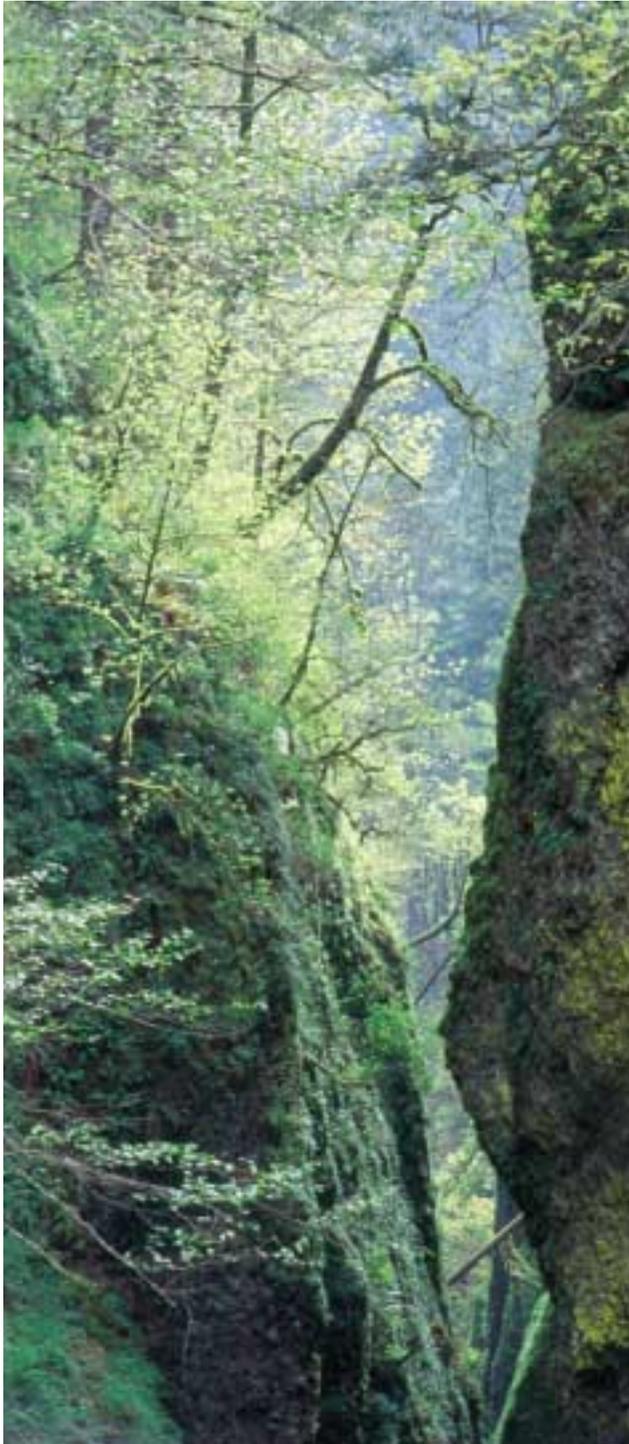
Ed DePuit (Acting)  
Wenatchee Forestry Sciences Laboratory  
1133 N. Western Avenue  
Wenatchee, WA 98801  
Phone: 509-662-4315 Ex. 222  
E-Mail: ejdepuite@fs.fed.us

## RESOURCE MANAGEMENT AND PRODUCTIVITY (RMP) PNW-4163

### Program Manager:

Charley Peterson  
Portland Forestry Sciences Laboratory  
P.O. Box 3890  
Portland, OR 97208-3890  
Phone: 503-808-2026  
E-Mail: cepeterson@fs.fed.us





If you are interested in more information about the PNW Research Station, would like to receive copies of publications, software, or videos mentioned in this report, or would like to receive a quarterly list of publications written by Station scientists, please contact:

**Cynthia L. Miner**  
**Communications Director**  
Pacific Northwest Research Station  
P.O. Box 3890  
Portland, OR 97208-3890  
(503) 808-2135  
clminer@fs.fed.us

or

browse PNW Research Station on the Web at:  
<http://www.fs.fed.us/pnw>

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*Credits:*

*Writers - Valerie Rapp and Carolyn Wilson*

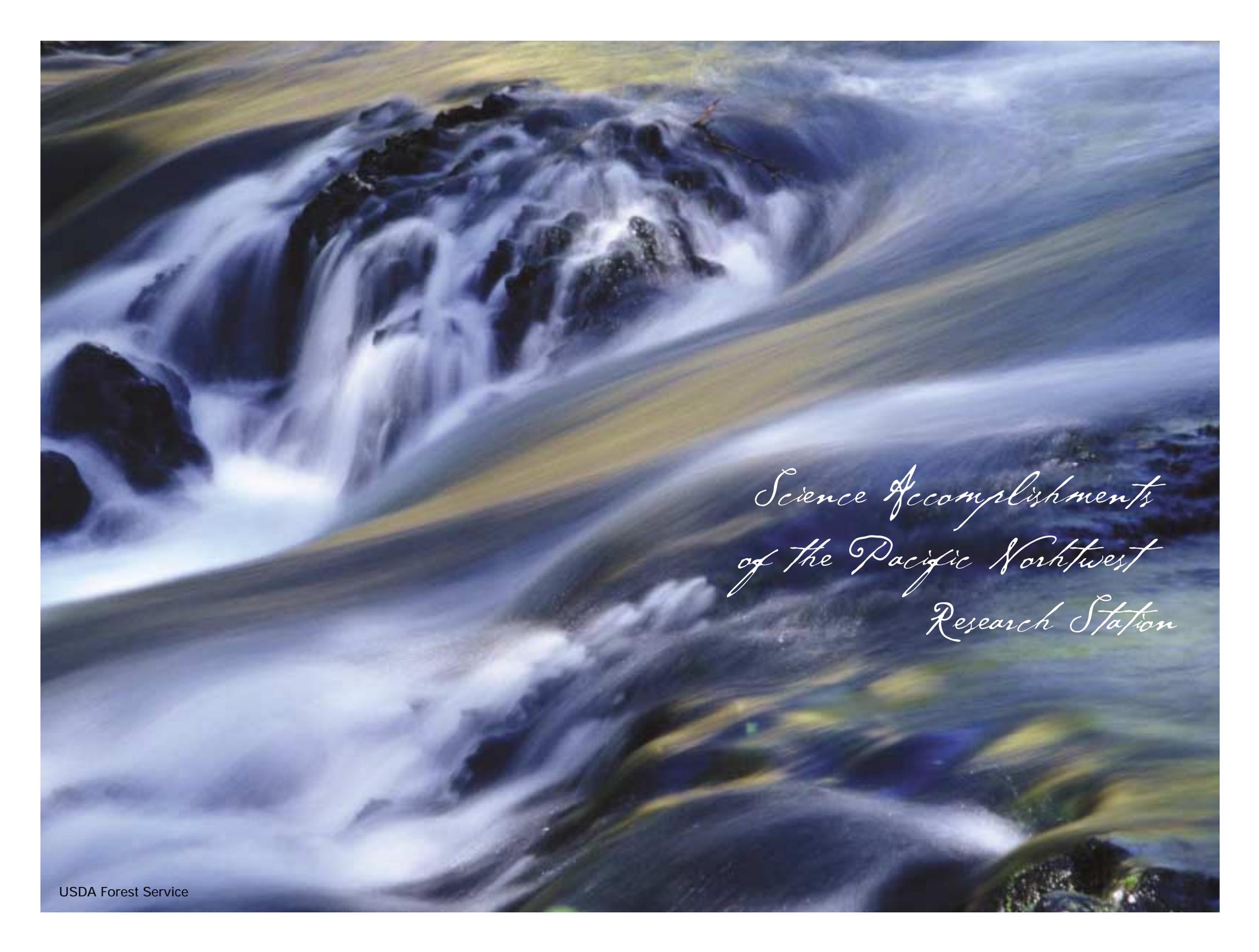
*Editors - Carolyn Wilson and Lynn Starr*

*Design and Layout - Nancy Doerrfeld-Smith*

*Art direction and production - Frank Vanni*

*Photographs - credits with photos*

*All unaccredited photos - USDA Forest Service, Tom Iraci, Bob Szaro, or other Forest Service staff*

A long-exposure photograph of a waterfall, likely in a forested area. The water is blurred into a smooth, white, cascading flow, creating a sense of motion. A vibrant rainbow is visible in the mist created by the falling water, arching across the scene. The surrounding environment is dark and lush, with green foliage and rocks visible in the background and foreground. The overall mood is serene and natural.

*Science Accomplishments  
of the Pacific Northwest  
Research Station*