Ecosystem Processes Program Report

Pacific Northwest Research Station Mission

Our mission is to generate and communicate scientific knowledge that helps people understand and make informed choices about people, natural resources, and the environment.

Program Mission

Our mission is to improve knowledge about ecosystem processes at multiple scales for the forests of the Pacific Northwest, the Nation, and the globe and to develop approaches for applying this knowledge to protect, use, and enhance forest resources for present and future generations.

Research Problem Statements

Problem 1: Biophysical controls on forest landscapes and ecosystems.
Problem 2: Sustainable ecosystem productivity research.
Problem 3: Ecological foundations of biodiversity and the management and conservation of sensitive wildlife species.
Problem 4: Ecological aspects of adaptive and ecosystem management.

Science Accomplishments and Products in 2004

To fulfill our mission, the Pacific Northwest Research Station has developed four goals that guide our integrated programs of research, development, and application. These four goals focus on developing a fundamental understanding of systems, assessing status and trends, developing options and alternatives for management, and applying and communicating our science findings.

The Ecosystem Processes Program is proud to report the following goal accomplishments and products in fiscal year 2004.

Key Findings and Accomplishments

Management system developed for creating multiple-value forests
Society increasingly demands diverse values from all forests of the region, including ecological services, economic products, and aesthetic forests and landscapes. But retaining old trees or conventional thinning alone fail to produce the biodiversity and complexity needed to supply all these values. Scientists developed Active Intentional Management (AIM) for Multiple Values, an integrated system of management techniques for producing forests that provide diverse values. The

AIM system manages a forest's multiple ecological processes, by using techniques such as retention of mature trees, management of multiple tree species and dead and dying trees, and variable-density thinning, which involves varying the intensity of thinning in patches within stands across the landscape. Data show that AIM has demonstrated potential for producing forests that provide diverse values simultaneously.

Recently the Washington State Department of Natural Resources chose AIM as the preferred alternative for management of 2 million acres of Washington state forest lands. The AIM system is also being used in a number of Forest Service timber sales and in management of a community forest on Vashon Island, Washington.

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Timing of prescribed burns makes a difference

Prescribed fire is a major tool used to reduce the risk of catastrophic wildfire in low- and mid-elevation ponderosa pine forests in the Blue Mountains of eastern Oregon and Washington. These prescribed burns have the potential to affect more than just the accumulation of understory growth they are aimed at eliminating, however. Belowground processes and microbial communities may also be affected. Ponderosa pine, the dominant tree species of the Blue Mountains region, relies on ectomycorrhizal, or root-dwelling, fungi for nutrient uptake and resistance to drought stress. Although the important obligate role of these ectomycorrhizal fungi is known, much remains unknown about fungal community structure and their response to fire.

Scientists studied the effect of underburning in fall, when fires historically occurred in the region, and in spring, when most prescribed burns currently occur, on belowground root biomass and ectomycorrhizal fungi. They found that fall underburning significantly reduced live root biomass and species richness of ectomycorrhizal fungi compared to spring underburning. The scientists also found that fall underburns killed live roots to a depth of 4 inches and significantly reduced species richness of ectomycorrhizal fungi for at least 2 years. Forest managers can balance this information with other factors they consider when planning prescribed burns.

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More information: Science Findings 66, September 2004. *Dead wood, living legacies: habitat for a host of fungi*. www.fs.fed.us/pnw/sciencef/scifi66.pdf.

Demographic studies indicate northern spotted owl declining in some areas

Scientists summarized data from 14 long-term northern spotted owl demography studies in Oregon, Washington, and California during the period 1985-2003 and found that populations in 8 areas are declining, populations in 4 areas are stable, and the population in 1 area was probably declining. One area had insufficient data to estimate population growth rate. The estimated average rate of decline on eight federally managed areas was 2.5 percent per year, compared to 6.6 percent a year on the other study areas. Population declines were greatest in Washington.

Results from the studies indicate that population declines are likely the result of a number of factors including loss of habitat on nonfederal lands and habitat damage from fire, insects, and pathogens. Scientists believe the decline in spotted owl populations may also be due to competition with barred owls, a more aggressive species. As one test of this hypothesis, scientists completed genetic studies of hybridization between spotted and barred owls.

These findings, which are the result of a 10-year review on the status and trends of the spotted owl, are used by federal agencies to determine the status of the northern spotted owl and to evaluate factors that influence the owl population.

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Partners: USDI Geological Survey, USDI National Park Service, USDI Bureau of Land Management, National Council for Air and Stream Improvement, Oregon State University, Colorado State University, Simon Frasier University, Hoopa Tribal Forestry, University of Minnesota

Tree diameters may help predict murrelet nest sites

Marbled murrelets are small seabirds that spend time in both marine and terrestrial ecosystems—they forage in coastal waters and nest inland on the branches of large coniferous trees in the Pacific Northwest. Federally listed as a threatened species, the marbled murrelet is a species whose conservation is an important part of the Northwest Forest Plan.

Platforms, defined as limbs greater than 4 inches in diameter covered with moss or infected by mistletoe, or as larger bare limbs, are one factor critical to defining suitable nesting habitat. However, data on these nesting platforms are not

typically gathered as part of ongoing forest inventories. Because of the lack of data on platforms, scientists used tree diameter and species to predict the abundance of platforms in forests in Washington. After counting platforms and measuring the diameter of more than 13,000 trees in 68 study plots, scientists performed a statistical analysis that found a very strong correlation between tree diameter and the occurrence of platforms, a relationship that differed among tree species. Among all species surveyed in the Washington forests, trees with diameters greater than 40 inches had a 50-percent or greater likelihood of having platforms. These findings suggest that commonly measured stand attributes—in this case, tree diameter—may be used to predict potential suitability of marbled murrelet nesting habitat.

Results of this work provide scientific support for defining a threshold of tree diameter that can be used to define potential murrelet nesting habitat and have been critical in developing maps of potential habitat in support of the Northwest Forest Plan effectiveness monitoring program.

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New maps lend insight into biodiversity patterns and causes

Conservation of biodiversity is an important forest policy issue and management objective for many individual forests across the region. The patterns and causes of biodiversity in any given forest differ depending on the individual landscape. Scientists used new, highly detailed maps of forest vegetation in coastal Oregon to examine biodiversity patterns and their causes. They found that gradients in tree species composition were strongly linked to environmental factors, especially climate, and were insensitive to disturbance, such as timber harvesting, fire, and disease. Forest structure, however, was found to be strongly linked with the history of disturbance and land ownership and only weakly linked with environment. The detailed tree-, stand-, and species-level data in the maps revealed regional trends that would be masked in a coarse-filter assessment.

Findings suggest that regional conservation planning include all ownerships and land allocations, as well as fine-scale elements of vegetation composition and structure. These detailed vegetation maps are used as input to models that simulate future landscape conditions to evaluate effects of silvicultural treatments and forest policies on vegetation, aquatic, wildlife, biodiversity, and commodity values.

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Invasive species may affect flood-plain wildlife habitat

Alaska's glacial rivers are dynamic, with frequent changes in water level and river course. Flood plains are constantly in flux, and recently deposited surfaces have been found to be susceptible to invasion by certain exotic plant species. These sites are often highly productive with lush plant growth, which makes them prime habitat for moose, an ecologically and economically important species in the state.

Such flood-plain surfaces are often dominated by willows, an important browse species for moose. In interior Alaska, for example, the Tanana Flats support more than 15,000 animals, or more than 3 moose per square mile. The willow stands along the Tanana River provide critical winter forage for this population. However, in a survey of flood-plain plant species composition, scientists found sweetclover, an invasive flowering plant belonging to the pea family, invading the flood plains of three Alaskan rivers, moving from south to north. Sweetclover has come to dominate the lower reaches of the Stikine River, in southeast Alaska; is a major component of portions of the Matanuska River flood plain, in south-central Alaska; and has been detected in small amounts on the flood plain of the Nenana River, in interior Alaska. Although sweetclover has not yet been found on the flood plains of the Tanana or Yukon Rivers, it is common along roadsides that cross or are adjacent to those habitats. As sweetclover invades and establishes itself on the flood-plains of Alaska's major river systems, significant changes in critical moose habitat may occur. Because of concerns that sweetclover may replace native flood-plain species, research has begun to examine competitive interactions between sweetclover and willows to better understand potential effects on native plants, wildlife forage, and habitat quality.

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Book traces history and mystery of the Deschutes River

Central Oregon's Deschutes River is unusual as far as rivers normally go: its flow is very stable, it produces astonishingly low levels of sediment, and it is shaped by extremely large floods. In a book recently published by the American Geophysical Union, scientists synthesized a wide range of scientific studies conducted as part of the relicensing of three large hydropower dams on the river to provide an integrated view of how large river basins function and how human impacts, such as dams, are intimately tied to the intrinsic properties of the landscape.

With chapters focusing on aspects of the geology, geomorphology, hydrology, and ecology of the river basin as well as the effects of dams, the book provides a model for integrated watershed assessments. Findings from the studies described in the book were used by the Federal Energy Regulatory Commission, along with power utility, tribal, and agency scientists and managers, in reaching a settlement agreement for the Pelton-Round Butte dams and were cited as key factors resulting in an unusually successful and historic multiparty relicensing agreement.

Contact: Gordon Grant, ggrant@fs.fed.us, Ecosystem Processes Program (Citation: **A Peculiar River: Geology, Geomorphology, and Hydrology of the Deschutes River, Oregon.** Water Science and Application series, #7, American Geophysical Union, Washington, DC. 219 p.)
Partners: USDI Geological Survey, Portland General Electric, Oregon State University

Murrelet group size at sea may be a gauge of productivity

Marbled murrelets are fast-flying seabirds that divide their time between foraging in coastal marine waters and nesting inland in large coniferous trees. During the nesting period, both parents take turns incubating their single egg, switching duties every 24 hours. Thus on any given day during incubation, one member of a breeding pair is alone on the water while the other is sitting on the nest. Because of the birds' unusual nesting behavior, scientists have not been able to estimate from marine surveys alone what proportion of the murrelet population is actually nesting inland in any given year, an important productivity measure for this threatened species.

Scientists tested a new technique for estimating murrelet nesting activity by using marine surveys. Based on studies with murrelets that were radio-tagged, scientists found that nesting birds were significantly more likely to be solitary while on the water than were nonnesting birds. By counting numbers of single birds versus paired birds, as determined by boat surveys, scientists created an index of productivity found to be successful in 4 out of 5 years tested (1997 to 2001). This finding may lead to a tool that managers can use to assess murrelet reproductive status from data routinely collected during ocean surveys.

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Gravity affects height growth rate of large trees

The height of trees in a stand is one factor used by silviculturists to determine the quality of a site, but very little is actually known about the underlying processes that influence height growth patterns. Research at the Wind River Canopy Crane Research Facility in Washington and other locations showed that gravity plays a major role in limiting the height of trees. Gravity's force makes it difficult for taller trees to transport water to their uppermost leaves and branches and also reduces the turgidity, or internal pressure, of individual plant cells, which ultimately decreases leaf and stem expansion and the emergence of buds. Collectively, these effects translate into increasingly slower growth rates as trees grow taller.

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Partners: Oregon State University, University of Washington

Small-diameter down wood is important foraging habitat for pileated woodpecker

The pileated woodpecker is a large, striking red-crested species that requires live and dead trees with heartwood decay for nesting and roosting, as well as standing dead and downed wood for foraging. The woodpecker's foraging and cavity excavation provide many ecological benefits, including habitat for other cavity-using species. But the pileated woodpecker, a keystone species, is also a species of special concern because of its habitat requirements.

Work on the Sun Pass State Forest in southern Oregon has yielded new findings on the pileated woodpecker's foraging ecology. Scientists found that during the snow-free months, pileated woodpeckers foraged in small-diameter down wood (9 inches at the large end) not only in large-diameter wood. They also found that the prey species in this wood is more often large wood-boring beetle larvae, not carpenter ants as had been thought previously. These findings can help refine management guidelines for pileated woodpecker habitat on the Sun Pass State Forest, also benefiting the many other species that use woodpecker-created cavities.

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Other Accomplishments and Products

Scaling of water use with tree size is not universal

A recent hypothesis asserts that as trees undergo dramatic increases in size from seedlings to large trees, their use of water and other resources increases in a

universal manner for all species. However, using research conducted at the Wind River Experimental Forest in southwest Washington and other sites, scientists found that the changes in water use in relation to tree size, or scaling, were universal only among 17 flowering tree species, but differed from that of five Pacific Northwest conifer species. Water use scaled consistently with tree size within certain groups of conifers, but not others. Moreover, the type of scaling model obtained for both conifers and flowering trees was fundamentally different from that proposed in the universal scaling hypothesis.

This information is important to forest ecologists, hydrologists, and those involved in the management of watersheds, where the effect of tree size and species composition on water yield are of concern.

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Scientists apply widely used model to evaluate dead wood components

Models are important to land managers and scientists for many reasons, including their ability to predict and display the possible future result of forest treatments and prescriptions from individual tree to landscape scales. One projection model, known as Zelig, models individual tree-level growth and yield. The model also has the capacity to generate dead wood (snags and logs) from live trees, thus allowing it to simulate silvicultural practices that create or retain dead wood during management activities. Scientists adapted model routines to address a variety of thinning, harvest, dead wood, and green tree retention management scenarios that were developed in conjunction with major landowners of the coastal province in Oregon.

Beginning in fall 2004, the revised version of Zelig will be used by the Coastal Landscape Analysis and Modeling Study (CLAMS), which is producing a set of tools that will help assess sustainability of different forest and land use policies through time.

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More information: General Technical Report PNW-GTR-557, 2003. *Accelerating Development of Late-Successional Conditions in Young Managed Douglas-Fir Stands: A Simulation Study*. www.fs.fed.us/pnw/pubs/gtr557.

Northern spotted owls prefer nocturnal arboreal rodents

Scientists summarized 30 years of northern spotted owl diet data based on a sample of 24,497 prey items collected from 1,118 owl territories in Oregon—the longest and largest data set ever collected on diets of spotted owls, which are listed as threatened under the Endangered Species Act. The vast majority of species preyed upon by spotted owls, which numbered at least 131, were mammals. On average, the majority of species taken were nocturnal arboreal mammals. Although northern spotted owl diets tended to differ among owl territories, geographic regions, and years, they generally were dominated by northern flying squirrels, woodrats, red tree voles, western red-backed voles, deer mice, and gophers. These findings suggest that management practices that promote healthy populations of these species should benefit northern spotted owls in Oregon and Washington. This study serves as a reference to management agencies for regional variation of diets of the northern spotted owl in Oregon.

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Partners: USDI Geological Survey, USDI Bureau of Land Management, Oregon State University

Statistical models can help predict soil compaction

Some activities associated with thinning and harvest have the potential to disrupt forest soils. The movement of logging trucks and mechanical removal of logs are examples. Whereas soil erosion may seem to be the primary concern, soil compaction is also of interest, as compacted soils may have detrimental effects on future tree growth and survival. To help anticipate and prevent compaction, soils traditionally have been classified based on their risk of being compacted by using probes, which measure the physical potential for compaction by gauging the energy required to penetrate the soils. Now, scientists have developed a new method, in cooperation with Weyerhaeuser, that has a statistical, quantitative basis.

Using a database of example soils from Forest Service and Weyerhaeuser lands, scientists are developing a statistical prediction model of soil compaction risk level. The model is based on a combination of statistical analyses and expert experience and is being integrated into spreadsheets that suggest potential compaction risk levels of unclassified soils. Tools being used in this analysis include rule-induction modeling, classification trees, discriminant function analysis, and other approaches.

Results obtained from the research will be used to classify risk levels of soils on Weyerhaeuser lands in western Oregon and may be used to help evaluate soil compaction risk on Forest Service lands in the region.

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Region's conifers opportunistically acquire water in summer

Although the Pacific Northwest is well known for its generous rainfall, forests in the region experience severe droughts in summer. Research conducted at the Wind River Experimental Forest in southwest Washington has shown that conifers in the region's forests are structurally adapted to maintain relatively stable water uptake rates throughout summer, despite the shortage of rainfall. Scientists found that the conifers have deep roots that allow the trees to access water stored in deeper soil layers as the upper portion of the soil dries during summer months. In an old-growth Douglas-fir stand, scientists found that, at the beginning of summer, more than 60 percent of the water taken up by trees comes from the upper 1.5 feet of soil. But, by the end of summer, only about 20 percent of the water acquired comes from this layer, yet the trees are still using considerable amounts of water.

Many current models of forest ecosystem behavior fail to acknowledge the role of deep roots in water acquisition; these findings will contribute to formulating new, more accurate models of forest behavior during droughts and have implications for hydrological models that predict the seasonal behavior of forested watersheds.

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Western hemlock adjusts water balance during dwarf-mistletoe infection

Dwarf mistletoe, by some estimates, is the single most destructive pathogen of commercially valuable conifers in many regions of the world. A flowering parasitic plant that grows on conifer branches, dwarf mistletoe has a "root" system that penetrates the bark and sapwood of its hosts, affecting tree growth and wood quality and, in severe infestations, killing trees. Dwarf mistletoe's sticky seeds are powerfully discharged from ripe fruits and may be carried over long distances by birds and mammals to other host trees.

Although dwarf mistletoe's detrimental effects on trees are well-known, its effects on tree physiology are not as well understood. Scientists examined water and carbon relations in infected and uninfected old-growth western hemlock forests on the Wind River Experimental Forest in southwest Washington. They found that

the penetrating “root” system of dwarf mistletoe reduces the movement of water in branches, but adjustments in the whole-tree water transport system compensate by stabilizing water relations at the leaf level. At the whole-tree level, heavily infected trees used 40 percent less water than uninfected trees, and their photosynthesis was reduced by up to 60 percent. These findings suggest that although western hemlock is able to adjust its water balance to compensate for dwarf mistletoe infection, it cannot do the same with its photosynthesis rate. Understanding of these tree-level processes contributes to a better understanding of water and carbon cycles in entire forests.

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Surveys reveal relative stability of marbled murrelet populations

Scientists completed development of the first population survey protocol for the marbled murrelet in 2000. Since then scientists have been using the protocol to monitor murrelet populations in the Puget Sound region. Data indicate a relatively stable population of marbled murrelets, averaging about 8,000 birds, over the past 4 years. This finding was critical to a recent U.S. Fish and Wildlife Service status review of the marbled murrelet, a species listed as federally “threatened.”

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Partners: USDI Fish and Wildlife Service; USDI Bureau of Land Management; Washington Department of Natural Resources; Washington Department of Fish and Wildlife; USDA Forest Service, National Forest System

Scientists help design Biscuit Fire recovery experiment

In 2002, the Biscuit Fire burned nearly half a million acres in southwestern Oregon, making it the largest wildfire in the state’s recorded history. Scientists assisted managers on the Rogue River-Siskiyou National Forest with their recovery plan for burned areas on the forest. The team designed a landscape-scale experiment aimed at restoring an ecosystem after a large fire. The study will test three strategies for managing burned mature or old-growth forest: (1) harvest dead trees and replant with a focus on quickly growing fire-resistant stands, (2) aid natural recovery without salvage logging and allow natural succession of tree species, and (3) harvest dead trees and replant fire-resistant species and then reintroduce low-intensity fire. The study covers about 36,000 acres and is the largest replicated postfire experiment in the United States. Ready to be implemented, it will allow

managers to assess the efficacy of the various treatments. The concept for the study was first developed by PNW Station scientists in the Five Rivers landscape management project on the Siuslaw National Forest.

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More information: Research Paper PNW-RP-560, 2004. *Southwest Oregon Biscuit Fire*. www.fs.fed.us/pnw/pubs/pnw_rp560.pdf.

Harvester systems disseminate climate and hydrology data

For more than half a century, USDA Forest Service scientists have been generating climate and hydrology data from small watershed experiments taking place across the Nation's experimental forest network. These data have been analyzed extensively by Forest Service scientists and cooperators, but are not easily accessible and remain untapped reservoirs of new information.

Scientists developed the ClimDB and HydroDB data harvester systems to continually capture and update data from multiple sites into a central database. The systems, available online at http://www.fsl.orst.edu/climhy, provide agency specialists, academics, and others access to Forest Service data sets and long-term records for research, education, planning, and other activities. Registration systems that track the number of visitors to the sites demonstrate a substantial number of users, with more than 500 Web sessions and more than 200 files downloaded or plotted per month.

ClimDB and HydroDB improve access to the vast data gathered from the Nation's experimental watersheds. Innovative new science involving intersite studies has been possible as a result of these data harvester systems as are assessments of alternative forestry practices, climate change, and wildfire.

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More information: Science Findings 62, April 2004. *Windows into the Forest: Extending Long-Term Small-Watershed Research*. www.fs.fed.us/sciencef/scifi62.pdf.

New findings on ecology of two Alaskan small mammals raise questions about their suitability as indicator species

The Prince of Wales flying squirrel and Wrangell Island red-backed vole are two small mammal species endemic to southeast Alaska. Although studies have suggested that the species' counterparts in the Pacific Northwest are intimately linked to old-growth forest and thus are good indicators of old-growth condition, little research has been done in southeast Alaska to determine if the same holds true there.

Scientists analyzed flying squirrel live-trapping study data and found it to be consistent with other studies that identified old-growth coniferous forests as the primary habitat of the species. But analysis also revealed that another forest type, peatland mixed-conifer, which had been thought to be unsuitable habitat, does in fact support breeding populations of flying squirrels in southeastern Alaska.

Analysis of red-backed vole live-trapping study data suggested that this species is not as sensitive to forest canopy removal as has been found elsewhere in Western coniferous forests. Scientists found vole densities to be similar in old-growth and managed habitats, contrary to previous studies that found few or no voles in clearcuts and young second-growth forests. Both studies suggest that the ecology of southeastern Alaska forests has important differences from the ecology of west-side forests in Oregon and Washington, with understanding of these differences important for successful ecosystem management.

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Effects of brown bear predation on salmon depends on density and social behavior

Images of brown bears wading in streams in pursuit of spawning salmon are a common depiction of the salmon's life cycle in Alaska. But salmon predation serves an important purpose beyond just satisfying a bear's appetite: it is a process that transfers marine-derived nutrients from aquatic to terrestrial environments.

Salmon are anadromous fish, meaning they spend most of their lives in marine waters before returning to freshwater rivers and streams to spawn. While at sea, salmon accumulate marine-derived nutrients in their bodies, particularly nitrogen. When they return to freshwater to spawn, they distribute these nutrients to the streams, when they die, and to forests, when they are caught and consumed by bears. Because bears consume large amounts of salmon during spawning seasons, they can move significant amounts of marine-derived nutrients from aquatic to

terrestrial ecosystems. Scientists found that this movement, the "bear effect," increases with increasing salmon density, but at a decreasing rate. The movement itself is influenced not only by stream characteristics, which affect the ease of fish capture, but also bear aggression, which can significantly limit the access of less aggressive bears to some of the best fishing patches.

This improved understanding of the interaction of stream size, salmon densities, and bear densities (and subsequent behavior) and their effects on the population biology of bears and the ecological consequences of their feeding on salmon has implications for managing habitat and ecosystems for sustained productivity and biodiversity and human recreation planning.

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Note: This research was conducted by Scott Gende when the Alaska Wildlife Habitat Team was part of the Aquatic and Land Interactions Program.

Symposia, Workshops, and Tours

A changing Alaskan forest ecosystem. About 120 people gathered in Homer, Alaska, to discuss effects of spruce beetle outbreaks and associated management practices on forest ecosystems in south-central Alaska. A synthesis of science and management information on the impacts of the spruce beetle epizootic was presented.

CLAMS research workshop: behind the green curtain. This workshop, held at the Station's Corvallis Forestry Sciences Laboratory, highlighted CLAMS geographic information systems (GIS) work. The workshop was designed to explore how people perceive and use GIS maps. About 25 stakeholders from various public and private institutions participated in focus groups to discuss benefits and limitations of GIS.

Innovation Fair. Station scientists showcased their science-based innovations at the Station's Innovation Fair, held at the World Forestry Center in Portland. The Ecosystem Processes Program participated in the fair, which featured scientific work and products directly applicable to managing the forests and landscapes of the region. More than 100 people attended the fair, which was cosponsored by the Western Forestry and Conservation Association. Streaming video footage of the event is posted on the Station's Web site at http://www.fs.fed.us/pnw.

Integrated regional spatial forest modeling. This workshop at the Corvallis, Oregon, laboratory was designed to facilitate the exchange of scientific information between the CLAMS project and a similar project in Sweden. About 15 people participated.

Northern spotted owl field tours. Eight tours to various locations hosted about 40 people to acquaint them with northern spotted owl biology and ecology.

Old-growth forest ecology and policy. This field trip at the Wind River Experimental Forest, Gifford Pinchot National Forest, was designed to present the latest information about the ecology of old-growth forests, including structure, dynamics, canopy ecology, and recent policies designed to sustain old-growth forests. Twenty-five people attended.

Wind River Canopy Crane 10th annual science conference. This conference near Stevenson, Washington, offered oral presentations and posters summarizing the most notable findings of the first 10 years of canopy crane operation to about 70 attendees. A field trip took scientists and forest managers to forest stands that had a history of different management regimes.

Conservation Education

2003 GIS Day. Program scientists took part in "GIS Day," part of an international event where real-world GIS applications are demonstrated to students and the general public. Highlights of the event included hands-on demonstrations; a poster session; a global positioning system tour of the campus of Oregon State University in Corvallis, Oregon, where the event took place; and a featured speaker. The goal of "GIS Day" was to make GIS applications come alive and showcase projects within the forestry community that use the technology. Some 130 students in grades kindergarten through 12 and more than 50 members of the interested public, Oregon State University, and the USDA Forest Service took part in the day's activities.

"Dry ice—discovering CO_2." Program scientists taught a program to 60 third-graders in Albany, Oregon, on the properties of the gas carbon dioxide and its many uses. They put a little fun in science, showing how this compound can go from solid to gas and explaining we drink it in soda, along with explaining how we breathe it out and plants "breathe" it in.

Forest camp. Program employees presented a "Web of Life" segment, with a forest fungi component, for 300 sixth-grade students from more than six school districts at "Forest Camp" in Lebanon, Oregon. The event was hosted by the USDA Forest Service, Siuslaw National Forest.

Growing fungi and bacteria from the dirt on our hands. Program scientists led 60 third-graders in Albany, Oregon through an experiment where the children rubbed their dirty hands on an agar petri plate, then watched what grew over time. The children also did controls where they rubbed their freshly washed hands on petri plates and watched what grew.

University Park Elementary School science fair. A program scientist organized a science fair for 60 students at an elementary school in Fairbanks, Alaska.

"What lives in a forest." Program scientists participated in a program designed to expose elementary school age children in Albany and Salem, Oregon, to ecology of forests and forest fungi. Children learned how the forest "system" works together, from animals to fungi, to make a healthy forest. In addition to teaching children about ecology, the program also is designed to introduce them to different research and science occupations. More than 500 Oregon students took part.

Honors and Awards

Lifetime Achievement Award

Eric Forsman, a research wildlife biologist with the Ecosystem Processes Program, received this award from the Oregon Chapter of The Wildlife Society for his northern spotted owl research. Forsman studied the spotted owl for both his master's degree and doctorate and has been conducting spotted owl demographic studies since 1987. According to The Wildlife Society, its awards honor those wildlife professionals who have made notable contributions to the field of wildlife research.

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