



GOAL ACCOMPLISHMENTS

*Skokomish River Valley,
Washington, by Pete Bisson*

GOAL 3: Develop science-based
options for informed management



Key Findings and Tools

- Surrogate species can be effectively used in conservation planning to represent broader sets of species that would be too numerous to effectively manage individually.
- Scientists map adaptive diversity in ocean spray, an important restoration shrub; the map serves as a guide for seed collection and native plant restoration and revegetation.
- Scientists determine the geographic and taxonomic scope of an amphibian disease implicated in the decline and extinction of numerous amphibian species.
- A model identifies the initiation sites for landslides and assesses the likelihood of a landslide reaching a fish-bearing stream in western Oregon.
- Scientists develop new framework for wildfire risk assessment and fuel treatment planning.
- A landscape analysis of dry forests helps cross-ownership restoration projects and evaluation of biomass supply in eastern Washington.
- Biomass studies highlight areas where cost of fire-hazard-reduction treatments could be offset by sale of products.
- Cost of treatments, including prescribed fire treatments, were generally higher in the West than in other regions of the country.
- The quality of wood from spruce and hemlock stands that were precommercially thinned was found to be equivalent to unthinned stands in southeast Alaska.
- Trees 25 to 80 years old from southeast Alaska yield quality timber for high-value products.
- Classifying recreation visitors by trip type leads to better estimates of visitor spending than classifying visitors by the type of activity they engage in.
- California officials use the station's smoke forecasts to inform the public about wildfire-related air quality concerns.
- Compacted trails created by tree harvesting equipment may not reduce growth of trees in or near the trails.



Surrogate species are an effective tool for conservation planning



HOW CAN THE Forest Service and other federal agencies best address the conservation needs of hundreds of species of concern in land use planning? There

Outcome:
Forest Service and BLM adopt surrogate species approach to conservation in the interior Columbia basin.

are often too many species to consider each individually, even though

all species of concern must be considered under federal laws and regulations.

Using surrogate species or groups of species as proxies for broader sets of species may be one way to address this dilemma. Scientists demonstrated this in the interior Columbia basin. An effective surrogate approach requires specific objectives, a regional geographic scale, explicit scientific criteria for selecting and linking surrogates to the larger set of species, tests of logic and consistency, identifying and demonstrating how knowledge gaps are addressed, and monitoring the effectiveness of management applications.

The surrogate species approach and guidelines are scientifically defensible and efficient, enabling managers to save substantial time and money. The Forest Service and Bureau of Land Management (BLM) are using these guidelines and approach in more than 50 administrative units in the interior Columbia basin. Also, the Forest Service has incorporated the approach and guidelines in its national planning direction, including proposed regulations to update guidelines for the National Forest Management Act.

Contact: Michael Wisdom, mwisdom@fs.fed.us, Managing Disturbance Regimes Program

Partners: The Nature Conservancy, USDA Forest Service National Wildlife Ecology Program, USDI Bureau of Land Management

Different timber harvest scenarios lead to significant differences in future carbon sequestration on U.S. public timberlands

TERRESTRIAL CARBON sequestration can mitigate global climate change and could help offset greenhouse gas emissions from all sectors of the U.S. economy. Public forests in the United States represent approximately 20 percent of the U.S. timberland area and 30 percent of the U.S. timber volume. With such a large standing timber inventory, management of this resource affects the amount of carbon sequestered by public forests. To help decisionmakers understand the carbon implications of potential changes in public timberland management, researchers compared a baseline timber harvest scenario with two alternative harvest scenarios and estimated annual carbon stock changes associated with each.

A scenario that eliminated timber harvests on public lands increased the amount of carbon sequestered annually by 17 to 29 million metric tons (MMT) of carbon between 2010 and 2050—as much as a 43-percent increase over current sequestration levels on public timberlands. This scenario also offset up to 1.5 percent of total U.S. greenhouse gas emissions. In contrast, a more intense harvest scenario similar to harvest levels that prevailed in the 1980s



Mary Rowland

Data collection on a sagebrush study plot near John Day, Oregon.



Todd Mangano

Public forest lands yield 30 percent of the U.S. timber volume.

resulted in annual carbon losses of 27 to 35 MMT. These losses represented a 50- to 80-percent decline in anticipated carbon sequestration associated with the existing timber harvest policies.

Contact: Ralph Alig, ralig@fs.fed.us, Human and Natural Resources Interactions Program

Partners: Environmental Protection Agency, Duke University, Oregon State University, Texas A&M University

Scientists model potential impacts of climate change on California's ecosystem services

STATION SCIENTISTS were key contributors in a project examining the potential impact of climate change on services provided by California ecosystems. They simulated

Outcome: Climate change study informs California governor and legislature.

potential changes in vegetation distribution, associated carbon pools and fluxes, and wildfire occurrence in California under nine future climate and greenhouse gas emission scenarios.

This output was given to The Nature Conservancy, which is translating it into ecosystem services values for carbon, water availability, forage production, and carbon sequestration. Project results will be published in the 2008 Climate Change Impacts Assessment, the Second Biennial Report to the California Climate Action team, which submits these reports to the governor and the state legislature.

Contact: Jim Lenihan, jlenihan@fs.fed.us; Ron Neilson, rneilson@fs.fed.us, Managing Disturbance Regimes Program

Partners: California Energy Commission, Oregon State University, Scripps Research Institute, The Nature Conservancy

Scientists map seed zones for oceanspray based on climatic variables



LAND MANAGERS generally try to use locally adapted and genetically diverse plant materials in restoration and revegetation efforts. Oceanspray (*Holodiscus discolor*) is an important restoration shrub in the Pacific Northwest; genetic variation exists within the species because local populations adapt to local conditions. In this study, station geneticists identified the patterns of genetic diversity of oceanspray related to climatic variables, such as average December minimum temperature, by characterizing the variability in growth and physical characteristics for individual shrubs from 39 locations in western Oregon and Washington.




Landslides may be important sources of wood and spawning gravels, which are building blocks for fish habitat.

As part of this study, scientists produced a seed zone map for land managers that illustrates adaptive patterns of genetic diversity of oceanspray within the Pacific Northwest. The map can be used to guide seed collection and deployment for native plant restoration and revegetation activities.

Contact: Matt Horning, mhorning@fs.fed.us, Resource Management and Productivity Program

Partners: Corvallis Plant Materials Center and Tangent Service Center, USDA Natural Resources Conservation Service

Pivotal research contributes to amphibian conservation worldwide

 WORKING WITH researchers around the world, a station scientist determined the geographic and taxonomic scope of chytridiomycosis, an amphibian disease implicated in amphibian species decline and species extinctions. The aquatic fungus that causes the disease is widely detected in the Americas and Australia, patchy in Africa and Europe, and not yet seen in wild amphibian populations in Asia.

The disease has been detected in 59 percent of countries sampled, 85 percent of U.S. states, and 56 percent of the species sampled, including 17 anuran (frog and toad) families and 5 caudate (salamander) families.

This project is an unparalleled example of collaboration among scientists. Data were collated from more than 2,000 sites worldwide. The data are accessible on an interactive Web portal with




Charlie Crisafulli

mapping capabilities (<http://www.spatialepidemiology.net>). Maps associated with the project have been used in various publications such as *Nature* and the *Seattle Times* to increase awareness of this disease.

Contact: Dede Olson, dedeolson@fs.fed.us, Aquatic and Land Interactions Program

Partners: Amphibian Specialist Group, World Conservation Union; Department of Infectious Disease Epidemiology, Imperial College, London, UK; Partners in Amphibian and Reptile Conservation

Landslide model useful in managing fish habitat

 THE ROLE OF landslides in creating and maintaining fish habitat is a much-debated topic among scientists and land managers. Land managers traditionally

Outcome: Federal agencies use landslide initiation and runout model to develop and evaluate land management plans.

worked to minimize the occurrence of all landslides. However, recent research suggests that landslides may be important sources of wood and spawning gravels, which are building blocks for fish habitat.

Scientists developed a model for western Oregon that identifies landslide initiation sites and assesses the likelihood that a landslide from that site will reach a fish-bearing stream. The model has been adapted to estimate relative volumes of wood that might be delivered to a stream. When using the model, managers will be able to identify and prioritize landslide sites with a high probability of affecting a fish-bearing stream either positively or negatively. The model facilitates analysis of alternative management scenarios, enabling the user to assess the potential for cumulative management effects.

This model was used extensively by the Oregon Bureau of Land Management to develop and evaluate options for their new land management plan. It was also used by the Aquatic and Riparian Effectiveness Monitoring Plan of the Northwest Forest Plan.

Contact: Kelly Burnett, kmburnett@fs.fed.us, Aquatic and Land Interactions Program

Partners: Earth Systems Institute, USDI Bureau of Land Management Oregon, Oregon Headwaters Research Consortium, USGS Biological Resources Division

When evaluating salmon habitat, life stage of salmon matters

RESEARCHERS ANALYZED the relationships between salmon life-history stages and landscape characteristics at multiple spatial scales to assess salmon distribution and abundance. For adult salmon, researchers found conditions across a large scale helped explain salmon distribution and abundance. Mean precipitation of the watershed, for example, and the percentage of large trees in the riparian buffer at the subbasin level were significant variables. For juvenile salmon, however, researchers found local conditions, such as the percentage of sand in spawning beds and the distance from pools to spawning beds explained juvenile abundance and habitat occupancy better than did large-scale landscape conditions.

This information is useful when designing management activities to maintain and recover stream ecosystems and when developing monitoring programs to evaluate the effectiveness of management activities.

Contact: Rebecca Flitcroft, rflitcroft@fs.fed.us, Aquatic and Land Interactions Program

Partners: Oregon Department of Fish and Wildlife, Oregon State University

Juvenile coho salmon move through culverts at lower flows than expected

STREAMS THAT ARE intermittent during the summer but flow during the winter period can be critical rearing areas for juvenile coho salmon in the Oregon Coast Range. During the dry summer, these streams become disconnected from the main stem. This study found that fish begin moving into these streams with the first high flows of the fall season and over a much shorter period than previously thought. Most of their movement occurs,

however, during low to moderate flows. Current design criteria for culverts assume that fish move through them during a wide range of flows.

These results provide management and regulatory agencies with valuable insights about the timing of coho salmon movements through culverts and will influence the design and placement criteria for culverts.

Contact: Bruce Hansen, bhansen@fs.fed.us, Aquatic and Land Interactions Program

Partners: Environmental Protection Agency, Oregon Department of Fish and Wildlife, Oregon State University, USDI Bureau of Land Management



Pete Bisson

For juvenile salmon, the amount of sand in spawning beds and distance from pools to spawning bed are particularly important.



The Dungeness River, Washington.

Peak flow assessment completed for BLM Plan Revisions

STATION SCIENTISTS assessed the science relating to the effects of forest management on peak streamflows in the Pacific Northwest (PNW). The Bureau of Land

Outcome:
BLM uses assessment in management plan for western Oregon.

Management (BLM) used this assessment in their revised management plan for western Oregon. Scientists analyzed several decades of peak flow data

from experimental watersheds across the PNW and developed novel relationships to guide forest managers in assessing the risk of peak flow increases and channel responses in different geographic regions within the PNW. The results of this effort were published in general technical report PNW-GTR-760.

Contact: Gordon Grant, ggrant@fs.fed.us, Ecosystem Processes Program

Partners: USDI Bureau of Land Management

Applying ecosystem resilience theory to communities aids understanding of social and economic changes

DURING THE LAST 30 years, many rural natural-resource-dependent communities have experienced a downturn in their commodity-oriented industries and an upsurge in activities such as recreation,

tourism, second-home ownership, and retirement immigration. Scientists applied the concept of adaptive cycles from ecosystem resilience theory to display these historical changes in three amenity-transition communities: McCall, Idaho, Leavenworth, Washington, and Prineville, Oregon. Scientists interviewed key informants and used historical records and social and economic indicators to document social and economic changes in these communities since the 1950s. These changes were depicted using stages of the adaptive cycle: exploitation, conservation, release, and reorganization.

This study shows how resiliency theory and adaptive cycles can be used to identify potential community-based indicators of adaptive capacity, sources of vulnerability and resiliency, and opportunities to build adaptive capacity. This study also suggests this method may be useful for integrating social and economic change with ecological dynamics in large-scale, integrative studies of socioecological systems.

Contact: Dale Blahna, dblahna@fs.fed.us, Human and Natural Resources Interactions Program



Mark Nechodom

Forest biomass removed to reduce fire hazard can be used to produce electricity. Above, a biomass plant in California.

Landscape analysis facilitates cross-ownership restoration projects and evaluation of potential biomass supply



THE FORESTS OF the eastern Cascade Range are ecologically complex. A century of human use, however, has fundamentally changed forest structure and processes, making a complex system even more challenging to manage. New uncertainty about the impact of climate change compounds the challenge of long-term management of east-side forests.

Forest landscapes and many management issues transcend property boundaries. However, forest management activities in the east Cascades are generally applied at a stand scale within an ownership, rather than a landscape scale across ownerships. Scientists conducted a landscape analysis to reveal the effects policy and land management activities have on forest ecosystems across multiple ownerships in eastern Washington. The analysis examined how fire exclusion and past management created current forest conditions. The resulting report also discusses methods

for increasing forest resiliency, conservation of older forest conditions, and developing biomass use.

The Washington Department of Natural Resources, tribal and private landowners, and other interested parties are using information from this analysis to plan integrated restoration projects, examine potential biomass supply, and inform policy discussions.

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Partners: Tapash Cooperative, The Nature Conservancy, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, USDA Forest Service Pacific Northwest Region, Yakama Nation

BioSum model optimizes fire hazard reduction and bioenergy capacity

THE BIOSUM MODEL is a tool for optimizing fire-hazard-reduction treatments and determining the economic feasibility of

Outcome: *BioSum Model is used at local and regional levels to identify bioenergy opportunities.*

using material removed during treatment for traditional timber products or to produce bioenergy.

Scientists applied BioSum to a 25-million-acre study area in

western Oregon and northern California. They found the study area is capable of annually producing (1) \$590 million in net revenue; (2) 6 to 12 million green tons of biomass; and (3) 0.8 to 1.2 billion cubic feet of merchantable wood over the

course of a decade. This assumes a 10-year implementation and depreciation of the biomass plants constructed to support fuel treatment on all acres for which treatments would achieve fuel reduction benefits.

Under this scenario, fuel hazard would be reduced on 2.8 to 8.1 million acres while providing bioenergy capacity of 496 to 1009 megawatts—enough to power a city of 500,000 to 1,000,000 people.

Several clients have requested custom analyses using BioSum. Lakeview, Oregon, used the model as a basis for decisions on

sizing a planned bioenergy facility; the California Department of Forestry and Fire used it to evaluate forest practices policy options; and it has been used in a regional analysis of opportunities to attract bioenergy investment capital in New Mexico, to assess bioenergy development feasibility in central Oregon, and in support of forest planning on the Shasta-Trinity National Forest.

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

Partners: USDA Forest Service National Fire Plan, Western Forest Leadership Coalition

Biomass studies lead to strategic thinking regarding fuel reduction treatments



MANY FORESTS IN the Western United States are prone to larger, more severe wildfires than they were prior to settlement by Euro-Americans. Reducing

Outcome:
Western Governors' Association uses study techniques to evaluate potential to produce electricity and biofuels from all forests in the Western United States.

fire hazard can be costly, but studies by station scientists indicate areas where the cost for fuel reduction treatments potentially may be offset by the sale of

products removed during treatment.

Tree size, species, and proximity to a processing facility are some of the factors that determine the salability of wood removed during these fuel reduction treatments.

A study focused on southwest Oregon and northern California found that large trees often need to be removed to accomplish fire-hazard-reduction goals, even when one objective is to minimize the amount of merchantable timber harvested. This is because the crowns on these trees are so large, they are often key factors in



Eiri Lowell

Certain parameters must be met before producing electricity and biofuels from forest biomass becomes economically feasible.

Tool: Harvest Cost-Revenue (HCR) Estimator

Description:

This Windows®-based financial and engineering software calculates the cost of wildfire fuel-reduction treatments on a project-by-project basis. It may be used to evaluate cost-per-acre thresholds for logging contractors, appraise contract bid rates, or assess stumpage values for ponderosa pine stands in the Southwest United States. It illustrates variability in fuel reduction costs as related to the level of fuels reduction achieved, volume of merchantable wood removed from different forest stands, and availability of markets for removed material.

Use:

The HCR Estimator allows users to examine ways to lower harvesting and transport costs through various levels of in-woods processing. It also provides a decision-support tool to help evaluate economic limitations of different fuel reduction treatments given current product markets for small-diameter material. It can be used to identify potential value-added products that may present opportunities to support community industries that require low capital investment while providing employment for residents of northern Arizona.

How to get it:

<http://www.fs.fed.us/pnw/publications/gtr748/>

Contact:

Eini Lowell, elowell@fs.fed.us, Human and Natural Resources Interactions Program

Partners:

Greater Flagstaff Forest Partnership, Inc.; High Desert Investment, Inc.; Northern Arizona University; Perkins Timber Harvesting; Skyline Resources; USDA Forest Service Coconino National Forest, Forest Products Laboratory, Rocky Mountain and Southern Research Stations


both torching (crown fire initiation) and crowning (crown fire spread). This information will help fire managers evaluate fuel conditions at a variety of spatial scales and consider various scenarios for reducing fire hazard. These studies are particularly useful for showing how treatment effectiveness and timber volumes might differ given different policy directions or budget constraints.

National forests are using the techniques developed for this study to evaluate potential stewardship contracts, and the Western Governors' Association used them to evaluate the potential to produce electricity and biofuels from all forests in the Western United States.

Contact: Jamie Barbour, jbarbour01@fs.fed.us, Focused Science Delivery Program

Partners: USDA Forest Service Southern Research Station, Oregon Department of Forestry

Study evaluates investments in fuel treatments and gains in resource protection

 RESEARCHERS EVALUATED the cost and effectiveness of prescribed fire, mechanical treatments, and mechanical treatments plus fire on seven long-term study sites that are part of the national Fire and Fire Surrogates Program.



Todd Morgan

Results indicate that treatments costs, including prescribed fire, were generally higher in the West than published costs for other regions in the United States. The cost of these treatments could be offset, in some cases, by the value of the harvested timber. This study also found that these three treatments are likely to reduce the severity of fire, which in turn, may decrease the need for immediate suppression. These noted benefits may expand the range of available treatment options. This information can be used to compare the financial and technical feasibility of various fuel reduction treatments to address tradeoffs associated with different resource and budget scenarios.

Contact: Jamie Barbour, jbarbour01@fs.fed.us, Focused Science Delivery

Partners: Joint Fire Science Program, Oregon State University, Texas Tech University, University of California (Berkeley and Davis), USDA Forest Service Alaska Region

Quality of wood in thinned and unthinned stands assessed



AREAS OF PRINCE OF WALES and Mitkof Islands were harvested before 1970, with resulting regeneration forming dense stands of Sitka spruce and western

Outcome:
Tongass National Forest uses results from wood quality study to plan future management.

hemlock. Some sites were thinned between 1962 and 1985 to several levels of residual stocking. Adjacent, unthinned control stands were available for comparison. To determine whether treatments had influenced wood quality, trees from the thinned and

unthinned stands were harvested and sawn into dimension lumber. Researchers found that the wood quality in the thinned stands was not significantly different from wood quality in the unthinned stands.

The Tongass National Forest is using information from this study to appraise potential timber operations in second-growth timber stands, and to plan future thinning operations in densely regenerated stands.

Contact: Eini Lowell, elowell@fs.fed.us, Human and Natural Resources Interactions Program

Partners: Alaska Department of Natural Resources, Ketchikan Wood Technology Center, USDA Forest Service Forest Products Laboratory, Tongass National Forest, Southern Research Station



Pete Bisson

A second-growth stand of spruce and hemlock on the Olympic National Forest.

Description:

The Excel®-based FRCS model estimates the cost of harvesting and collecting biomass from small trees and from forest residues associated with commercial logging operations. The model has variants for the western, southern, and northern regions of the United States.

Use:

These new variants of FRCS have been used to develop forest biomass supply curves for all forested counties in the continental United States. The original version was published in 2004 and was limited to forests of the interior West. A request to use the model for a nationwide assessment of the economic supply of biomass available from farm and forest residues and biomass plantations to support bioenergy and biofuels led to this extension of the capabilities of FRCS so that all regions of the United States could be evaluated. In addition, an independent cost module was developed that permits users to easily update costs of diesel fuels, equipment, and labor in any part of the country. Production equations from numerous studies on biomass harvesting operations in different regions of the country were incorporated so that users can select the most relevant equations for their needs.

How to get it:

http://www.fs.fed.us/pnw/data/frcs/frcs_home.htm

Contact:

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Spruce trees killed by bark beetles on
Alaska's Kenai Peninsula can be
used to make wood-plastic composites.

Young-growth timber can be used for high-value products



ROUGHLY 200,000 acres of trees 25 to 80 years old on the Tongass National Forest are scheduled for treatment in the next 10 years. Species such as red alder, Sitka spruce, and western hemlock have regenerated in areas originally harvested under the 50-year contracts that supported Alaska's pulp mills.

Scientists conducted several studies to evaluate the quality of this young-growth timber and found it can be used for high-value timber products. Grade yields of red alder lumber are comparable to older trees harvested in the Lower 48 States and Canada. Sitka spruce and western hemlock can be used for high-quality house logs, and the shipping weight can be reduced 38 percent by removing the bark and allowing the logs to air dry for a year.

In many of these stands, crown closure inhibits the growth of understory vegetation that would support deer and other wildlife. Thinning and selective removal of these trees may promote the development of the forest understory, and subsequently, food for wildlife.

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Partner: Ketchikan Wood Technology Center

Alaska beetle-killed wood can be used to make wood-plastic composites

BARK BEETLE EPIDEMICS have killed countless trees on more than 1.4 million acres of Alaska's Kenai Peninsula. These standing dead trees pose a severe fire hazard to the communities of Homer, Kenai, Soldotna, and others. Community leaders and forest products manufacturers want to know if the beetle-killed wood can still



Vikram Yadama

Manufacturing wood-plastic composites could provide economic benefits to Alaska's Kenai Peninsula.

Description:

ArcFuels is a library of macros within the ArcMap® GIS software. It links (1) key wildfire behavior models, (2) fuels and vegetation data, (3) Microsoft Office software, and (4) ArcGIS. It is used in fuel treatment planning and wildfire risk analyses to streamline wildfire threat and mitigation assessments. The ArcMap framework helps specialists leverage local data and existing fire models to address project-specific issues that typify many fuel treatment projects.

Use:

In 2008, four workshops were held to train nearly 100 fuel specialists to use ArcFuels and related programs.

How to get it:

<http://www.fs.fed.us/wwetac/arcfuels/>

Contact:

Alan Ager, aager@fs.fed.us, Western Wildland Environmental Threat Assessment Center

Tool: Enhanced MAPSS Fire Forecasting System

Description:

The MAPSS Fire Forecasting System continuously updates monthly forecasts of fire danger and drought looking 7 months ahead for the conterminous United States. The forecasts are based on output from the MC1 Dynamic General Vegetation Model, and recent enhancements allow better characterization of fire danger in shrub and grass regions.

Uses:

For the 2007 fire season, the MAPSS Fire Forecasting System predicted 8,221,775 acres burned in the conterminous United States as compared to the observed 8,796,309 acres burned. A comparison to the large-fire locations observed in 2007 and provided by the National Interagency Coordination Center showed that 62 percent of the locations were successfully predicted by the forecasting system. Currently, nearly 200 land managers from various resource agencies are alerted each month to new fire forecasts posted on the MAPSS Web site via an ever-growing e-mail list.

Contact:

Jim Lenihan, jlenihan@fs.fed.us,
Managing Disturbance Regimes Program

be used to produce wood products. If so, having a market for this raw material could help offset fire hazard reduction activities.

To address this question, station researchers evaluated the mechanical and physical properties of wood-plastic composites produced using wood flour from beetle-killed spruce. They found it is a viable way to use beetle-killed spruce trees. Results also showed that the manufacturing facilities can be started with relatively low capital inputs, and that there could be significant benefits for rural employment and economics.

Contact: Eini Lowell, elowell@fs.fed.us, Human and Natural Resources Interactions Program

Partners: Alaska State Division of Forestry, USDA Forest Service Chugach National Forest, Washington State University

Method improved for estimating recreation-visitor spending



ESTIMATES OF national forest recreation-visitor spending are used with estimates of recreation visits and economic models to identify the

Outcome:
Multiple forest planning activities and analyses at the regional and national levels use improved visitor-spending estimates.

contribution of national forest recreation to the economies of local forest communities. Traditionally, visitor spending estimates were classified by various recreation activities (camping, hiking, fishing, etc.). Using visitor spending data collected as

part of the National Visitor Use Monitoring program from more than 20,000 national forest recreation visitors, PNW researchers showed that the type of recreation trip (i.e., day or overnight trip, local or nonlocal trip) better explained variation in the spending of recreation visitors than did recreational activity. Although the visitor's recreation activity has some influence on visitor spending, ultimately a trip-type approach to visitor classification yields visitor spending estimates that are more reliable and more easily transferred across national forests.

The spending averages estimated using this approach have been used in



To estimate visitor spending, researchers find trip type rather than activity is a better indicator.

forest planning activities in the Forest Service's Northern, Eastern, and Rocky Mountain Regions; by the Bureau of Land Management in Montana; and in national Forest Service recreation reports. These spending averages have been incorporated in Natural Resource Information System computer applications, and in the TMECA



Tom Iraci

The Three Sisters, Oregon

computer application for use in National Forest System Travel Management analyses.

Contact: Eric White, emwhite@fs.fed.us, Human and Natural Resources Interactions Program

Partners: Michigan State University, USDA Forest Service Planning Analysis Group

Visitors differ in their preference for managing postfire recreation

THE 2003 B&B FIRE burned much of the Mount Jefferson, Mount Washington, and Three Sisters Wilderness areas in the Deschutes and Willamette National

Outcome: Willamette National Forest uses findings to develop a postfire recreation monitoring plan.

Forests. Forest managers wanted to know how best to manage for recreation after fire. Research focused on the Eight Lakes Basin within the Mount

Jefferson Wilderness, where day hiking, backpacking, climbing, and horse camping are traditional uses. Visitors were asked

about their past use, changes in use after the fire, and preferences for managing postfire recreation. Use declined slightly in burned areas 1 to 2 years later; however, these declines appeared less than those caused by the fee demonstration program implemented in 1998.

Visitors differed in their preferences for managing postfire recreation, with some visitors preferring little or no management, some preferring access and use restrictions coupled with site development, and some preferring either access and use restrictions or site development alone.

The Willamette National Forest used these findings to develop a recreation monitoring plan for the B&B Fire area.

Contact: Jeff Kline, jkline@fs.fed.us, Human and Natural Resources Interactions Program

Partners: Oregon State University, University of Idaho, USDA Forest Service Willamette National Forest

New framework helps assess wildfire risk



SCIENTISTS DEVELOPED a framework for assessing wildfire risk that can be used in fuel treatment planning. As part of this process, they evaluated the factors that control spatially explicit burn probabilities, such as spatial patterns of fuels, topography, and wind. They then incorporated burn probability models and risk modeling with planning tools and applied these tools to large landscapes to test fuel treatment management hypotheses.

Scientists completed an initial wildfire risk analysis using this framework for the Ochoco National Forest. These results will be incorporated into the forest's wildfire management plan. Scientists made several presentations about this work to managers and fuel specialists with the Ochoco National Forest and Washington office staff.

Contact: Alan Ager, aager@fs.fed.us, Western Wildland Environmental Threat Assessment Center

Partners: University of California Berkeley, The Nature Conservancy, USDA Forest Service Ochoco and Deschutes National Forests and Rocky Mountain Research Station



Alan Ager

A new decision framework may help forest managers reduce the risk of uncharacteristic wildfires.



Tom Iraci

Smoke forecasts help protect the public's health.

Smoke forecasts used to alert public



THE STATION and its partners provided smoke predictions for the October 2007 wildland fires in southern California. Using the BlueSky smoke

Outcome: California fire managers and public health officials use station's smoke and fire weather predictions.

modeling framework developed in part by station scientists, the group provided daily 48-hour forecasts of surface smoke concentrations.

Fire management officers, incident commanders, and public health officials used these forecasts to much success. In July 2008, the team was asked to provide similar support for fires in northern California.

The smoke and fire weather predictions were used extensively by fire management

personnel and public health officials in California. They were also used in briefings to Forest Service leadership and the Presidential Cabinet.

The station and its partners also are providing fire weather model predictions for meteorologists with the Incident Command System and others. Working with the California Air Resources Board (CARB), AirFire has deployed five smoke monitors in northern California as part of a Joint Fire Science Program (JSFP) project. The monitoring locations are providing data for the JFSP project, additional CARB monitors, and public health officials.

Contact: Narasimhan Larkin, larkin@fs.fed.us, Managing Disturbance Regimes Program

Partners: Desert Research Institute; Sonoma Technologies Inc.; USDA Forest Service Southern Research Station and Washington office State and Private Forestry Fire and Aviation Management

Prefire fuel treatments can reduce postfire tree mortality

THE VALUE OF fuel treatments and other silvicultural practices aimed at reducing wildfire hazard and severity had not been conclusively demonstrated over large areas. To address this, scientists capitalized on the 175,000-acre Tripod Fire that burned through many well-documented fuel treatments on the Okanogan-Wenatchee National Forest in 2006.

Scientists determined the lowest postfire mortality in the forest overstory occurred in areas that had been heavily thinned and received a surface fuel treatment. This indicates that thinning plus surface fuel treatment greatly reduces fire hazard.

These findings validate thinning plus fuel treatments as an effective method for reducing fire hazard and modifying fire behavior and fire severity on the Okanogan-Wenatchee National Forest. The results are also applicable to other dry forests in the West that contain ponderosa pine and mixed-conifer forest.

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Partners: University of Washington, USDA Forest Service Okanogan-Wenatchee National Forest

Fuel treatments likely need to be repeated

IN MANY FIRE-prone forests in the United States, changes over the last century have resulted in overstory structures, conifer densities, down woody structure, and



Andrew Youngblood

A prescribed burn at the Metolius Research Natural Area.

Outcome:
The Joint Fire Science Program and the Wallowa-Whitman National Forest use study results to synthesize ecological effects of fuel reduction treatment.

fuel loads that deviate from those described historically. These conditions elevate the fire hazard. Fuel reduction treatments are one method for reducing fire hazard, but as scientists

found, single applications of thinning and burning fuel-reduction treatments do not permanently mitigate the nearly 80 years of fire exclusion and fuel accumulation in low-elevation dry forests in northeastern Oregon.

Scientists used the Fuel Characteristics Classification System to construct a representative fuelbed for each study unit and then calculated three indices of fire potential as measures of the change in fire

hazard resulting from treatments. Surface fire behavior, crown fire behavior, and fuels available for consumption returned to pretreatment levels within 6 years, indicating that repeated fuel reduction treatments may be needed to reduce the risk of uncharacteristically severe wildfires.

Contact: Andrew Youngblood, ayoungblood@fs.fed.us, Managing Disturbance Regimes Program

Partners: Joint Fire Science Program, USDA Forest Service Wallowa-Whitman National Forest

Scientists compile a new fuels data set for alternative postfire reforestation treatments

MANAGEMENT DECISIONS for postfire restoration must balance the benefits of revegetation against risks associated with the development of fuels and potential for reburn. After the 2002 Timbered Rock Fire in southwestern Oregon, scientists established eight alternative vegetation restoration treatments and applied them to 40 experimental treatment units. For 4 years, they have monitored the dynamics of vegetation community development, snag abundance and condition, and fuel loading on those units. Each treatment unit provides a prospective fuels model, and these

Description:

The AQUIPT is designed to help land managers predict the probable impact of smoke from a potential fire, planned or unplanned. It combines the historical weather data of the North American Regional Reanalysis with the Fuel Characteristics Classification System and the BlueSky Framework. Users are able to enter their burn prescription parameters (e.g., maximum and minimum relative humidity, maximum windspeed, and time of year) and AQUIPT will provide a statistical summary of the potential smoke impacts.

This summary includes maps showing average release of fine particulate matter, probability of a location experiencing a significant impact, or maximum release of fine particulate matter produced by all historical episodes meeting the specified conditions. The AQUIPT can also model other nonfire sources of air pollution including industrial emissions and dairy farms.

How to Get It:

Contact Narasimhan Larkin, larkin@fs.fed.us, Managing Disturbance Regimes Program

Tool: A field guide to predict delayed mortality of fire-damaged ponderosa pine

Description:

This field guide for land managers can be used to determine the probability of mortality for an individual tree, or the proportion of trees projected to die within a stand. It is recommended for use in any stand throughout southeastern Oregon or northern California. In the absence of a more accurate validated model, the field guide can be used for ponderosa pine elsewhere in Oregon and Washington. It can be used for trees damaged by prescribed fire or wildfire and is applicable to trees ranging from 3 to 83 inches in diameter and of various ages.

Contact:

Walt Thies, wthies@fs.fed.us. Managing Disturbance Regimes Program

More information:

Gen. Tech. Rep. PNW-GTR-769. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 16 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr769.pdf

data will be used in simulation studies to evaluate the effects of treatments on potential fire behavior at stand and landscape scales.

This ongoing study will provide relative measures of potential fire risks associated with the early phases of active vegetation restoration in burnt forests typical of southwestern Oregon. Managers can use this information to better design the landscape application of vegetation restoration and fuels management treatments.

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

Partners: Oregon State University, USDI Bureau of Land Management

New model predicts fuel consumption in sagebrush

BEFORE THIS PROJECT, little research had been done to quantify and model fuel consumption in shrub-dominated ecosystems. Quantifying fuel consumption is critical for evaluating fire severity, and for effectively modeling fire effects such as smoke emissions, plant and tree mortality, and wildlife habitat restoration.

This project is developing new consumption models for shrub-dominated ecosystems where a substantial portion of the fuelbed is composed of living and upright vegetation. They differ from models



Scientists are using data collected before and after this prescribed burn near Lakeview, Oregon, to develop a fuel-consumption model for shrub-dominated ecosystems.



Clint Wright

A prescribed burn in sagebrush near Steens Mountain, Oregon.

for forested systems where most of the fuelbed is composed of dead and down organic matter.

A preliminary model for big sagebrush has been published and incorporated into the fire management decision-support software Consume 3.0. Consume 3.0 has been taught at technical fire management workshops and conferences. Additional models to predict biomass consumption in other shrub-dominated ecosystems such as pine flatwoods, chamise chaparral, and pitch pine scrub are under development.

Contact: Clinton S. Wright, cwright@fs.fed.us, Managing Disturbance Regimes Program

Partners: Joint Fire Science Program, University of Washington

Decision framework helps evaluate risks

STATION SCIENTISTS developed a series of questions to guide fire research and a framework to address these questions. The framework provided an approach for examining the adequacy of existing frameworks, and another for addressing business functions such as fuels treatment budgeting, planning, and application at various spatial and temporal scales; allocating suppression resources around the country; and real-time suppression actions.

Contact: Charles G. "Terry" Shaw, cgshaw@fs.fed.us, Western Wildland Environmental Threat Assessment Center

Partners: Joint Fire Science Program

Function:

The BlueSky smoke modeling framework forecasts smoke concentrations and trajectories, including the cumulative effects of smoke from multiple wildfires and prescribed fires, long-distance smoke movements, and smoke movement over a 24- to 48-hour period. Version 3 can be used as a modular system that incorporates the most common fire consumption, emissions, plume rise, and dispersion models. By integrating SMARTFIRE output, it also includes better fire location and size information. The framework computer code was completely overhauled to allow users to integrate custom modules or models and adjust parameter settings.

Use:

The SMARTFIRE component of BlueSky version 3 has been positively received by representatives of the Environmental Protection Agency, the National Wildfire Coordinating Group, and the National Interagency Coordination Center, among others. The version 3 rewrite also led directly to the Smoke and Emissions Modeling Intercomparison Project funded by the Joint Fire Science Program, and is being examined for use in other science areas including fuels treatment and effects.

Contact:

Robert Solomon, robertsolomon@fs.fed.us, Managing Disturbance Regimes Program

How to get it:

<http://getbluesky.org/>

Tool: Annotated bibliography on fire-bark beetle interactions

Function:

This synthesis and annotated bibliography examines literature regarding current trends in fire and bark beetle activity in western forests, beetle effects on fire activity, and fire effects on beetle activity. The project was undertaken to meet the needs of forest managers in the Western United States who are facing more fires and the most extensive bark beetle outbreaks recorded for the region.

Contact:

Becky Kerns, bkerns@fs.fed.us, Western Wildland Environmental Threat Assessment Center

Partner:

University of Wisconsin

How to get it:

http://www.fs.fed.us/wwetac/publications/WWETAC_Fire-BB_InterX_25Feb2008.pdf

Large-scale thinning may push bark beetles into other stands

SCIENTISTS USED the Westwide Pine Beetle Model and Fire and Fuels Extensions of the Forest Vegetation Simulator (FVS) to simulate a bark beetle outbreak under different fuel treatment scenarios on a 173,000-acre landscape on the Deschutes National Forest. They also analyzed effects of a thinning strategy on subsequent dynamics of a simulated beetle outbreak.



John Laurence


The simulations suggested that thinning stands greatly reduced endemic bark-beetle-caused tree mortality. However, when a beetle epidemic was simulated by inducing drought stress, the beetle population migrated from outside the study area and attacked trees throughout the landscape, even when the majority of the area was thinned. A conclusion from these simulations is that large-scale thinning treatments do not reduce beetle-caused tree mortality under epidemic conditions. The results are supported by several published field studies.

This work resulted in a modeling framework tool that can be used to integrate the long-term potential impacts of bark beetles and management activities into landscape planning for wildfire risk and fuels treatments.

Contact: Alan Ager, aager@fs.fed.us, Western Wildland Environmental Threat Assessment Center; Jane L. Hayes, jlhayes@fs.fed.us, Managing Disturbance Regimes Program

Partners: USDA Forest Service Central Oregon Insect and Disease Service Center, Forest Health Technology Enterprise Team

Logging-induced soil compaction not always detrimental to tree growth

 IT IS CONVENTIONAL wisdom that when logging activities compact the soil, tree growth is negatively affected. Some have suggested that equipment trails should be tilled to ameliorate the compaction. Station scientists, however, have found that equipment trails are not always detrimental to tree growth, and ameliorative treatments may not be necessary on many sites. Three studies published this year indicate that tree growth of seedlings on equipment trails or growth of older trees adjacent to equipment trails was not reduced, and in some cases was increased, when compared to growth away from such trails.

Several caveats pertain, however. The impacts of harvesting equipment on soils will differ depending on initial soil

Tool: The Canopy Fuel Estimator



Thomas Terry

Researchers find that soil compaction is not always detrimental to tree growth.

conditions as well as conditions during harvesting operations. Equipment trails need to be properly designed for local conditions and the appropriate equipment selected for the project. And the conclusions only apply to soil compaction, not to other factors that could be associated with equipment traffic such as removal of topsoil, puddling, or establishment of nondesirable vegetation on disturbed areas.

Contact: Richard Miller, emeritus scientist, millersoils@aol.com, Resource Management and Productivity Program

Partners: Agenda2020, Mississippi State University, Oregon State University, Plum Creek Timberlands, Weyerhaeuser Company, USDA Forest Service Olympic National Forest

Description:

Fire behavior models need information about the type, quantity, and distribution of forest canopy fuels to predict potential fire movement and risk over the landscape. The Canopy Fuel Estimator (CFE) is a new software tool that characterizes canopy fuels over large areas using airborne laser scanning (LIDAR) data. The software automates the process of computing vegetation structure metrics from LIDAR data and then uses these metrics in canopy-fuel regression models to map canopy-fuel weight, crown bulk density, canopy base height, and canopy height across a landscape. Currently, CFE only includes fuel models applicable to forests in western Washington; however, the system allows users to use model sets based on their own regression results for forests in any area.

Use:

The CFE produces spatially explicit, high-resolution estimates of canopy fuel characteristics over large areas. Such data provide managers with baseline information describing canopy fuels. When used with fire behavior modeling software such as FARSITE, these data help managers predict fire severity and

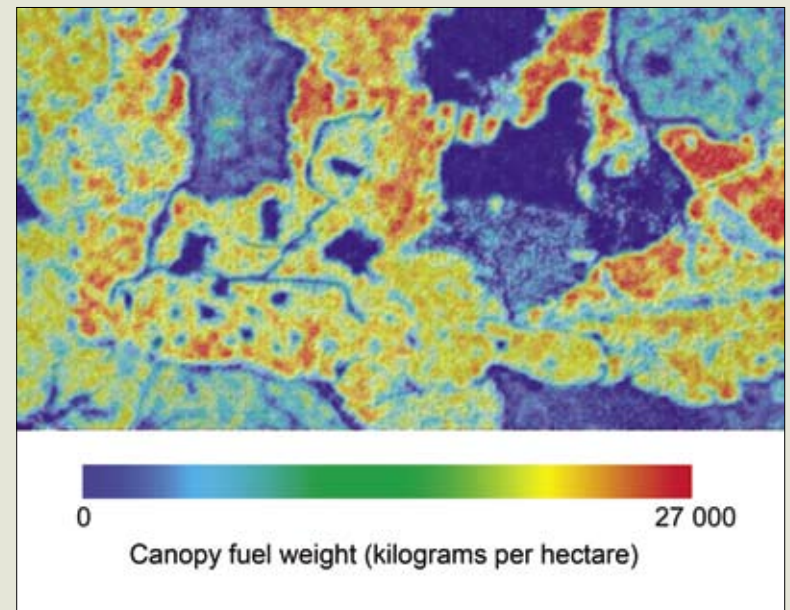
fire behavior across entire landscapes. The CFE approach was used to map canopy fuels over 100,000 acres at Fort Lewis Army Base in Washington. Several national forests, Bureau of Land Management, National Park Service, and several state land management agencies are undertaking large-area LIDAR vegetation mapping projects that can use the CFE package to better map canopy fuels.

How to get it:

CFE is available for download at <http://orsys.cfr.washington.edu/cfe/cfe.html>.

Contact:

Robert J. McGaughey, bmcgaughey@fs.fed.us, Resource Management and Productivity Program



The Canopy Fuel Estimator uses LIDAR data to determine where forest canopy conditions are most likely to support a crown fire.



Warren Devine

Researchers trench the perimeter of a plot to exclude competition from tree roots at this study site in Fort Lewis, Washington.

Root competition limits development of Douglas-fir saplings

SCIENTISTS EXAMINED the growth and morphology of Douglas-fir saplings in thinned, mature stands of Douglas-fir after excluding different types of root competition. Stem growth of saplings increased by 27 percent, and foliar biomass increased by 33 percent where root competition from overstory trees was excluded. Tree root

exclusion also increased frequency of buds and bud size on saplings and the retention of needles more than 4 years old.

Root competition from understory vegetation did not affect saplings because their development was already limited by shading and soil water competition from overstory trees. Although low- or moderate-intensity thinning of mature Douglas-fir may provide short-term increases in understory light, development of Douglas-fir saplings will likely be limited by the

intense root competition from overstory trees. This finding helps public and private land managers who are interested in managing multiaged Douglas-fir stands.

Contact: Warren Devine, wdevine@fs.fed.us, Resource Management and Productivity Program

Partner: Fort Lewis Military Reservation

Understory vegetation of young Douglas-fir forests is resilient to low-intensity thinning

SCIENTISTS INITIATED the Uneven-Age Management Project on the H.J. Andrews Experimental Forest in the late 1990s to evaluate alternative thinning practices for converting young, second-growth Douglas-fir plantations to stands that are diverse in their structure, age, and species composition.

After 5 years of multiple thinning treatments that removed few to many trees in any given area, researchers found relatively little change in the abundance and composition of the understory plant communities. The dominant woody shrubs and fern species regrew after each thinning treatment. Scientists found that the light to moderate degree of disturbance was not sufficient to offset the vigorous growth of preexisting species, or to permit the establishment of different species.

The process of stand conversion from a uniform, even-aged structural condition to a more variable, diverse uneven-aged structure requires several repeated thinnings.

If the management goal is to increase the abundance and diversity of under-story vegetation in young, second-growth Douglas-fir forests in the western Cascades, more substantial thinning treatments may be needed to create larger openings in the forest canopy.

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

Partner: USDA Forest Service Willamette National Forest



Rick Edwards

Western hemlock and Sitka spruce respond well to thinning

THE PRIMARY objective of the Cooperative Stand-Density Study, a long-term silviculture experiment located on the Tongass National Forest, is to understand how western hemlock-Sitka spruce stands of different ages and site productivities respond to a range of thinning intensities. This study was initiated in the 1970s. After 20 years, data were analyzed from 128 permanent study plots distributed over 250 miles. Scientists found that thinning well-stocked, even-aged, mixed-species stands of western hemlock and Sitka spruce in southeast Alaska significantly increased growth in thinned stands relative to that of unthinned stands, the effect being greater for younger stands or stands growing on more productive sites.

The models developed in this analysis will help land managers predict how western hemlock-Sitka spruce stands of different ages and site productivities respond to different thinning intensities in terms of diameter growth during the first 20 years after treatment.

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

Partner: USDA Forest Service
Tongass National Forest

Description:

Forest managers often use growth models to predict how trees will respond to different treatments. Previously, the equations used to predict growth and survival of Oregon white oak were based on only a few dozen trees, and those equations under-predicted growth when the results were compared to remeasured research plots. Station researchers created a data set of growth plots for Oregon white oak based on more than a thousand trees from several sources and then developed equations that were incorporated into a new release of the publicly available growth model ORGANON. The new equations predict the species to grow faster and be more responsive to management than was previously expected.

Use:

New equations predicting growth and survival of Oregon white oak have been published and the results compared to the models previously available. The new equations were recently used in a landscape analysis of various management alternatives at Fort Lewis Army Base, Washington.

How to get them:

Contact Connie Harrington, charrington@fs.fed.us, Resource Management and Productivity Program

Tool: New snag and log sampling methods and software

Description:

Snags and logs provide essential habitats for many forest animals, and land managers routinely monitor these structures in relation to other management goals. Accurate and efficient methods for sampling snags and logs have been integrated with software to facilitate evaluation of snag and log management and status in relation to other uses, including timber harvesting, firewood gathering, and other types of human access in the Northwestern United States.

Use:

These new methods and software eliminate large sources of sampling bias present in past methods and increase sampling efficiency by more than 50 percent compared to past methods, none of which had software to facilitate sample design and data analysis. These methods, software, and results from their application are being used by national forests in eastern Oregon, eastern Washington, Idaho, and western Montana as part of forest planning, revisions, amendments, and environmental assessments and impact statements.

Contact:

Michael Wisdom, mwisdom@fs.fed.us,
Managing Disturbance Regimes Program



Tom Iraci

Number of retained trees more important than retention pattern

IN THE PACIFIC Northwest, retaining live trees in harvest units is an integral part of forest management practices on federal lands, yet the ecological benefits that result from various levels or patterns of retained trees remain speculative. The Demonstration of Ecosystem Management Options (DEMO) study was established in 1994 to address these information gaps.

Treatments represent strong contrasts in the level (15 to 100 percent) and pattern (dispersed vs. aggregated) of retention in mature Douglas-fir forests. A variety of

ecological and microclimatic responses were measured, and public perceptions of visual quality were evaluated.

Short-term results indicate that the level of green-tree retention has a greater influence than does the pattern of retention on most ecological and social response variables.

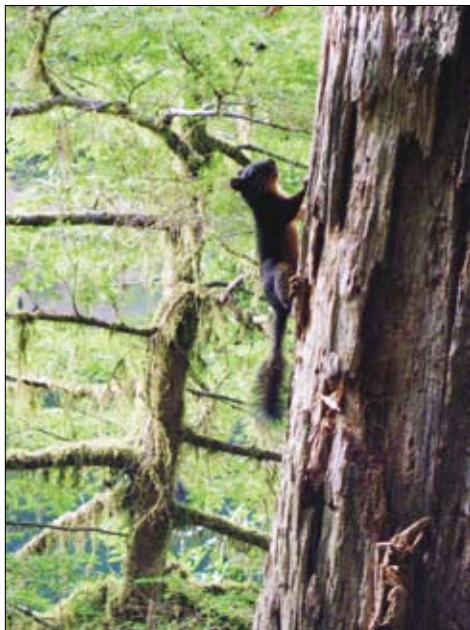
Scientists found that combining relatively large (at least 2.5 acres) aggregates of uncut trees with dispersed trees at levels considerably greater than the current minimum standard of 15 percent may be the most effective strategy for conserving species that are sensitive to disturbance, ameliorating environmental

stresses associated with overstory removal, and gaining public acceptance of variable-retention harvests.

These and other key findings were presented and discussed at a technology transfer workshop for forest managers in November 2007 and at the IUFRO conference *Old Forests, New Management* in February 2008 held in Tasmania.

Contact: Charley Peterson, cepeterson@fs.fed.us, Resource Management and Productivity Program; and Keith Aubry, kaubry@fs.fed.us, Ecosystem Processes Program

Partners: Oregon State University, University of Oregon, University of Washington, USDA Forest Service Umpqua and Gifford Pinchot National Forests, Washington State Department of Natural Resources



Pete Bisson

Pilot study refines techniques for mapping ecology, climate, and topography

SCIENTISTS COMPLETED initial work on a pilot study to develop and refine “nearest neighbor” mapping techniques for a nationwide project. This project will use forest inventory data, satellite image and ancillary data, and nearest neighbor techniques to construct a moderate-resolution national data set of forest attributes.

These data products will be used in applications ranging from localized scenario modeling (e.g., fire, insects, pathogens, critical habitat) to broad ecosystem modeling (e.g., carbon sources/sinks, climate changes, and ecosystem services).

Forest resource managers and policy-makers increasingly require spatially explicit, border-to-border data products that provide statistical summaries for a large array of forest attributes at small to large spatial extents. Nationwide forest attribute data products that are currently available offer coverage for only a few forest attributes of interest and generally lack useful measures of statistical validity.

Contact: Jerome Beatty, jbeatty@fs.fed.us, Western Wildland Environmental Threat Assessment Center

Partners: Michigan State University, Northern Research Station, Oregon State University, USDA Forest Service Forest Health Technology Enterprise Team and Remote Sensing Applications Center

More information: See the Nationwide Forest Imputation System Web site at <http://blue.for.msu.edu/NAFIS/>

Description:

EMDS 4.0 provides integrated, multiscale landscape analysis and planning for any spatial scale or combinations of scales. EMDS is an extremely general solution framework that has been applied to many environmental management problems around the world since its initial release in 1997.

Use:

This latest version maintains compatibility with contemporary operating systems and geographic information systems (GIS) widely used in the U.S. Department of Agriculture, Department of the Interior, and state, federal, and private institutions. A significant improvement is the implementation of .NET, a programming interface that increases speed and stability. The latest version also offers an alternative, stand-alone implementation for less technically inclined end users who may be uncomfortable with conventional GIS interfaces. EMDS 4.0 supports evaluation of performance with respect to outcomes over the long term, thus supporting a key requirement of environmental management systems.

Contact:

Keith Reynolds, kreynolds@fs.fed.us, Managing Disturbance Regimes Program

How to get it:

<http://www.institute.redlands.edu/emds/>



GOAL ACCOMPLISHMENTS

*Mecca Flats, Deschutes River,
Oregon; © Miles Hemstrom*

GOAL 4: Communicate science findings
and enhance their application

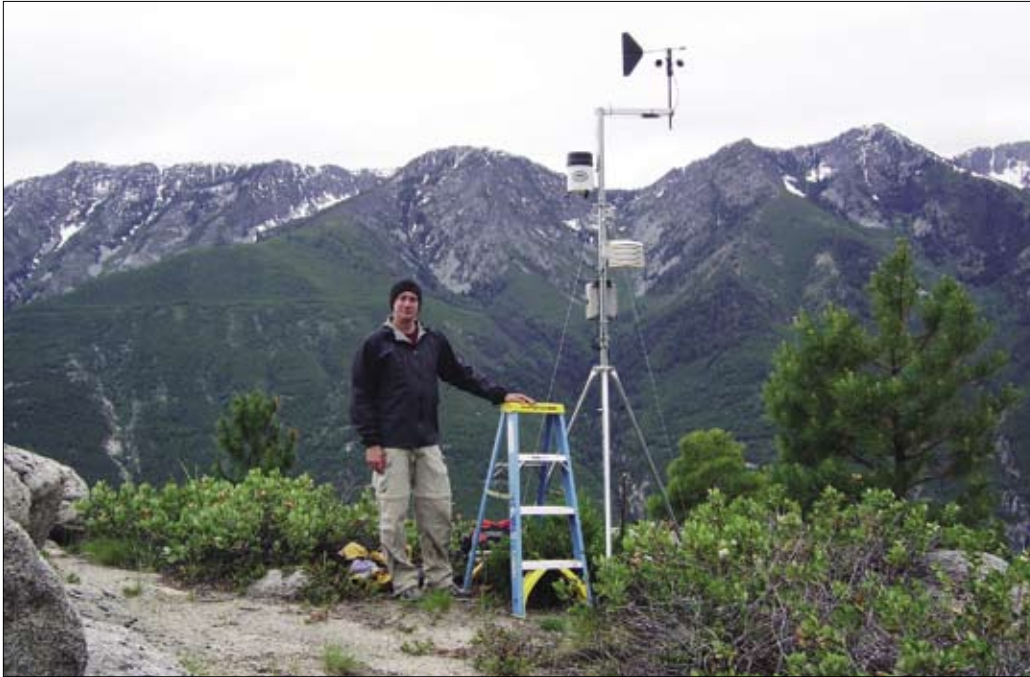


Key Products

- The Climate Change Resource Center Web site was launched to provide information for land managers developing adaptation and mitigation strategies for climate change.
- Options for climate change adaptation for national forests were summarized for the first time.
- Scientists taught a course to help land managers understand how various types of vegetation models can be used in decisionmaking that addresses the uncertainty of future climate.
- A new online multimedia guide provides field procedures on assessing and designing culverts that provide optimal passage for fish and other aquatic organisms.
- Land and fire managers identified their needs for science information as they manage aquatic ecosystems in fire-prone landscapes.
- Youth from inner-city Portland, Oregon, explored watersheds and wildlife as part of a long-term program conducted by the station and its partners.
- Books about rare and little-known species, forest and human community connections, Mount St. Helens, and more were coauthored by station scientists.

Researchers at Starkey Experimental Forest and Range, Oregon.





Rick Woodsmith

Station scientists identify climate change adaptation options



ONLY RECENTLY have the Forest Service and other federal agencies begun thinking about ways to adapt to a changing climate. Station scientists

Outcome: *Olympic National Forest is implementing climate-smart actions in operational management and long-term planning.* contributed to the first effort to summarize adaptation options for national forests and provide the scientific basis for those options. The report, *Synthesis and Assessment of Adaptation Options for Climate Change in National Forests*, was

done as part of the U.S. Climate Change Science Program.

Also, station scientists and the University of Washington Climate Impacts Group, have established a long-term science-management partnership with the Olympic National Forest to develop locally focused adaptation options for addressing climate change. Through workshops, presentations, and consultations, they are providing the scientific basis for implementing climate adaptation management and planning on the Olympic National Forest. Further workshops explaining the Olympic National Forest pilot project have been conducted with other national forests in

the region, and similarly focused planning processes to address climate change may be implemented on other regional forests.

Contact: David L. Peterson, peterson@fs.fed.us, Managing Disturbance Regimes Program

Partners: National Center for Atmospheric Research, U.S. Environmental Protection Agency, University of Washington, USDA Forest Service Olympic National Forest

Station and Pacific Northwest Region address climate change together

THE STATION AND Pacific Northwest Region are coordinating their response to climate change through the Climate Change Strategy Group. The group works with leadership and employees to develop ways to reduce our carbon footprint and to manage forests so they can adapt to climate change. The group hosted a Climate Change Short Course in Portland, Oregon, for 200 Forest Service employees to familiarize them with current climate change information and concepts. It has also coordinated a series of sustainable operations and green team workshops across Oregon and Washington, and shared approaches for adapting to and mitigating climate change effects with numerous national forests.

Contact: Becky Gravenmier, bgravenmier@fs.fed.us, Station Director's Office

Partners: USDA Forest Service Pacific Northwest Region

More information: Presentations from the Climate Change Short Course are available at <http://www.fs.fed.us/ccrc/video/>

Station contributes to national primer on climate change and water

Climate Change and Water: Perspectives From the Forest Service is a brochure that succinctly explains the vital role healthy and resilient watersheds have in maintaining clean water supplies, and how these watershed services could be compromised if the climate changes as projected. It outlines steps resource professionals and landowners can take to prepare for climate change, manage for watershed resiliency, support entrepreneurial projects, advance knowledge, and connect with the public. It emphasizes that actions taken now can minimize future impacts.

Contact: Michael Furniss, mfurniss@fs.fed.us, Communications and Applications Group

Partners: USDA Forest Service National Forest System and State and Private Forestry

More information: See *Climate Change and Water: Perspectives From the Forest Service* at <http://www.fs.fed.us/emphasis/products/water-climate-brochure.pdf>



John Laurence

Scientists teach course on climate change, vegetation models, and decisionmaking

CLIMATE CHANGE and its impacts add another layer of complexity to the decision environment encountered by forest managers, planners, policymakers and other decisionmakers. Planners and managers have long used vegetation models for decisionmaking and communications, but these models differ in their ability to handle uncertainty.

Station scientists developed and taught a course that examined different classes of vegetation models with particular emphasis on their utility for management and planning under climate uncertainties. The course also reviewed generalities of climate change that are useful for decisionmaking purposes. Video presentations from this short course are available online, and scientists are developing a publication on vegetation modeling and climate change.

Contact: Charles G. "Terry" Shaw, cshaw@fs.fed.us, Western Wildland Environmental Threat Assessment Center

Partners: JISAO CSES Climate Impacts Group at the University of Washington, USDA Forest Service, Rocky Mountain Research Station

More information: See <http://forestryvideos.com/videos/>



Description: The Climate Change Resource Center (CCRC) Web site is a new resource for land managers developing adaptation and mitigation strategies for climate change. The site offers educational information—including basic science modules that explain climate and climate impacts—as well as decision-support models, maps and simulations, and toolkits that address common Forest Service management and planning situations.

In addition to a more technical subset of educational resources, such as an annotated bibliography and more than 20 topic papers, the Web site also features a primer on climate change and a growing suite of video lectures that may interest more general audiences, including members of the media and other interested publics.

Since the site's launch in March 2008, it has received 11,040 visits. Visitors are from all 50 states, Puerto Rico, and 101 other countries.

The CCRC is a collaborative project of the Pacific Northwest, Pacific Southwest, and Rocky Mountain Research Stations and the Western Wildland Environmental Threat Assessment Center.

How to get it:

<http://www.fs.fed.us/ccrc/>

Contact:

Michael Furniss, mfurniss@fs.fed.us, Communications and Applications Group

Online tutorial leads to improved aquatic organism passage through culverts



STATION SCIENTISTS produced an online, multimedia guide for field procedures on assessing and designing culverts that provide optimal passage for

Outcome:
Land and road managers nationwide use online course to improve fish passage through culverts.

fish and other aquatic organisms. The tutorial takes the place of a 1-week course, thus saving time, eliminating travel costs, and reducing participants' carbon

footprint. The tutorial is highly interactive and includes video, audio, animation, live field forms, and links to other resources.



It covers 50 topics relating to safe, effective culvert inventory and assessment. This tutorial complements a national guide written by a station scientist.

The online tutorial is being used nationwide by land and road managers working

for counties, states, timber companies, the Bureau of Land Management, Forest Service, and National Park Service.

Contact: Michael Furniss, mfurniss@fs.fed.us, Communications and Applications Group

Partner: San Dimas Technology and Development Center

More information: See "A tutorial for procedures for inventory and assessment of road-stream crossings for aquatic organism passage" at http://www.fs.fed.us/pnw/pep/PEP_inventory.html

Case studies facilitate advanced learning about culverts and fish passage

ONCE BASIC principles are mastered, advanced learning takes place through case studies.

This is widely recognized in law and medicine, but also holds true for other

Outcome:
Federal Highway Administration uses case studies to guide design and retrofit of culverts.

professions. Hydrologists, engineers, and other land and road managers who work to ensure safe roads and passage of aquatic organisms have

contributed to 46 case studies from across the country. Designing and constructing road stream crossings can be complex, and a wide variety of solutions can exist, depending on the situation. It is also an inherently expensive endeavor, and mistakes can be very costly. Accessible online, these cases emphasize the application of general principles, the means used to address a wide variety of site conditions, and the



Pete Bisson

lessons learned. The Federal Highway Administration has adopted this resource in its effort to guide design and retrofit of highway culverts for fish passage.

Contact: Michael Furniss, mfurniss@fs.fed.us, Communications and Applications Group

Partner: USDA Forest Service Washington office Engineering and Fisheries

More information: See <http://www.stream.fs.fed.us/fishxing/case.html>

Progress made toward managing fish and fire in the same landscape



THE LONG-TERM effects of fire on aquatic ecosystems are not well understood. During a two-part workshop, land managers and fire managers identified their information needs for managing aquatic ecosystems in fire-prone areas. Scientists then developed summaries of existing research, theories, and models in response to the problem areas identified by the land and fire managers.

This effort produced a specific outline of research needed to help policymakers and land and fire managers make more informed choices. The national Joint Fire Science Program is using this assessment of research needs to determine subsequent study programs. The Pacific Northwest and Rocky Mountain Research Stations will use the information to guide new research, syntheses of existing research, and science delivery efforts.

Contact: Jamie Barbour, jbarbour01@fs.fed.us, Focused Science Delivery

Partners: The Keystone Center, USDA Forest Service Pacific Northwest Research Station, USDI Bureau of Land Management, U.S. Fish and Wildlife Service

Introducing more kids to the wonders of the woods



To GET MORE children and young people outdoors, the station contributes to several conservation education programs. One of these is Inner City Youth Institute (ICYI), which provides natural resource education programming to Portland, Oregon, youth. It targets minority and underrepresented communities as a way to encourage students to pursue higher education and careers in natural resources and environmental fields. ICYI received the Forest Service's 2008 More Kids in the



Becky Bittner

Students at the ICYI summer camp learn to identify tree species.

Woods challenge cost-share funding for a new Watershed and Wildlife Exploration project. About 200 students participate in ICYI programs annually.

Contact: Becky Bittner, bbittner@fs.fed.us, Communications and Applications Group

Partners: Portland Public Schools, Oregon State University, Urban League of Portland, USDI Bureau of Land Management



Alan Ager

More research is needed to effectively manage fish and fire in the same landscape.

Climate change task force begins evaluating genetic and silvicultural options

STATION SCIENTISTS and their colleagues at Oregon State University have formed a task force of forest managers, forest geneticists, tree breeders, silviculturists, and tree physiologists to explore management options for adapting to the effects of climate change on forests in the Western United States.

As part of its outreach education efforts, the task force developed a Web site to inform the public about the potential

Tool: Electronic “feeds” brings research to users

To better meet user’s needs, the station has made its popular content available through electronic subscriptions. Subscribing to a Really Simple Syndication (RSS) feed causes new publications or press releases to be automatically delivered to the subscriber’s computer.

Currently, more than two dozen feeds are available. Subscribers can receive specific publications, such as *Science Findings*, or notification about new publications under a variety of topic areas, including climate change, fire, or forest management. Because users subscribe to just those feeds that are of interest to them, RSS puts users in control of the information they receive from the station.

How to get it:

See <http://www.fs.fed.us/pnw/RSS/index.shtml>

Contact:

Tiffany Dong, tdong@fs.fed.us, Communications and Applications Group

effects of climate change and forest management options. The site has links to relevant publications, presentations, and upcoming workshops.

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

Partner: Oregon State University

For more information: See <http://tafcc.forestry.oregonstate.edu/index.html>

TimeMap rounds up 150 years of research

RESEARCH ACTIVITIES in the Copper River Delta and Cordova Ranger District of the Chugach National Forest date back more than 150 years. Until recently, a person would have been hard pressed to locate some of these studies or find reliable records of what was done over the years. To address this need, researchers constructed an online visual index arranged by time and topics. This innovation in knowledge management allows users to see all research and management activities on a single “map,” arranged by time, in all disciplines and topics. This index facilitates discoveries and preserves a wealth of information and history.

Contact: Michael Furniss, mfurniss@fs.fed.us, Communications and Applications Group

Partner: USDA Forest Service Chugach National Forest

More information: <http://www.fs.fed.us/pnw/timemaps/crd/>

PNW Media Highlights, 2007–2008

THE DEVASTATING WINTER floods in Washington State’s Lewis County prompted a number of news stories in December 2007. Reporters sought the expertise of hydrologist Gordon Grant when they had questions about the relationship between the area’s past logging and building practices and the massive floods. Grant was quoted in stories run by *The Bellingham Herald*, *The Seattle Times*, *The Chronicle* (Centralia, Washington), and *The Columbian* (Vancouver, Washington). Later, Grant was quoted in stories on Oregon’s Marmot Dam removal and on glacial melt at Mount Rainier and the possibility of debris flows. Stories appeared on the television program *Oregon Field Guide* and in *USA Today*, *The Seattle Post-Intelligencer*, and *The Olympian* (Washington).

Research wildlife biologist Keith Aubry and colleagues were featured in several news articles highlighting their work to study the elusive wolverine in the North Cascades and describing the capture and radio-collaring of the study’s sixth animal. Stories appeared in several outlets, including *Audubon* magazine, *The Everett Herald* (Washington), *The Wenatchee World* (Washington), and *Methow Valley News* (Washington).

Also generating coverage was the discovery that extracts from the heartwood of yellow-cedar can halt the growth of sudden oak death, a dangerous pathogen responsible for widespread tree death in



D. Peter

Once widespread, oak communities now occupy as little as 1 percent of their historical range in some areas of the Pacific Northwest.

California and Oregon. The study was co-led by research forester Rick Kelsey, who was interviewed for stories that appeared in *Agricultural Research News* and *Capital Press* (Salem, Oregon).

Research forester Connie Harrington's studies on the region's declining oak communities also drew attention. Once widespread in parts of the Pacific Northwest's lowlands, oak communities now occupy as little as 1 percent of their

historical range in some areas. Stories on Harrington's research and the species' plight appeared in newspapers all along the Interstate 5 corridor—the historical range of the oak—including *The Seattle Post-Intelligencer*, *The Olympian* (Washington), *The News Tribune* (Tacoma, Washington), *The Chronicle* (Centralia, Washington), and *The Corvallis Gazette-Times* (Oregon).

Contact: Sherri Richardson Dodge, srichardsondodge@fs.fed.us, Communications and Applications Group

Station funds five new Agenda2020 studies

AGENDA2020 IS A national partnership committed to sustainable forestry and its application in the United States. Funded by the Forest Service and the American Forest and Paper Association (AF&PA), the partnership fosters research exploring numerous high-priority areas.

From 2002 to 2007, numerous collaborative studies were established in the Pacific Northwest through a combined new investment of \$2,592,000 from the Pacific Northwest Research Station, \$465,000 in matching funds and in-kind from timber companies, and \$196,000 in-kind from universities. This year the station, AF&PA Western Research Committee, and Bureau of Land Management awarded funding to the following studies:

- Developing red alder growth and yield models
- Predicting genetic gain using growth models and genetic-gain trials
- Managing forest plantations in the Pacific Northwest: additional site characterization and instrumentation for paired-tree fertilization
- Performance of Douglas-fir as determined by climatic differences between seed sources and planting sites

- Effectiveness of modern forest practices for maintaining water quality and fish habitat in headwater streams of western Oregon using paired watersheds

Contact: Charley Peterson, cepeterson@fs.fed.us

Partners: American Forest & Paper Association, National Council on Air and Stream Improvement, Oregon State University, Plum Creek Timber Company, Port Blakely Tree Farm, University of Washington, USDI Bureau of Land Management, U.S. Geological Survey, Weyerhaeuser Company

Station provides science review for regional planning activities

THE STATION ROUTINELY provides science support to federal land use planning efforts by developing new products, synthesizing findings, and providing consultations and scientific reviews. This year, the station completed a science review of a regional process for evaluating aquatic ecological sustainability. The review included scientists from Pacific Northwest and Southwest Research Stations and the National Marine Fisheries Service. The review provided constructive feedback that will help national forests in Oregon and Washington ensure that the best available science is considered as they revise forest management plans.

Contact: Becky Gravenmier, bgravenmier@fs.fed.us, Station Director's Office

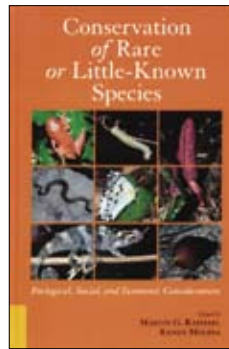
Partner: USDA Forest Service Pacific Northwest Region



FEATURED PUBLICATIONS

Conservation of Rare or Little-Known Species

Conservation of Rare or Little-Known Species, edited by Martin Raphael and Randy Molina, evaluates approaches and



management options for protecting rare or little-known terrestrial species. It also addresses social and economic implications of alternative conservation approaches. The

book brings together leading ecologists, biologists, botanists, economists, and sociologists to classify approaches, summarize their theoretical and conceptual foundations, evaluate their efficacy, and review how each has been used. It fills a gap in conservation biology literature by emphasizing the potential importance of species that often constitute the majority in many ecological communities.

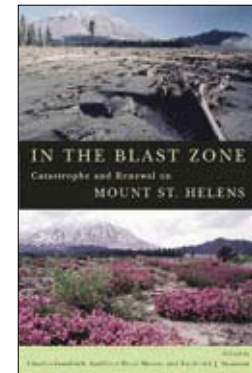
Contact: Martin Raphael, mraphael@fs.fed.us, Ecosystem Processes Program

Partners: Oregon State University, Society for Conservation Biology, The Nature Conservancy, USDA Forest Service Rocky Mountain Research Station, USDI Bureau of Land Management, USDA Forest Service National Forest System, USDI Fish and Wildlife Service, USGS Biological Resources Division

More information: Raphael, M.; Molina, R., eds. 2008. *Conservation of Rare or Little-Known Species*. Washington, DC: Island Press. 392 p.

In the Blast Zone: Catastrophe and Renewal on Mount St. Helens

THE LONG-TERM Ecological Reflections program brings together nature writers, poets, philosophers, and scientists to reflect on the natural world. One such gathering at Mount St. Helens led to the publication of *In the Blast Zone: Catastrophe and Renewal on Mount St. Helens*. This anthology of essays and poems addresses ecological, geological, and human dimensions of the 1980 eruption of the volcano. Writers offer their interpretations of the volcanic landscapes—the resilience of life, the changing character of a severely altered landscape, and the value of personal relationships in interdisciplinary inquiry in such a place. Writings from *In the Blast Zone* are now used in the interpretive program in the National Volcanic Monument, adding a humanities dimension to the interpretive program dominated by geology and ecology lessons.



Contact: Fred Swanson, fswanson@fs.fed.us, Ecosystem Processes Program

Partners: Oregon State University

More information: Goodrich, C.; Moore, K.D.; Swanson, F.J. 2008. *In the Blast Zone: Catastrophe and Renewal on Mount St. Helens*. Corvallis, OR: Oregon State University Press. 128 p.

Integrated Restoration of Forested Ecosystems to Achieve Multiresource Benefits

Integrated Restoration of Forested Ecosystems to Achieve Multiresource Benefits is the byproduct of the 2007 National Silviculture



Workshop. These proceedings present new ideas in silviculture and forest management for producing multiple resource benefits. Topics include ecosystem

services, forest restoration and climate change, increasing biodiversity, fuel reduction, improving wildlife habitat, and forest insect, disease, and health issues.

Contact: Robert Deal, rdeal@fs.fed.us, Focused Science Delivery

More information: PNW-GTR-733. Integrated Restoration of Forested Ecosystems to Achieve Multiresource Benefits. <http://www.treeseearch.fs.fed.us/pubs/29399>

Forest Community Connections

THE PAST TWO DECADES have seen a dramatic shift in the social forces that shape natural resource policy. A new book, *Forest Community Connections*, examines the complex relationships that have emerged among individuals, organizations, communities, and forest ecosystems. Bringing together perspectives from sociology, anthropology,

Pete Bisson



Log bridge on the Olympic National Forest.

political science, and forestry, the authors confront a range of management issues, including wildfire risk, forest restoration, labor force capacity, and the growing demand for a variety of forest goods and services.

The book reveals that the connections that communities have to forests are not simple or static; they are complex and evolving. Understanding these connections is important because it is through these connections that the goals of sustainable forest management will be realized. Through diverse and detailed



approaches, this book takes stock of the ways communities interact with forest ecosystems and the opportunities and challenges of community-based forest management and collaborative forest management.

Contact: Ellen Donoghue, edonoghue@fs.fed.us, Human and Natural Resources Interactions Program

Partners: Colorado State University, Institute for Culture and Ecology, Northern Arizona University, North Carolina State University, Oregon State University, Southern Oregon University, University of Minnesota, University of Montana, University of Oregon, University of Vermont, USDA Forest Service Pacific Southwest Research Station

More information: Donoghue, E.M.; Sturtevant, V.E. 2008. *Forest Community Connections*. Washington, DC: Resources for the Future. 280 p.