

# Resource Monitoring and Assessment Program

## **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**

The mission of the Resource Monitoring and Assessment Program is to improve forest and range ecosystems by developing and applying inventory and monitoring methodology to maintain current comprehensive inventories and conduct multiscale assessments of the status, trends, and prospective futures of the region's ecosystems.

## **Research Problem Statements**

**Problem 1:** How can we provide essential information on the status, extent, and characteristics of forest and rangeland in the Pacific region and their change over time to decisionmakers?

**Problem 2:** How can we increase the efficiency and add value to inventory and monitoring efforts through the development of new tools, techniques, and methodology?

**Problem 3:** How can inventory and monitoring data be used to understand the effects of human use, climate, and natural disturbances on the forest and rangeland condition?

## **Key Findings in 2011**

### **New field guide highlights nonnative invasive plants found in Pacific Coast forests**

Nonnative plants affect the composition and function of natural and managed ecosystems. They can limit or degrade land use options and can be costly to eradicate. Despite their influence, very little comprehensive information on the abundance, distribution, and impact of nonnative invasive plants is available. To remedy this, researchers developed a prioritized list of nonnative invasive plants affecting forest lands in the Pacific coastal states of California, Oregon, and Washington. They produced a field guide featuring 56 invasive plants believed to be the most prevalent or problematic. The color photos of each plant in various stages of development and

written descriptions in nontechnical language facilitate reliable identification in the field.

The Pacific Northwest Research Station Forest Inventory and Analysis (FIA) program is considering adopting the list and guide for targeted sampling of nonnative plants. Future FIA analyses would be able to assess the distribution and impact of these key nonnative species more effectively than current protocols.

**Contact:** Andy Gray, agray01@fs.fed.us, Resource Monitoring and Assessment Program

**Partners:** Institute of Applied Ecology, University of Washington

**For more info:** Gray, A.N.; Barndt, K.; Reichard, S.H. 2011. Nonnative invasive plants of Pacific coast forests: a field guide for identification. Gen. Tech. Rep. PNW-GTR-817. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 91 p. [http://www.fs.fed.us/pnw/pubs/pnw\\_gtr817.pdf](http://www.fs.fed.us/pnw/pubs/pnw_gtr817.pdf)

### **LIDAR used to estimate biomass supply near interior Alaska communities**

Remote rural communities in interior Alaska generally rely on fossil fuel to meet their power and heating needs. Diesel prices increased 83 percent from 2000 to 2005, however, and utility costs can amount to more than a third of a household's income. Wood-based energy may be a viable alternative, but estimates of available forest biomass are needed before comprehensive plans for bioenergy production can be developed. Interior Alaska has relatively few roads, making it difficult to measure biomass availability over a large area using conventional ground-based sampling methods. Therefore, researchers tested the precision of data collected by aircraft equipped with LIDAR (airborne laser scanners) and used it in conjunction with data from sparse field plots.

The LIDAR sampling approach estimated total biomass with an 8 percent level of precision, indicating that the 200 000-hectare study in the upper Tanana valley contained 8.1 million ( $\pm$  0.7 million) metric tons of biomass. They found that precision increased when plot locations were more accurately located, when larger plots were measured, and when additional smaller trees in the ground plots were measured.

This study indicates that airborne LIDAR sampling can be useful in planning bioenergy development in interior Alaska. In regions with very limited road access, an approach to field plot selection within accessible areas can be used to ensure that representative plots are measured to develop robust LIDAR biomass estimates.

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**Partner:** Oregon State University

**Scientists evaluate methods for estimating biomass of leaves and branches**

Different sampling schemes have been used to estimate tree foliar biomass, but the effectiveness of these schemes has rarely been evaluated. To address this, researchers used extensive branch and tree foliage biomass data sets for Douglas-fir and ponderosa pine to evaluate the statistical and cost efficiency of various sampling schemes. They wanted to know how inclusion of auxiliary data (e.g., branch diameter or position) affected estimates of foliar biomass. Although auxiliary information may improve the precision of the estimators, it involves a cost: the information has to be collected and compiled, and it may require processing larger samples. Researchers found that including auxiliary information after samples were drawn resulted in a more cost-efficient sampling scheme than when auxiliary information was used earlier in the design phase of the sampling scheme. For both species, a simple systematic sampling design with ratio estimation provided the most efficient method for estimating tree foliage biomass.

The results can be used to develop efficient and cost-effective methods to estimate individual tree foliar and branch biomass. These methods will help improve estimates of forest and ecosystem biomass and carbon.

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**Partners:** Oklahoma State University, Oregon State University, University of Maine

**New models help detect spread of sudden oak death**

Sudden oak death (SOD) was discovered in Oregon forests in 2001. Despite considerable control efforts, the disease continued to spread. In response, scientists developed two models to map where SOD was likely to become established and its risk of spread. The scientists determined that 40 square miles of forested land were likely invaded by 2009, and that the disease threatens more than 1,300 square miles of forests across western Oregon. The greatest risk is in southwest Oregon where susceptible host species, such as tanoak, are concentrated. The Oregon Department of Forestry and other agencies are using the models to prioritize early detection and eradication efforts in the state.

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**Partners:** Oregon Department of Forestry, Oregon State University, University of North Carolina at Charlotte

**Use:** Oregon Department of Forestry uses models in eradication efforts.

### **Choice of model influences live-tree carbon estimates**

Estimates of the amount of carbon stored in a tree are influenced by numerous uncertainties. One of them is model-selection uncertainty: the user has to choose among multiple empirical equations and conversion factors that can be plausibly justified as locally applicable to calculate the carbon store from inventory measurements such as tree height and diameter at breast height (DBH). Researchers quantified model-selection uncertainty for the five most common tree species in northwest Oregon. They found that model-selection error may introduce 20 to 40 percent uncertainty into a live-tree carbon estimate, making this form of error the largest source of uncertainty when estimating live-tree carbon stores. Uncertainty from sampling error, represented as a 95-percent confidence interval, was only 6 percent. Predicted carbon content of individual trees can vary even more among model aggregating pathways, especially the predictions for large trees, which on the Pacific coast comprise an unusually large share of carbon stores.

Model-selection uncertainty is not an easily remedied error and may call into question the premise of tracking forest carbon with the precision and accuracy required to support contemplated offset protocols. The greatest risk is the potential for choosing a particular calculation pathway to justify a preferred outcome.

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**Partner:** Oregon State University

### **Forest Inventory and Analysis in the Pacific Islands**

Researchers collected, analyzed, and summarized field data gathered on islands throughout the western Pacific. They summarized forest information for the Federated States of Micronesia and compared it to prior vegetation mapping work done there. Researchers found that the extreme diversity of vegetation across Micronesia can be attributed to differences in longitudinal climatic influences and human land use practices. Similar data collection and analysis of forest resources were done on the Commonwealth of the Northern Mariana Islands; there researchers found that urban areas have grown, contributing to losses in forest land area. On the Marshall Islands, rising sea levels are threatening numerous native plant species.

Data and summaries from these inventories are used by island groups to develop their statewide assessments and resource strategies that enable them to compete for funding. The data also are used to guide resource management and policy decisions.

**Contact:** Joseph Donnegan, jdonnegan@fs.fed.us, Resource Monitoring and Assessment Program

**Partners:** American Samoa Forestry; Department of Land and Natural Resources, Commonwealth of the Northern Mariana Islands; Federated States of Micronesia Forestry; Kosrae Forestry; Marshall Islands Forestry; National Tropical Botanical Garden; University of Guam; USDA Forest Service Pacific Southwest Research Station, State and Private Forestry

## Tools

**Tools:** LandTrendr and TimeSync

**Description:** These tools are used in tandem to detect trends in forest disturbance and recovery. LandTrendr (Landsat-based detection of Trends in Disturbance and Recovery) is a mapping tool that automatically extracts information on land surface changes (e.g., fire, insect and disease damage, timber harvesting or regrowth) from Landsat satellite imagery. TimeSync is a companion image interpretation software tool for synchronizing algorithm and human interpretations of Landsat imagery. These tools capture both short-duration events such as harvest and fire, and long-term trends such as declines in forest health and regrowth. Researchers can use these new tools to comprehensively map change over every Landsat pixel (30 m) since 1972 in forested ecosystems and understand the accuracy of the maps.

**Use:** The National Park Service uses these tools for its inventory and monitoring program. The Forest Service Pacific Northwest Region uses them for the Effectiveness Monitoring Program of the Northwest Forest Plan. The Pacific Northwest Research Station, Oregon State University, National Aeronautics and Space Administration (NASA) Goddard Space Flight Center, and the University of Maryland are using these tools to help characterize the U.S. carbon budget.

**How to get it:** <http://landtrendr.forestry.oregonstate.edu>

<http://www.fsl.orst.edu/larse/>

**Contact:** Warren Cohen, [wcohen@fs.fed.us](mailto:wcohen@fs.fed.us), Resource Monitoring and Assessment Program

**Partners:** Oregon State University, NASA, University of Maryland, USDA Forest Service Rocky Mountain Research Station

**Tool:** PNW-FIADB

**Description:** This tool allows users to work with the database populated and maintained by the Pacific Northwest Research Station's Forest Inventory and Analysis team. Users can answer questions about the status and trends of forest resources by summarizing data on live and dead trees, down woody materials (fuels), and understory vegetation.

**Use:** Resource managers and policymakers can use this tool to help inform their

decisionmaking process. The LANDFIRE project used the database to update its comprehensive fuels maps and spatial data layers for the Pacific Northwest. The California Climate Action Registry used the database to develop baseline levels of carbon stocks in private forests in the state. The database was used to quickly respond to congressional requests about biomass size distribution and the availability of wood supplies from national forests.

**How to get it:** Contact Karen Waddell, [kwaddell@fs.fed.us](mailto:kwaddell@fs.fed.us), Resource Monitoring and Assessment Program

## **Symposia, Workshops, and Tours**

**2011 National FIA User Group Meeting:** Twenty-six clients attended this workshop in Sacramento, California. They learned how field measurements are made and used to produce the Forest Inventory and Analysis (FIA) data used throughout the Nation.

**Forest Inventory and Analysis (FIA) Client Meetings and Data Workshops:** FIA held a symposium in Anchorage, Alaska, to discuss current research activities in the Pacific Northwest. The following day FIA hosted a data workshop where clients were guided through methods for analyzing FIA data and using them to answer challenging questions about natural resources. About 40 people attended the event. A similar event was held at Magness Tree Farm, Oregon, for 15 members of the Society of American Foresters. A third meeting and workshop was held at Portland State University, Oregon, for about 10 faculty and staff.

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