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Forest Inventory and Analysis: The Nation's Forest Inventory Program

A National Forest Service Program with Regional Roots

BY GLENN A. CHRISTENSEN

Inventory data collected by the Forest Service's Forest Inventory and Analysis (FIA) are being used in ways never imagined or thought possible when Congress established the program in 1928. Today, FIA data are used to address critical questions of climate change and carbon flux, wildfire hazard reduction and post-fire effects, and tree species health and migration, and to develop the next generation of models and resource tools available to forest managers. This issue of the *Western Forester* focuses specifically on FIA. We highlight some of the work being done regionally at FIA's Pacific Coast and Alaskan regions based out of the Forest Service's Pacific Northwest (PNW) Research Station.

PHOTO COURTESY OF DAN IRVINE

An FIA crew measuring inventory plots in Alaska is treated to a stunning view as they hike in.

Origins of the FIA program

Currently organized under the Research and Development branch of the Forest Service, FIA was originally established by Congress in 1928 to conduct a survey of the timber supply on national forests. The newly created program was charged to report back to Congress every 10 years on the status of the nation's timber supply including the growth, drain, and projected requirements for forest products.

Initially installed in the 1930s, the first inventories of Oregon and Washington used a combination of sampling methods from timber type maps to line transects with sample plots. These first measurements were published in 1940 as a comprehensive report on the forest resources of the Douglas-fir region by H.J. Andrews and Robert Cowlin. The first Forest Service timber surveys in coastal Alaska followed World War II in the 1950s as an effort to support growing interest for a pulp industry in the southeast region of the state. In the 1960s, interior Alaska was included in the survey effort and in 1967 O. Hutchison published these early surveys as the first comprehensive statistical-based report of Alaska's forest resources (see sidebar on page 3 for more information).

Seventy years after originally established, FIA underwent a major change with the passage of the Agriculture Research, Extension and Education Reform Act of 1998 (the Farm Bill), which established an annual system of forest inventory across the country that includes a consistent plot design, data collection methodology, estimation and compilation procedures, and data reporting requirements. The annual inventory system expanded FIA to now include all forestland on all ownerships, sampled incrementally

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In This Issue: FIA in the PNW

Forest Inventory and Analysis

(CONTINUED FROM FRONT PAGE)

State	Forestland area	Timberland area	Percentage of forest area as timberland	Annual system started	Remeasurement begins	Most recent published report
	Million acres	*Million acres*	*Percent*	*Year*	*Year*	*Publication No.*
Alaska – coastal	15.2	6.0	39.5	2004	2014	PNW-GTR-835
California	32.6	17.0	52.1	2001	2011	PNW-GTR-763
Idaho	21.5	16.9	78.6	2004	2014	RMRS-RB-14
Oregon	29.8	24.1	80.9	2001	2011	PNW-GTR-765
Washington	22.4	18.1	80.8	2002	2012	PNW-GTR-800

Notes: Ground-measured inventory plots are on a grid spaced approximately every 3.4 miles across all ownerships. Each plot represents about 6,000 acres. Forestland is land that is at least 10 percent stocked with forest trees, or was formerly, and is not currently developed for a nonforest use. Timberland is forestland that is capable of producing at least 20 cubic feet per acre per year of wood at culmination of mean annual increment and excludes reserved forest lands. Publications are available for download as PDF files at treesearch.fs.fed.us.

SOURCE: www.fia.fs.fed.us/tools-data

Table 1. Current estimated forestland and timberland area and inventory status for selected western states and coastal Alaska.

every year using a grid of permanent plot locations. The annual inventory design makes it possible to: 1) provide a nationally consistent measure on the current status of the nation's forests, including timber resources; and 2) monitor how the nation's forests are changing using a system of permanent plot locations. More information on the current inventory design can be found at FIA's online library at www.fia.fs.fed.us/library/.

Current status of FIA

Under the new annualized direction, FIA has grown into the nation's forest inventory program and by 2013 was active in 50 states including Hawaii and coastal Alaska where a proportion of all plots are measured each year. Exceptions are the US-affiliated Pacific and Caribbean islands where plots are installed on a non-annualized basis, and interior Alaska, which is not currently being sampled. However, efforts are under way that will, if successful, start bringing interior Alaska into the inventory. Starting in 2014 a small pilot study is being undertaken where both ground-based and remote-sensed plots are combined as a method to generate updated inventory estimates for interior Alaska (see Pattison and Andersen article found elsewhere in this issue).

The sample design and collected measurements

FIA's sample design consists of a three-phase sampling system where phase 1 plots use remote sensing or aerial photography to classify land primarily as either forested or nonforest. Phase 2 consists of field plots where ground-based measurements are taken on a grid of permanent sample points located approximately every 3.4 miles across all ownerships. Phase 3 plots were originally established as a subset of Phase 2 plots to measure a set of forest ecosystem health indicators.

Each ground-based Phase 2 plot covers an area of 2.5 acres and consists of a cluster of four fixed radius subplots and transects. This is where the majority of FIA data is collected. For the western states including coastal Alaska, 10 percent of the plots are measured each year. Then, in approximately 10 years, each plot is remeasured and assessed for change. When summarized, each plot statistically represents approximately 6,000 acres of the surrounding landscape. Collected attrib-

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Next Issue: Reforestation and Nursery Management

utes include basic plot level information such as slope and topographical position down to the smallest detail including counting seedlings and proportion of the plot covered by each forb species. Information is gathered on live and dead trees, other vegetation, down woody material (logs, sticks, duff, and litter), potential site productivity, management practices, and disturbances such as fire and disease.

After the 2013 field season all western states and coastal Alaska will have measured 100% of the initial phase 2 plots (see Table 1). When the 2014 field season begins, for the first time, all west coast states will be remeasuring the originally installed phase 2 plots and trees. It is these remeasurements of individual trees at permanent based sample points over a vast geographic range where the power of FIA's annualized system pays off. Wide-scale estimates of tree growth and mortality from individual species provide detailed trend information not previously available at this scale using consistent inventory and estimation procedures. The 2014 field season also brings implementation of sub-meter precision GPS units that vastly increase the utility of location-sensitive data used in remote sensing applications.

Using the collected data

What follows in this issue is a brief overview of how these data collected by FIA are analyzed and used. Topics covered include how and where to get this freely available public information, as well as how FIA is investigating new inventory techniques to measure and analyze forest canopy cover. Other new techniques include incorporating remote sensing methods such as lidar combined with ground-based measurements as way to provide updated estimates in remote areas such as interior Alaska. Research that combines FIA inventory data with growth modeling to find affordable fuel treatment opportunities in dry-mixed conifer forests is highlighted. We also touch on how FIA is working with state agencies to evaluate and measure changes in land use.

PHOTO COURTESY OF SHARON STANTON

FIA crews measure fallen snags and other woody debris along a sampling transect. In addition to measuring many attributes on standing trees, crews also collect measurements on down woody material to describe the quality of wildlife habitat, structural diversity of the forest, fuel loading and fire behavior, the amount of carbon sequestered in dead wood, and the storage and cycling of nutrients.

The future

The pressures and risks to our western forests have never been greater than today. It is this current situation that the resource information and research provided by FIA has never been more relevant or pressing. Fortunately, with the vision provided when the program was first established 85 years ago and with continued support, FIA should be well suited meet to these, and yet unimagined, future challenges. ◆

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Where to Go for Historical Surveys

Results and more information on historical surveys can be found at:

• A History of the Forest Survey in the United States: 1830-2004, FS-877: www.fs.fed.us/emc/rig/documents/HFSbook_FINAL_07_0625.pdf

• The 1930s Survey of Forest Resources in Washington and Oregon, PNW-GTR-584: http://www.treesearch.fs.fed.us/pubs/6230

• Alaska's Forest Resources, PNW-RB-019: http://www.fs.fed.us/pnw/publications/pnw_rb019/

Is There Anything New to Learn from Inventory?

BY ANDREW GRAY

Why is the FIA inventory administered by a research organization? At first blush, a forest inventory merely consists of measuring a bunch of things and adding them up. A closer look reveals that there's quite a bit of science behind those deceptively simple statistics. A dynamic field of research is engaged in improving the quality of our standard estimates of forest status and trends with new techniques, and in examining new issues and questions that strategic inventories can provide insights to. FIA inventories provide a strong basis for understanding processes that affect all forests in a region. In contrast, it may be difficult to generalize results from research studies of carefully selected stands to the full range of conditions out there.

At a minimum, providing reliable inventory numbers requires a statistically-based sample, rigorous attention to definitions (e.g., of what qualifies as forestland or a tree), consistent standards for accuracy of field measurements, and application of the best equations and algorithms for compiling the inventory and calculating the precision of the estimates. Providing reliable estimates of change over time increases the difficulty by an order of magnitude, requiring accounting for potential differences in measurement tools, staff, definitions, equations, and the wide range of conditions encountered across all lands. We all have an image of what a "forest" looks like in our mind's eye, but when you systematically sample all forest types across all ownerships over large areas, you encounter landforms and stand conditions you would never imagine!

The key to producing reliable information on the status and trends of the nation's forests, then, requires that definitions of classifications and measurements are crystal clear, that we know the quality of the data, and that measurements are consistent over space and time (or that adjustments to deal with changes in field methods or analyses are carefully vetted).

A primary type of ongoing research in the FIA program is techniques research. Determining how things should be measured may be straightforward for any single question. However, optimizing different measurements to address the many different questions being asked of the FIA program, and to do this efficiently—with data that can be collected by a small crew in a single visit—is more challenging. For example, the most efficient way to measure standing volume is not the best approach for measuring tree growth and mortality, describing species diversity and stand structure, or measuring fuels on the forest floor. Research in recent years has led FIA to switch from variable-radius to fixed-radius plots, install systematic designs that sometimes straddle stand boundaries instead of moving sample points to stay within a stand, sample large trees with large plots to improve classification of older forests on the west coast, and switch from air-photo interpretation to satellite classification to improve the statistical precision of inventory estimates through post-stratification of field plots. Recent and ongoing studies include developing:

• Improved statistical estimators for the FIA systematic sampling design, and new ways of incorporating information from satellites and climate models. Results indicate that regression estimators are more efficient and flexible than the standard post-stratification currently used.

• Better biomass and carbon equations for live and dead trees for regional inventory estimates. Efforts are underway to develop nationally consistent methods of developing new equations and initial tree biomass measurements.

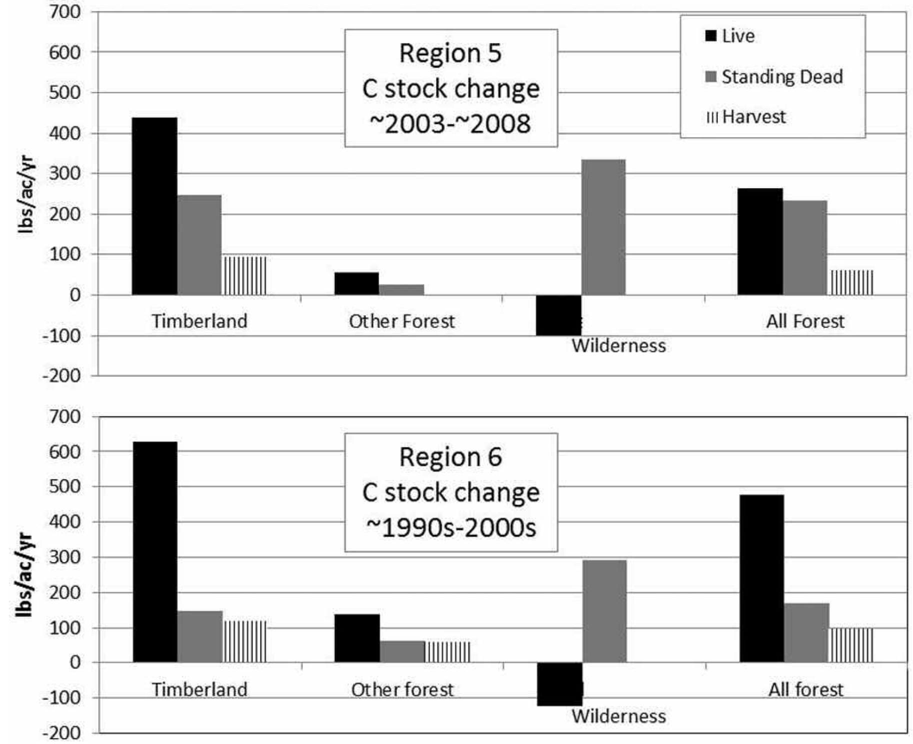
• Methods to incorporate lidar measurements in production inventories.

• Methods for assessing plant biological diversity and the impact of invasive species. Field protocols and estimation procedures have been developed and used to examine impacts across 24 states in the midwest and northeast U.S.

• Indicators of air pollution impacts from lichen species composition. Lichen community data have been used to identify hot spots of nitrogen pollution on the west coast not easily detected with the few available, expensive air pollution detectors.

• Crown and surface fire severity indices for western forests.

• More powerful equations for estimating tree heights from a subsample.



SOURCE: ANALYSIS BY J. FRIED AND A. GRAY OF NFS INTENSIFIED INVENTORIES

Figure 1. Recent results from an analysis evaluating annual change in carbon density of live and dead trees, and harvest, on national forests in Region 5 (CA) and Region 6 (OR and WA) by land class. Note declines on Wilderness lands that were primarily caused by wildfires.

• Models to estimate changes on plots from changes detected in satellite images.

• Methods to estimate carbon storage in dense moss and lichen mats and soils in boreal forests.

Another primary type of research in the FIA program is aimed at applying inventory and monitoring information to understand the effects of human use, climate, and natural disturbances on forest conditions. Many of these projects are initiated in response to requests from national or regional groups, or to address pressing issues of the day. This research usually requires melding the inventory data with other datasets and applying new models or results of other research. Integrating FIA data in these projects usually requires an in-depth knowledge of the strengths and limitations of FIA measurements given their temporal and spatial distribution. Many of these research projects address questions of how forests are changing over time and the likely causes, rather than how much there is. Recent topics of analysis include:

• Characterizing carbon pools and flux and management implications for storing atmospheric carbon dioxide. Results indicate that west coast forests are storing carbon, but most of that is happening on public timberland, with losses occurring in Wilderness (See figure 1).

• Understanding changes in land use and housing density, the effects of land-use policies, and their impacts on resource management.

• Assessing the impacts of insects and diseases on forest characteristics. Spruce budworm outbreaks in Oregon increased dead wood in stands, especially on public lands where mortality was not harvested as often as on private lands.

• Predicting the impacts of wildfire in relation to forest structure, management history, and weather conditions.

• Understanding the impacts of air pollution on forests.

• Predicting tree species distribution, growth, and mortality in relation to current and future climate, management, and disturbance.

• Evaluating the effect of nonnative plant invasions on forests.

• Developing modeling tools to characterize the availability of biomass for wood products and energy production given management objectives and constraints with respect to reducing fire hazards.

• Understanding the characteristics and value of trees in urban settings.

• Producing maps of forest composition and structure for forest management, landscape analysis, and conservation planning.

More information on these studies and the people involved can be found at www.fs.fed.us/pnw/rma/research-topics/index.php.

Many of these forest-related questions are not unique to the FIA research program. However, the comprehensive FIA dataset, collected in a consistent manner across all regions and ownerships, is valuable for providing a realistic assessment of forest conditions and ground truth for model development. Using the FIA data comes with its own types of challenges, however. Most research projects attempt to control as much unwanted variation as possible by selecting specific stands and locations where the effect of the specific question of interest can best be evaluated. In contrast, the FIA sample is designed to capture and characterize the full range of forest conditions, management practices, and disturbance histories found on the landscape. Using the FIA data productively requires being able to process data from thousands of plots to select the information most relevant to the questions of interest. That is the art and science of inventory research. ◆

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How to Access FIA

BY KAREN WADDELL

Forest Inventory and Analysis maintains a number of databases that the public can easily access. Because FIA databases are large and fairly complex, a variety of tools have been developed to help users work with the data to answer individual questions. Most tools have a user interface to simplify and speed up the time needed to learn and understand FIA's comprehensive inventory database.

Nationally, there is a database called the FIADB (FIA Database), which contains inventory data for every state in the country. An interactive, web-based tool (referred to as FIA-Tools and available at www.fia.fs.fed.us/tools-data) gives users access to the national FIADB and helps with a variety of tasks such as generating summary tables, basic maps, and downloading data (see Figure 1). Click the buttons on the webpage to check out the many national tools available.

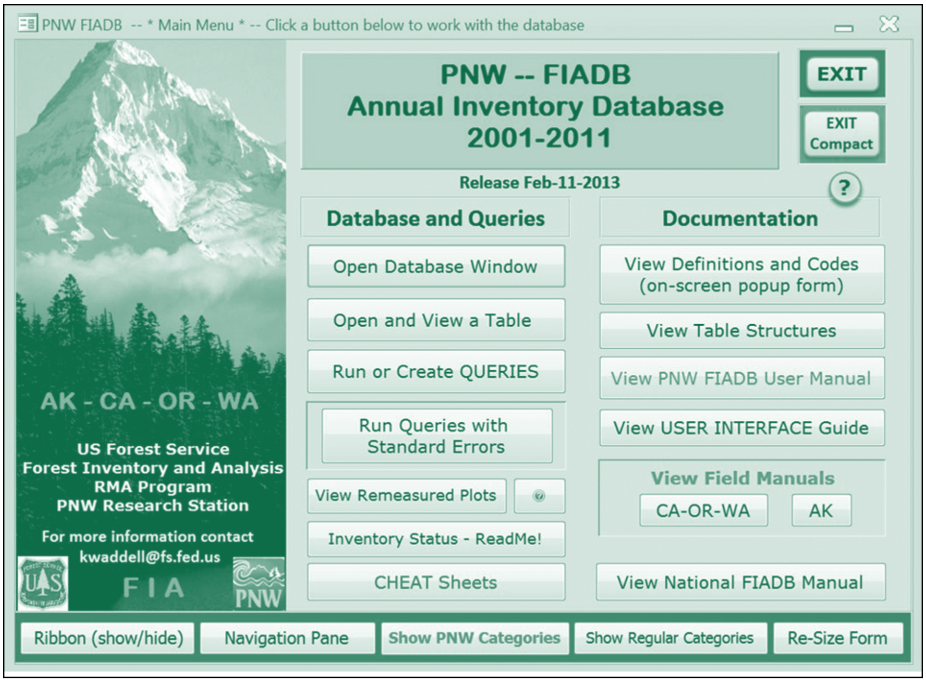

Figure 2. The PNW-FIADB, a regional tool to work with Pacific Northwest data.

Both FIDO (Forest Inventory Data Online) and EVALIDator are programs that summarize data based on user inputs to produce reports of forest attributes such as land area or tree volume, biomass, and carbon. Users begin with a pre-defined template (rows, columns, summary variable) and then customize the report by selecting a state, inventory period, and various filters. For example, a report can be created for Oregon that displays the acres of forestland organized by forest type and owner group for the years 2001-2010. The summary report contains the estimate and standard error for every cell in the table and can be saved as a spreadsheet, Adobe PDF, or map.

Another feature of FIDO is the option to select plots within a circular area on a map using coordinates and a Google map interface. A summary report can be run on the set of FIA plots that fall within that circle. For example, if you want to answer the question "How many tons of tree biomass fall within a 50-mile radius of Bend, Oregon?" you can easily do it using FIDO and the approximate coordinates of the city.

For those who want to work with the data directly, a national tool called the FIA DataMart (accessible from the FIA Tools web page shown in Figure 1) can be used to download FIA data for any state in the form of a Microsoft Access database or a comma delimited file. These databases contain data from both annual and periodic inventories. Although plot coordinates (latitude and longitude) are included, they are offset from the actual location because exact coordinates are confidential. There is a learning curve involved when working with FIA data, so it's a good idea to download and read the user guide and field manual before

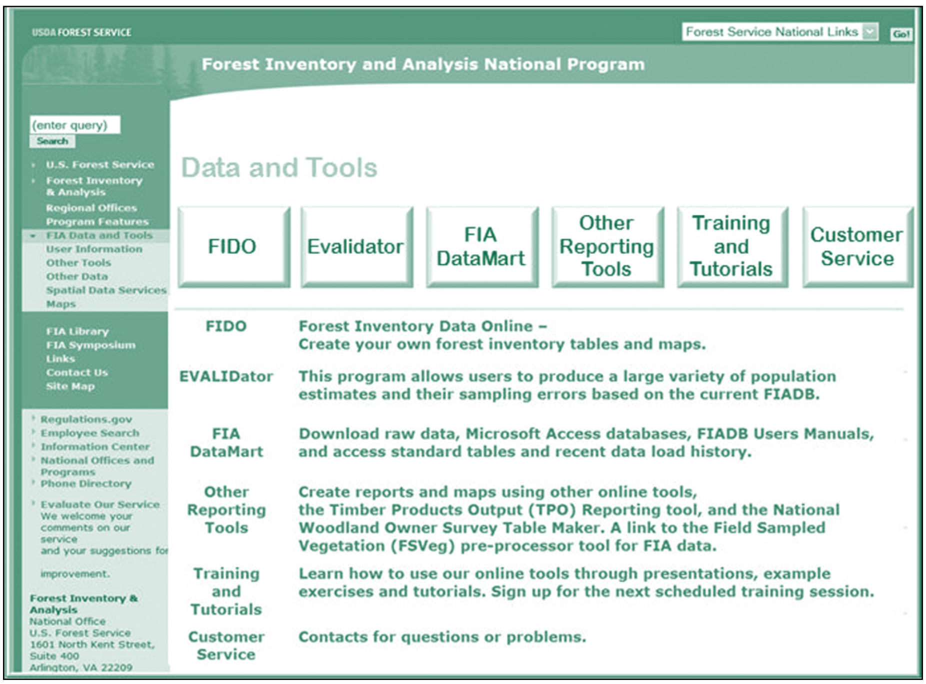

Figure 1. A national tool to access the Forest Inventory and Analysis Database (FIADB) can be found at www.fia.fs.fed.us/tools-data.

creating queries or conducting an analysis. These documents and other information can be found at www.fia.fs.fed.us/library.

Regionally, the Pacific Northwest FIA work unit maintains a local tool called the PNW-FIADB (see Figure 2). This tool is a Microsoft Access database with an easy-to-use front end that contains FIA data for Alaska, California, Oregon, and Washington. It is a regional version of the national FIADB. The tool has a push-button interface that functions as a "Main Menu" and sits on top of the database, giving users easy access to PNW forest inventory data, pre-built queries, database documentation, and field manuals. All of these features are available by simply clicking a button on the interface to select items from a drop-down list or open a documentation file (Adobe PDF).

In addition to the standard set of data tables, new information collected only by the PNW FIA work unit is included. Other tables have been added as "crosswalks" to help users translate codes to text when building queries. Currently, the database contains data for over 40,000 field plots with measurements on live and dead trees, down wood, understory vegetation, disturbance, silvicultural treatments, stand age, occurrence of insects and diseases, and many other forest attributes. A long list of calculated variables are included as well, such as cubic and Scribner volume, biomass and carbon of trees and down wood, forest type, site index, site productivity class, and much more.

It is easy to summarize data in the PNW-FIADB—simply click the Run Queries button on the interface and select from over 200 pre-built queries. Users can quickly summarize data for all forestland, which includes all ownerships, both reserved and unreserved land, and all productivity classes. Timberland queries are also available for those interested in just productive, unreserved forestland, often referred to as "commercial forestland." Once the query results are displayed, click another button to save the report as a spreadsheet. Queries are available for most attributes collected by FIA and can be run as-is or used as a template and modified to suit a specific analysis.

An extensive set of documentation is provided with the PNW-FIADB. At the click of a button, users can view simple cheat sheets, thorough user manuals, or actual field guides. All documents are Adobe PDF files, which open instantly allowing users to read through technical information whenever it is needed. Another feature is a pop-up form that displays a definition and set of valid codes for any data column a user selects.

The PNW-FIADB will help people become proficient with FIA inventory data, spending less time learning the technical details and more time producing usable summary reports for

(CONTINUED ON NEXT PAGE)

Figure 3. The PNW RMA/FIA regional website at www.fs.fed.us/pnw/rma.

their own individual project or analysis. Hopefully, the convenience of having a tool right on your own personal computer will encourage you to ask questions about the forests of west coast states.

The regional database and tool can be requested on CD or downloaded from the PNW-RMA/FIA website (see Figure 3) at www.fs.fed.us/pnw/rma/fia-topics/inventory-data/index.php. Click the "FIA Inventory Data" button on the home page and find the link to the PNW-FIADB. There are a number of options to select on this page, including a quick overview, status, documentation, and the data (please note that the file is large [473 MB] so a CD may be more convenient). If you request a CD, you will be prompted for your contact information and a CD with user guide will be mailed as soon as possible.

There is a wealth of information and data accessible on this website. Other FIA databases available are the Pacific Islands data and older periodic inventory data (the IDB). User guides (data dictionaries) for all databases and field manuals for all FIA inventories can be downloaded here as well.

Use the PNW-RMA/FIA website to find out about the latest research topics being investigated, download current publications or GIS maps, read about FIA's data collection methods, or view the latest forest statistics for each state and island that FIA inventories.

Please check the website often as it is updated with new data or information as they become available. ◆

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The Ins and Outs of Estimating Tree Canopy Cover

BY ANDREW GRAY

Forest canopy cover is an important attribute used in forest research and management in the west, but is difficult to measure accurately. Shelterwood or unevenaged management prescriptions are based on providing desired amounts of shade from trees retained in units in order to facilitate (or inhibit) tree regeneration and shrub growth. Assessments of disturbance severity (e.g., from fire or insects) are often based on changes in canopy cover. Management goals for many wildlife species specify desired amounts of canopy cover (e.g., for northern spotted owl dispersal habitat or shading of salmon-bearing streams). The vertical distribution of foliage is also important to descriptions of stand structure at different stages of development. Satellite remote sensing and aerial photography applications are primarily affected by patterns of canopy cover, so understanding how cover varies with stand age, volume, and tree density improves our ability to derive estimates from those images. Because of its many uses, there is a high demand for calculations of canopy cover from FIA data.

People use the term canopy cover to describe estimates derived from a wide range of techniques that don't always line up well. Technically speaking, tree canopy cover is the proportion of the ground that is occluded by the vertical projection of tree crowns. Techniques for measuring light levels in the understory, like spherical densiometers and hemispherical photographs, over-estimate canopy cover because their angle of view is much wider than the vertical. Vertical cover can be measured from the ground using a large number (100+) of point samples or the proportion of line transects covered with canopy (preferably with a densitometer with bubble levels to identify the vertical angle). Small gaps or thin foliage in a tree's crown are usually included as part of the tree's canopy outline.

Canopy cover can also be estimated from above using aerial photography, satellite images, and lidar pulses. The accuracy of these estimates is affected by the resolution of the imagery (or number of pulses), the angle between the sensor and the vegetation, sun angle, the ability to distinguish trees from other vegetation in the stand, and shaded crowns.

PHOTO COURTESY OF ANNE MCINTOSH

Estimating canopy cover can be challenging; this image is looking up into overlapping branches and foliage in a Douglas-fir stand.

Other approaches have measured crowns on individual trees, either to estimate cover directly, or to develop equations relating tree diameter and other attributes to crown area. These estimates need to account for the overlap of crowns of adjacent trees. A common assumption used in some stand projection models is that crowns overlap at random. Work to date indicates this assumption works well in the drier forest types of the west, but results in under-estimating canopy cover in moister forests (e.g., west of the Cascade Mountains). For the best estimates of canopy cover, there really is no alternative to measuring it in the field; the line transect approach has been found to be efficient and useful to use with inventory data.

Canopy cover is used in a variety of ways in forest inventories. FIA recently moved from using 10% potential stocking to 10% potential cover as the criteria for defining forestland. This change will improve comparability with other countries and align with remote sensing applications. Inventory crews assess tree cover in aerial photography to determine whether inventory grid points might qualify as forestland. On field-visited plots with sparse stands close to the 10% cover threshold (e.g., many oak woodlands and pinyon-juniper stands), crews measure individual tree crowns and assess land use to determine whether to classify plots as forestland. On plots clearly over the 10% cover threshold, canopy cover is being estimated visually.

Past inventories have measured crown widths on a large number of trees, and equations relating tree diameter to crown width were developed to estimate cover from tree lists, either in inventories or in simulation models like FVS. Line-transect measurements have also been used to measure stand cover on FIA plots. Recent transect work by Oregon crews is being used to develop improved equations for estimating canopy cover from plot measurements. We plan to have new equations developed and published by the end of 2014.

As estimates of canopy cover on FIA plots improve and become more widely available, we will be better able to address questions about tree shading and microclimate modulation, risk of crown fire, wildlife habitat, and ground truth for remote sensing. As is often the case with inventory data, no doubt new questions we haven't thought of yet will come along that we can help answer. ◆

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Geospatial Technologies in Support of FIA

BY HANS-ERIK ANDERSEN, WARREN COHEN, DEMETRIOS GATZIOLIS, ROBERT McGAUGHEY, STEVE REUTEBUCH, AND KEN WINTERBERGER

The emergence of several geospatial technologies in recent years promises to dramatically improve the quality of forest inventory information available to land managers. Active remote sensing technologies such as airborne laser scanning (lidar) and synthetic aperture radar (SAR) can provide maps of forest structure characteristics down to a level of detail at the scale of individual tree crowns, and handheld GPS technologies can allow a member of a field crew to record the spatial coordinate for an inventory plot with an accuracy of 1 meter or so. The publicly-available archive of Landsat satellite imagery allows us to map changes in vegetation structure, composition, and condition—at a resolution of 1/5 acre—over a four-decade-period. Scientists in the Resource Monitoring and Assessment (RMA) program of the PNW Research Station are actively involved in research aimed at both improving the efficiency of the current FIA inventory and expanding into areas (such as interior Alaska) that are not currently a part of FIA sampling through the use of geospatial technology and analysis.

Lidar

Airborne laser scanning (lidar) has the potential to truly revolutionize forest inventory. Lidar provides ultra-high-resolution (<0.5 meter) three-dimensional measurements through the entire forest canopy volume. Perhaps the most unique characteristic of airborne lidar is the capability of narrow laser pulses to pass through gaps in the forest canopy and obtain highly accurate measurements of the terrain surface. This highly-detailed, accurate terrain information provides the basis for equally detailed information describing forest canopy height and cover. In addition to the 3-D structural information contained in the lidar point cloud, the reflection intensity of each lidar return—when normalized—can provide information about tree species type and condition. Another encouraging development that promises to make lidar even more available to forest managers and inventory specialists throughout the western US is the formation of regional consortia made up of federal, state, and local agencies that pool resources to obtain lidar over entire states or portions of states. Examples of successful regional consortia include the Puget Sound Lidar Consortium (http://pugetsoundlidar.ess.washington.edu) and the Oregon Lidar Consortium (www.oregongeology.org/sub/projects/olc/). It is expected that lidar will become an increasingly important source of auxiliary data for FIA as these large regional datasets become available.

Because lidar is delivered as a fully digital and georeferenced product, it is very amenable to automated processing. However, it can be challenging to process the massive computer files associated with high-resolution lidar data collected over large areas. Over the past 10 years, PNW-RMA scientists have been developing software tools—such as the popular and freely-available FUSION package (http://forsys.cfr.washington.edu/fusion.html). This software enables forest managers to process extremely large raw lidar data sets into raster layers that are easily handled in a GIS environment. Statistical (regression) models relating lidar information to forest inventory data at the plot level can then be applied to the lidar-derived raster layers, enabling the accurate mapping of forest inventory parameters over the entire lidar coverage area. If these maps are used as the basis for estimating means and totals for inventory parameters across an area of interest, statistical sampling theory can be employed to quantify the uncertainty of these estimates.

Radar

Synthetic aperture radar (SAR) is another exciting technology becoming increasingly available for forest inventory applications. In contrast to lidar, which uses infrared light, SAR operates in the microwave portion of the electromagnetic spectrum. In essence, radar emits radio waves at specific wavelengths and measures how this energy interacts with (or reflects off of) earth surface features (such as forests). This interaction depends on both the wavelength and the properties of the reflecting surface. In a forested scene, longer SAR wavelengths (i.e., 20 cm) will penetrate into a forest canopy and the measured reflectance indicates the quantity of woody material scattering the radio signal. A distinct advantage of radar over lidar is the ability to penetrate through clouds and fog—a particularly important capability in tropical regions. While radar imagery can be a valuable tool for forest assessment and monitoring, the resulting data can be noisy and signal analysis can be confounded by topographic relief. PNW-RMA researchers and collaborators are actively investigating how radar from multiple dates and topographic correction algorithms can be employed to improve the quality of radar information in support of carbon and biomass monitoring efforts in remote areas such as interior Alaska.

Landsat time series

In 2008, the USGS opened up its historical archive of Landsat satellite imagery dating back to 1972, thereby enabling free access to an incredibly rich source of global information on changes in vegetation composition, forest condition, and land use. For over a decade, PNW-RMA scientists have been at the forefront in mining Landsat time series data to detect trends in vegetation characteristics across a range of scales from landscapes to multi-state regions. These investigations have resulted in the development of tools that allow for direct comparison of Landsat spectral trajectories and changes observed at specific field plot locations, which can inform analysis of subtle changes in vegetation health, productivity, or land use observed at the pixel level over the time spanned by the Landsat time series data stack. Given the increasing importance of aboveground carbon monitoring in the REDD (Reducing Emissions from Deforestation and Degradation) framework, it is expected that use of this rich Landsat archive to support national and global forest inventory and monitoring will only increase.

GPS on FIA plots

With the increased availability of high-resolution remote sensing data over large areas of the western United States, there is rising demand for improved spatial registration of FIA plot data to enable direct comparison of plot data to remotely-sensed measurements. From a statistical standpoint, lack of correlation between plot and remotely-sensed measurements due to plot geo-positioning error can contribute directly to increased variance for parameter estimates. Given the capabilities of current geopositioning technologies (known as Global Navigation Satellite Systems, or GNSS) and the spatial resolution of emerging remote sensing technologies, PNW-RMA has initiated an effort to eventually obtain coordinates for FIA subplots with less than 1 meter of error. In a pilot project carried out in 2013, PNW-RMA used sophisticated handheld GNSS receivers that track both American GPS and Russian GLONASS satellites and advanced PDR technology on FIA plots in all western states in order to arrive at an operational protocol resulting in more accurate FIA plot coordinates.

Linking multiple sources of auxiliary information for forest inventory

Although all of these geospatial technologies (airborne lidar, satellite imagery, FIA field plots) can have a separate role to play in contributing to the objectives of FIA, it is likely that their full value will be realized when they are used in combination, made possible by the accurate GPS-enabled spatial registration of FIA field plots. More recently, PNW-RMA scientists have worked on developing multi-sampling designs for large-area biomass inventory that utilize data collected at field plots, lidar collected on a strip sample, and wall-to-wall satellite imagery (Landsat TM and radar). These types of approaches make use of the complementary information provided by these various technologies and can further increase the value and quality of the inventory information produced by FIA. ◆

All co-authors are scientists with the PNW Research Station. Hans-Erik Andersen is a supervisory research forester in Seattle and can be reached at 206-221-9034 or handersen@fs.fed.us. Warren Cohen is a research forester located in Corvallis, Ore., and can be reached at 541-750-7322 or wcohen@fs.fed.us. Demetrios Gatziolis, 503-808-2038, dgatziolis@fs.fed.us, is a research forester in the Portland office. Robert McGaughey is a research forester in Seattle; reach him at 206-543-4713 or bmcgaughey@fs.fed.us. Steve Reutebuch is a research forester in Seattle and can be reached at 206-543-4710 or sreutebuch@fs.fed.us. Ken Winterberger, a forester in Anchorage, can be found at 907-743-9482 or kwinterberger@fs.fed.us.

Reviving an Old Inventory to Understand Changes in Alaska's Boreal Forests

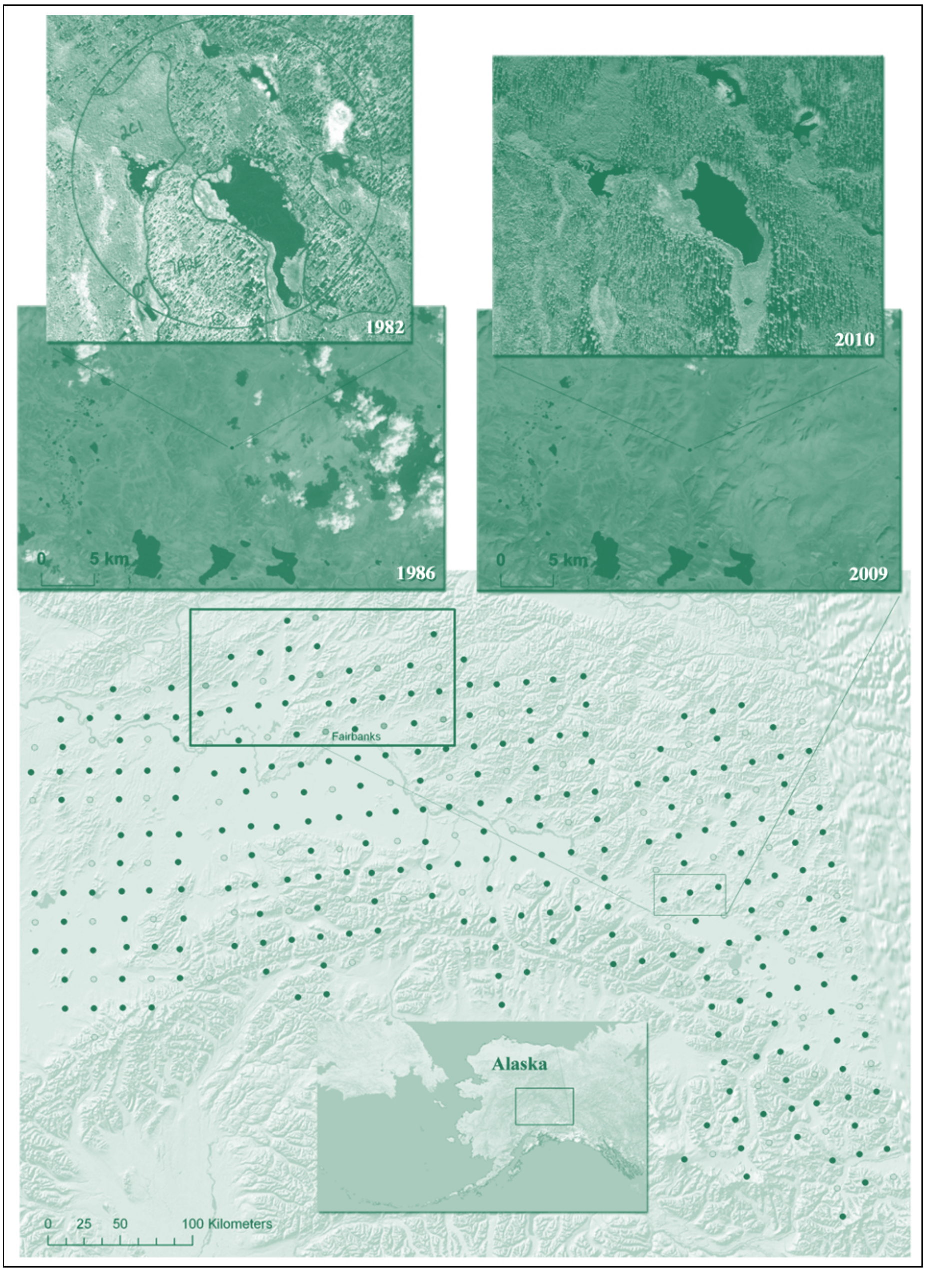
BY ROBERT PATTISON AND HANS-ERIK ANDERSEN

Robert Pattison

Hans-Erik Andersen

Recent studies have shown that the boreal forests of Alaska are experiencing rates of warming nearly double those of the global average. Mean annual temperatures in interior Alaska have increased by 2-3º F (1.5º C) over the past 50 years and could increase an additional 5-12º F (3-7º C) by the end of the 21st century. At first take you might think that warming would be good for the boreal forests of Alaska and that it could potentially lead to increases in productivity. After all, how bad could it be to have a little more warmth in an area where the average daily temperature for January is -15º F and for July is just 61º F? Unfortunately, as we learn more about the changes that are occurring in the interior Alaskan boreal forests it appears that they are changing in ways that could have important impacts on local forest resources as well as global carbon cycles.

One challenge to interior boreal forests is that while they are warming and experiencing longer growing seasons, they are not seeing increases in precipitation. Precipitation in the interior has only increased by 0.27" (7 mm) over the past 50 years, and while precipitation is predicted to increase, it likely won't be enough to offset the increases in temperature. As a result, some of the forests appear to be drying out. Not surprisingly, fires are also increasing both in size and intensity. The area of interior Alaska burned in the last decade was double that of any previous decade going back to the 1940s. Because these fires are occurring later in the growing season, when soils are drier, they are burning deeper into the soils often altering the successional dynamics of these forests in favor of deciduous species or in some cases shrubs and grasses. Also not surprising is that lakes are drying out in many regions of interior Alaska. However, in other areas where there is poor drainage some forests are converting to wetlands and ponds as warming melts the underlying per-



SOURCE: USGS

Figure 1. Location of AIRIS photo plots (green dots), AIRIS field plots (light green) within the Tanana Valley in interior Alaska. The rectangle in the upper left area of the main map shows proposed 17,000 km² study area for the project, with light green dots indicating the accessible AIRIS field plots to be visited. Inset graphics show Landsat TM imagery and low-altitude aerial photos acquired in the mid-1980s and late 2000s. Photo-interpreted forest type polygons within the 1982 8-ha photo plot are also shown. Note terrestrialization and shrinkage of pond area, as well as burned areas evident in Landsat TM imagery.

mafrost and lowers the forest floor. The interior is also experiencing outbreaks of insects. These outbreaks are linked to the drought stress of the trees as well as to improved conditions for insect lifecycle development. Against this background of change, another trend that is occurring is increased interest from local communities in using the forests for biomass to help address some of their energy needs.

Interior Alaska is a huge area with minimal infrastructure. The approximately 111 million acres of boreal forest in interior Alaska representing 15% of the forested area of the US have only a few roads. While there has been a lot of interesting and informative research in interior Alaska, compared to other regions of the US the current status and the trends in forest resources occurring in the region are not well understood. An FIA inventory in interior Alaska is not available. The primary insights into forest conditions have come from intensive work at specific field sites or through occasional studies in specific locations across a broader area. For the vast majority of interior Alaska the primary source of data on forest resources comes from satellite imagery.

In an effort to understand some of the changes that are occurring in interior Alaska, the PNW Research Station and FIA are studying how a portion of the region has changed over the past 30 years. In the early 1980s, the PNW-FIA program established an inventory of a 46,300 square mile area surrounding the Tanana River (see Figure 1 on page 12). This inventory, known as the Alaska Integrated Resources System or AIRIS, consisted of a systematic grid of low-altitude photo plots spaced 6.2 miles apart with every other photo plot having a field plot installed. PNW-FIA is reflying 161 of the photo plots and re-visiting 7-10 field plots. All the photos will be scanned and changes in stand structure, shrub and tree establishment, tree mortality, species replacement, and surface hydrology will be carried out using digital stereo imagery analysis. In addition, all 161 photo plots will have an analysis of trends in key vegetation indices such as Normalized Difference Vegetation

(CONTINUED ON PAGE 20)

Ground Mat Assessment to Determine Carbon Storage and Ecological Function

BY SARAH JOVAN

Mosses and lichens reach high biomass in cool, wet places such as the boreal and tundra zones of interior Alaska, often forming thick mats on the forest floor (see Figure 1). Mats may be 30 cm thick or more, becoming increasingly prevalent at higher latitudes. At the landscape-scale this ground cover is a significant C-pool. Mats also promote C sequestration by insulating permafrost, and in the case of peat mosses, accumulate large amounts of soil C in dead moss biomass. Moss-dominated peatlands cover only 3% of the global land mass yet they store nearly one-third of the world's soil C (~ 540 billion tons).

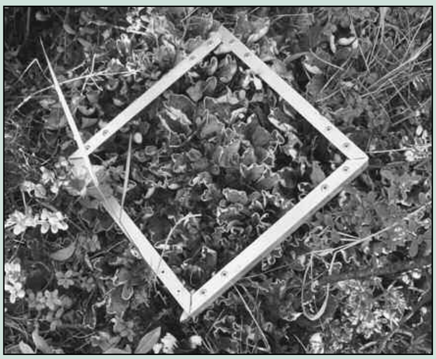
The PNW Forest Health Monitoring and FIA Programs are piloting a protocol for characterizing the biomass and composition of ground mats. The method estimates C storage in mats—including unfrozen peat deposits—as well as the biomass of functionally important species comprising the mats. These include "reindeer lichens," an abundant group of species that provide more than 50% of winter diet of Alaska caribou (Cladonia, Cetraria spp., see Figure 1). "Dog lichens" are also a focus for their contribution of nitrogen to low fertility soils in the Interior (Peltigera spp., see Figure 2).

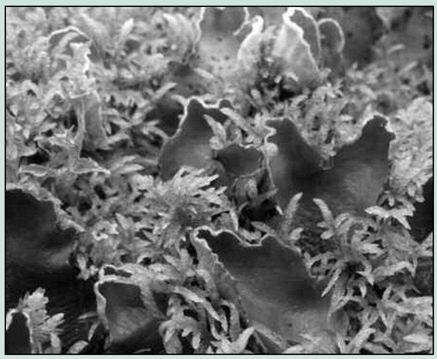
The mat assessment protocol is undergoing two years of field testing (2012-2013) and will be finalized by summer 2014. ◆

Sarah Jovan is a research ecologist with the PNW Research Station in Portland, Ore. She can be reached at 503-808-2070 or sjovan@fs.fed.us.

PHOTOS COURTESY OF SARAH JOVAN

Figure 1. Left: Black spruce (*Picea mariana*) stand sampled in Caribou-Poker Creek Research Watershed, interior Alaska. Right: Close up of ground cover, *Cladonia* spp. (white and brown reindeer lichen) and *Pleurozium schreberi* (moss).





PHOTOS COURTESY OF SARAH JOVAN

Figure 2. "Dog lichen" fixes N, which can enhance soil N up to 1.5 m from the lichen colony. Sampling frame is 20 x 20 cm.

Opportunities Abound for Affordable Mechanical Fuels Treatment in Dry Mixed-Conifer Forests

BY JEREMY S. FRIED AND THERESA B. JAIN

Jeremy Fried

Theresa Jain

The dry mixed-conifer forests that cover millions of acres in 12 western states experience low- to mixed-severity fire regimes; are typically heterogeneous in species composition, forest structure, and fuel dynamics; and grow quickly enough to generate concern about fuel treatment longevity. Yet compared to stands of pure ponderosa pine, there has been little research on fuel treatment effectiveness and economics in these forests.

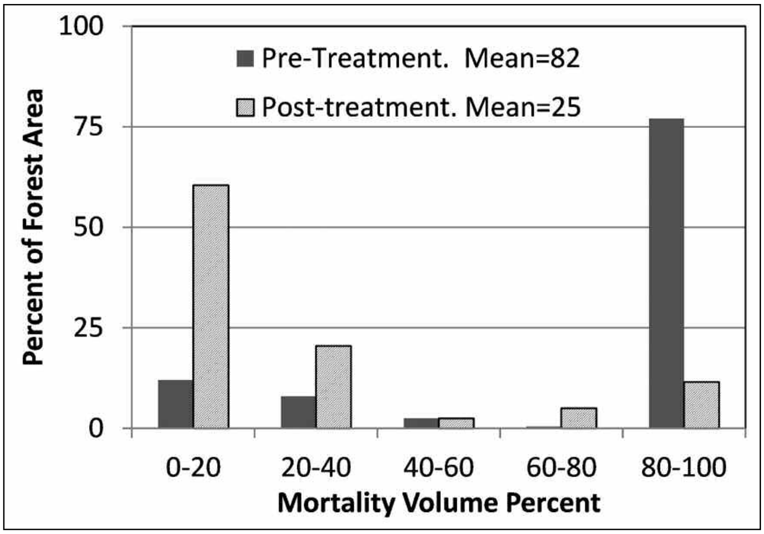
Treating fuels everywhere is impractical and likely not cost effective. Only some of the many possible kinds of treatments will be effective in any particular stand, and there are some stands that seem to defy effective treatment; in many more, effective treatment costs greatly exceed benefits. We modeled effectiveness and costs of three kinds of mechanical treatments on 5,000 FIA inventory plots that sample dry mixed-conifer forests in California, Oregon, Washington, Idaho, Montana, and Utah and found that, on average, compared to a no-treatment case, treatment led to more resilient forests over time, lower forest carbon emissions, and greater retention of the live trees that constitute an important component of wildlife habitat.

Defining fire hazard

We evaluated hazard via four attributes computed by the FFE-FVS (Fire and Fuels Extension of the Forest Vegetation Simulator) model for each forested condition in this FIA dataset under severe fire weather. Hazard thresholds for each attribute were constructed from information obtained via focus groups with fire and fuels managers. When compared to these thresholds, the attributes *probability of torching* (ptorch, expressed as a percent) and *torching index* (TI, defined as the wind speed in miles per hour at which crown fire initiation would be expected) identify conditions where fires are likely to transition from surface to canopy fuels, involving the crowns of some to all trees. Fuel treatments are often designed to minimize such torching fire behavior, and hazard thresholds of >20 mph for TI and <20% for ptorch provide an aspirational basis for torching hazard mitigation. *Surface flame length* (SFL) serves as a proxy for both fire intensity and fire suppression effectiveness (e.g., high flames may preclude direct attack). Direct attack on the fire perimeter is usually possible when SFL <4 ft., but rarely so when >4 ft., so fuel treatments that keep SFL below 4 ft. could promote fire suppression effectiveness. *Mortality volume percent* (MortVolPct), computed as predicted post-fire mortality volume expressed as a percent of pre-fire, live tree volume, serves as an indicator of economic and resource loss, lost carbon storage opportunity, and the viability of stands post-treatment. We set a 30% threshold for this hazard. We used these four attributes (TI, ptorch, SFL, and MortVolPct) and their associated thresholds as indicators of fuel treatment effectiveness. We also considered and report a composite hazard score calculated as the number of these four attributes by which a plot, and the acres it represents, qualifies as hazardous, producing a hazard score between 0 and 4. Treatments that reduced hazard score were considered effective. Over 90% of the 33 million acres we analyzed were rated hazardous, and about a sixth of these could be effectively treated, according to our definitions, by one of the prescriptions we simulated. Described by what is left as a residual stand, these were (with percent of acres on which the treatment proved the best choice in parentheses):

- "leave trees >21 in." (34%);
- "leave early seral species" (42%); and
- "leave 50 percent canopy cover" (24%).

Leave trees >21 in. was most effective in Douglas-fir and true fir types and entailed removing, on average, 30% of the volume or 3800 cu. ft. *Leave early seral species* was most effective in pine and larch types (which were more likely to contain early seral species trees in numbers sufficient for a viable residual stand) and removed, on average, 26% of wood volume or 1400 cu. ft.



SOURCE: www.fs.fed.us/rm/pubs/rmrs_gtr292.html

Figure 1. Percent of Douglas-fir and true fir forest area, in central and eastern Oregon and Washington, by Mortality Volume Percent (percent of live tree volume in trees predicted by FFE-FVS to die when subjected to fire under severe weather), pre- and post-treatment for the 1.03 million acres on which one or more treatments were considered effective.

What we learned

Having results for thousands of real, representative places on the ground provides more complete information about what can be accomplished than would rules of thumb or averages from case studies. For example, predicted tree mortality shifts dramatically post-treatment in the Douglas-fir and true fir forests of central and eastern Oregon and Washington. Pre-treatment, most stands experienced 90 to 100 percent mortality; treatment changed the distribution so that volumetric mortality rates below 20% dominate; the mean value of 25 is primarily influenced by the few cases where, despite improvements in other indices, MortVolPct remained high (see Figure 1).

	Merchantable Wood		Energy Wood			Costs				
	Volume removed	Value removed	Mass removed	Energy wood value	value as % of all product value	Treatment cost		Energy wood haul costs as % of all cost	Net revenue	Area
Forest type group	ft^3/acre	$/acre	Green tons per acre	$/acre		$/acre	$/100 ft^3		$/acre	Thousand Acres
Douglas/true fir	1,757	3,050	16	582	22	2,217	410	6	1,016	2,177
Pine and larch	1,266	2,143	13	468	23	1,021	146	7	1,340	456
Aspen	994	405	6	215	63	857	275	25	-791	112
Cedar	2,010	3,655	17	607	28	1,574	543	6	2,294	108
Other species	2,003	2,587	27	989	34	1,974	274	10	988	2,558
All	1,823	2,699	21	765	29	1,954	319	9	1,015	5,412

SOURCE: www.fs.fed.us/rm/pubs/rmrs_gtr292.html

Table 1. Mean production, economic, and area attributes by forest type group.

Volumes of merchantable and energy wood and cost and revenues due to treatment operations varied considerably among forest type groups, but in the types that are, in practice, most frequently treated (Douglas-fir, true fir, and pine and larch), merchantable wood recovered amounted to 1 to 2 thousand cubic feet per acre and net revenue averaged over $1000/ac. despite high on-site costs averaging 1-2 thousand dollars per acre (see Table 1). Energy wood, the tops and limbs of all trees and the boles of non-merchantable trees that could be chipped for production of

(CONTINUED ON PAGE 21)

Oregon and Washington Land Use Change

BY SHARON STANTON

The US Forest Service Inventory and Analysis Program has a long history of cooperating with state and regional partners to examine changes in forest resources and land use in the Pacific Northwest. Information gathered by the Forest Inventory and Analysis Program is valuable for assessing the effects of land-use decisions on forest management and trends in conversion of forests and farm lands to housing and other development.

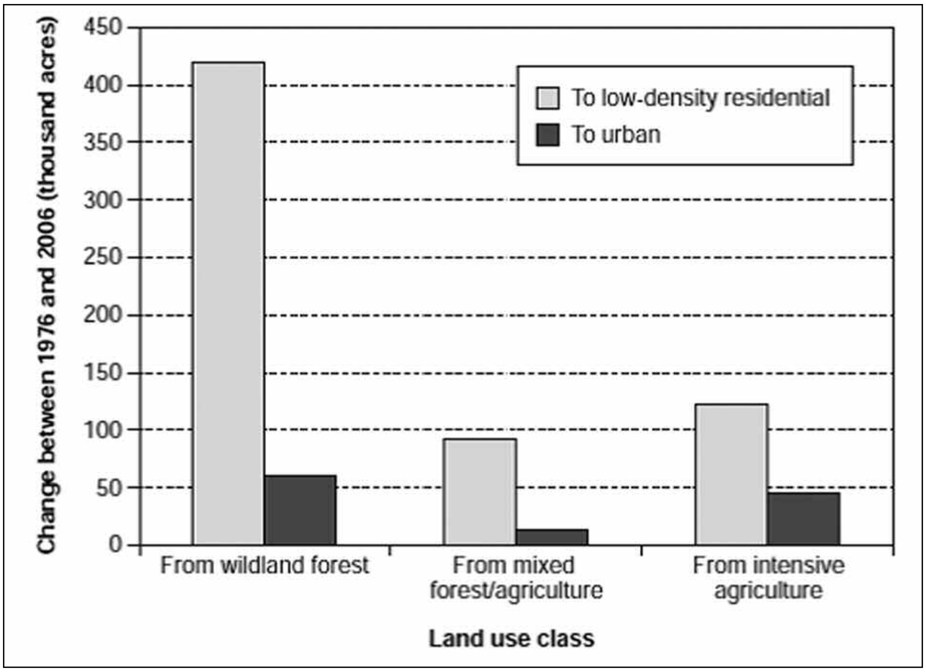
Changes in the way humans choose to use land have a variety of social, economic, and ecological consequences. Timber and agricultural production in particular are affected by how urban and residential areas develop to accommodate population increases and shifts in resource use and economic development. The extent and distribution of forestland is shifting in response to changes in land-use legislation and the pressures of development as the population continues to grow in the Pacific Northwest. Increases in housing density and development into the wildland-urban interface affect traditional economic production from rural lands. It is important to track changes in land use, identify where these changes are occurring, and evaluate them with respect to state and municipal land-use planning goals.

Aerial photos and digital imagery can be combined with FIA plot information to identify land-use categories and compare forest distribution over time. Researchers have compared land use in Oregon and Washington between two time points (the early 1970s and late 2000s) to assess development of forest and farm lands to other uses, as well as changes in housing density.

While the majority of forest, range, and agricultural land in Oregon and Washington remained in those uses over the last three decades, there have been some substantial changes in land use and housing development. Most changes in land use are shifts from forest, range, or agricultural to low-density residential or urban development (see Figure 1). These conversions are largely in response to population growth—an increase of approximately 1.5 million people in Oregon and 2.5 million in Washington since the 1970s. Most of the land developed into residential or urban uses was forestland at the beginning of the study period (650,000 acres in Washington and 270,000 acres in Oregon). Loss of forestland was greatest near urban areas, especially in western Washington and Oregon.

The distance between lands being used for natural resources and developed land influences the rate of land use change. Throughout the study period, distances decreased between private lands being used for natural resource uses and those in more developed uses. Most of the land in Washington that changed from resource use to urban or low-density residential was less than one-quarter mile from existing urban or residential areas. The closer proximity of developed land uses and housing structures to forestland may increase wildfire risk as well as reduce timber production. Others have noted that forestland being managed for timber production tends to decline as housing density in the surrounding area increases. In Oregon and Washington, rates and trends of land-use conversion from resource use to development differs between the western and eastern sections of the state.

Rates of development on resource lands are not consistent over time. Development was greater in the 1970s and 1980s than in the 1990s. Land use change in general slowed down as we entered the economic recession in 2007. Between 2005 and 2009, average



SOURCE: CHANGES IN LAND USE AND HOUSING ON RESOURCE LANDS IN WASHINGTON STATE, 1976–2006. GEN. TECH. REP. PNW-GTR-881.

Figure 1. Net change in land use classes in western Washington.

annual rates of conversion of private land in Oregon from wildland forest or range to more developed uses declined by half compared to the first half of the decade. The change from intensive agriculture use to more developed uses remained constant over the same time period. It is important to note that the density of housing structures on lands that remain in forest or agricultural use continues to increase despite economic fluctuations. The number of structures in and around resource land uses continues to increase in Washington and Oregon, with some of the greatest increases occurring in the eastern parts of the states where wildfire is more common.

The Forest Inventory and Analysis approach to assessing land-use change in the Pacific Northwest provides consistent information over large geographic areas and time spans. Other methods for assessing broad trends in resource use are less likely to detect patterns in vegetation cover, buildings, and counts of individual structures outside of established residential areas. FIA researchers will continue tracking land use change in the Pacific Northwest, as well as examine the effectiveness of land use planning policies by comparing different patterns in development and evaluating forest conversion in relation to fuels and fire risk. ◆

Sharon Stanton is an FIA natural resources specialist for the PNW Research Station in Portland, Ore. She can be reached at 503-808-2019 or sharonmstanton@fs.fed.us.

For More Information

• Gray, A.N., D.L Azuma, G.J. Lettman, J.T. Thompson, N. McKay. 2013. *Changes in land use and housing on resource lands in Washington state, 1976–2006. Gen.* Tech. Rep. PNW-GTR-881. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 51 p.

• Lettman, G.J.; A.A. Herstrom, D. Hiebenthal, N. McKay, T.J. Robinson. 2011. *Land use change on nonfederal land in Oregon 1974–2009.* Salem, OR: Oregon Department of Forestry. 69 p. www.oregon.gov/ODF/STATE_FORESTS/FRP/docs/ForestFarmsPeople2009.pdf.

2014 WSSAF/OSAF LEADERSHIP CONFERENCE

January 31 & February 1, 2014 – Red Lion Hotel, Kelso/Longview, Wash.

All SAF members are invited to participate in the 2014 Leadership Conference to be held at the Red Lion Hotel in Kelso/Longview, Wash. The conference will cover a wide range of issues related to the Society of American Foresters and organizational leadership. While focused on the SAF, the topics are of value to anyone active in community organizations. An array of speakers will cover the topics of general perspectives on leadership, meeting management, and SAF branding, activities, and value. An SAF National Office staff person will be in attendance. We would like to offer students scholarships to this event, so if you can contribute toward this effort, please see the registration form below. We look forward to seeing you in January.

FRIDAY, JANUARY 31, 2014

10:00 am Concurrent WSSAF and OSAF executive committee meetings

Noon Lunch for all Leadership Conference participants (included with registration)

1:00 pm Branding the Society of American Foresters—**Will Novy-Hildesley**, Quicksilver Foundry

2:30 Break

3:00 Meeting Planning Workshop—**Mary Webb**, Business Consultant and Leadership Coach

This session will discuss the planning required to organize a multi-day meeting with multiple sessions. Subject matter will include types of meeting organization, budget planning, fund raising, marketing, participant activities, permits, location, and facilities.

4:00 Tour Planning Workshop—**Richard Zabel**, Executive Director, Western Forestry & Conservation Association

Discussion will include how to organize field trips to maximize participants' learning experiences. Subject matter will include style of the tour, transportation, logistics, safety, speakers, and participant activities.

4:20 Leadership Topic to be determined

5:00 Adjourn

5:30 No-host Social Hour

6:30 Dinner and Keynote Speaker: United States Congressional Representative **Derek Kilmer** (invited) (included with registration)

SATURDAY, FEBRUARY 1, 2014

7:00 am Breakfast (included with registration)

8:00 Pacific Northwest Logging and Forestry History—**Jack Zaccardo**

This historical overview of our shared forestry background gives an important basis for the context to the state of forestry in our society.

8:30 The Value of SAF—**Adrian Miller**, Manager of Policy and Environment, Olympic Resource Management

9:00 Status of the Washington and Oregon SAF Foundation—**Peter Heide**, Director of Forest Policy, Washington Forest Protection Association, and **Ron Boldenow**, Professor of Forest Resource Technology, Central Oregon Community College

9:30 Break

10:00 Legislative and Policy Issues, and Proactive Responses to Forestry Issues
- **Harry Bell**, Washington State SAF Policy Chair
- **Paul Adams**, Oregon SAF Policy Chair
- **Dick Powell**, Oregon SAF Chair
- SAF National Office staff

11:00 SAF National Office Update—TBA, SAF National Office staff

Noon Adjourn

MEETING LOCATION AND LODGING The meeting will take place at the Red Lion Hotel & Conference Center–Kelso/Longview, 510 Kelso Drive, Kelso, WA 98626; 800-Red Lion; 360-636-4400; www.redlion.com/our-hotels/washington/kelsolongview. Reduced rate lodging at the Red Lion is available at the rate of $86.95 plus tax when mentioning the SAF meeting. After January 1, if rooms are still available, the group rate will be offered.

REGISTRATION The registration fee is $125 if received by January 24 and includes lunch and dinner on Friday, breakfast on Saturday, conference materials, and refreshments. The student rate is $75. A late fee of $25 will be in effect if received after January 24. Return completed registration and payment information to: SAF Leadership Conference, SAF Northwest Office, 4033 SW Canyon Rd., Portland, OR 97221; fax 503-226-2515. Checks should be payable to Washington State SAF. Visa and MasterCard accepted. Registration Questions? Contact Amanda at 503-224-8046 or amanda@forestry.org. Program questions can be directed to Joe Murray at 360-460-3733.

SAF CFE HOURS This program is approved for 2.0 hours of Category 1 credits and 5.5 hours of Category 2 credits.

Registration Form — 2014 WSSAF/OSAF Leadership Conference

January 31 & February 1, 2014 – Red Lion Hotel, Kelso/Longview, Wash.

Registration includes all materials and meals (Friday lunch and dinner, Saturday breakfast, and coffee breaks)

Name ______________ SAF Chapter ______________ Email ______________

Address ______________ City/State/ZIP ______________ Day Phone ______________

Special dietary needs? ______________

$ ________ $125/person regular conference registration if received by January 24; $150 if received after 1/24/14

$ ________ $75/student conference registration if received by January 24; $100 if received after 1/24/14

$ ________ Contribution toward student scholarships

$ ________ Add $6 if paying by credit card

$ ________ **TOTAL AMOUNT ENCLOSED**

METHOD OF PAYMENT

☐ **Check** (enclosed) ☐ **Credit Card** (Visa/MasterCard)

☐ **Purchase Order #** ______________

Number: ______________

Expiration Date: ________ Sec. Code: ________

Make checks payable to WSSAF

Return form & payment to: Leadership Conference, SAF Northwest Office, 4033 SW Canyon Rd., Portland, OR 97221; 503-224-8046; fax 503-226-2515; amanda@forestry.org

Calendar of Events

Volcanic Forest Soils of the Pacific Northwest, Nov. 21, Coeur d'Alene Resort, Coeur d'Alene, ID. Contact: WFCA.

Markets, Methods, and Innovations Driving PNW Timber Production, Dec. 3, Heathman Lodge, Vancouver, WA. Contact: WFCA.

How to Dry Lumber for Quality and Profit, Dec. 9-11, Corvallis, OR. Contact: Mike Milota, 541-737-4210, mike.milota@oregonstate.edu.

Sixth Annual Western Native Plant Conference, Dec. 9-11, Vancouver, WA. Contact: WFCA.

Helicopter Logging, Jan. 6, 2014, Corvallis, OR. Contact: FEI.

Mechanized Harvesting, Jan. 7-8, Corvallis, OR. Contact: FEI.

Basic Road Design, Jan. 13-16, Corvallis, OR. Contact: FEI.

22nd Annual Family Foresters Workshop, Jan. 17, Mirabeau Park Hotel and Convention Center, Spokane Valley, WA. Contact: Chris Schnepf, 208-446-1680; cschnepf@uidaho.edu, www.uidaho.edu/extension/forestry/content/calendarofevents.

Mapping the Course: 2014 Timberlands, Forest Products Processing and Energy Issues on the North American West Coast, Jan. 23, Heathman Lodge, Vancouver, WA. Contact: WFCA.

Skyline XL, Jan. 23-24, Coeur d'Alene, ID. Contact: FEI.

Cable Logging, Jan. 27-30 in Coeur d'Alene, ID, and Feb. 18-21 in Corvallis, OR. Contact: FEI.

SAF Leadership Conference, Jan. 31-Feb. 1, Red Lion, Kelso, WA. Contact: Joe Murray, 360-460-3733, jmurray@merrillring.com.

How to Use SkylineXL and LogCost/HaulCost Spreadsheets, Feb. 4-5 in Grand Mound, WA, and Feb. 11-12 in Redding, CA. Contact: WFCA.

Foresters' Forum, Feb. 5-7, Coeur d'Alene, ID. Contact: Ric Hagenbaugh, 208-883-4488 x117, hagenbaugh@nmi2.com.

Logging, Construction, Trucking and Heavy Equipment Expo, Feb. 20-22, Eugene, OR. Contact: Oregon Logging Conference, 541-686-9191, www.oregonloggingconference.com.

Unit Planning and Layout, Feb. 24-27, Corvallis, OR. Contact: FEI.

Tree School Clackamas, Mar. 22, Portland, OR. Contact: Sally Yackley, 503-655-8631, sally.yackley@oregonstate.edu.

ArcGIS 10: An Introduction to Environmental Applications, Mar. 25-27, Olympia, WA. Contact: Christa Lilly, 425-270-3274 x103, clilly@nwetc.org.

Variable Probability Sampling Workshop, Mar. 31-Apr. 4, Richardson Hall, Oregon State University, Corvallis, OR. Contact: OSU Conference Services, 541-737-9300, conferences@oregonstate.edu, http://oregonstate.edu/conferences/event/variableprobability2014/.

Oregon SAF annual meeting, Apr. 30-May 2, Seven Feathers Casino Resort, Canyonville, OR. Contact: Mark Buckbee, 541-580-2227, buckbeefamily@msn.com, www.forestry.org.

Washington State SAF annual meeting, May 7-9, Pack Forest, Eatonville, WA. Contact: Paula Hopkins, 253-951-1457, 4estmgr@gmail.com.

The Basics of Forestland and Timber Appraisal, June 9-13, Oregon State University, Corvallis, OR. Contact: WFCA.

Contact Information

FEI: Forest Engineering, Inc., 620 SW 4th Street, Corvallis, OR 97333, 541-754-7558, office@forestengineer.com, www.forestengineer.com.

WFCA: Western Forestry and Conservation Association, 4033 SW Canyon Rd., Portland, OR 97221, 503-226-4562, richard@westernforestry.org, www.westernforestry.org.

Send calendar items to the editor at rasor@safnwo.org.

Alaska's Boreal Forests

(CONTINUED FROM PAGE 13)

Index or NDVI (a measure of greenness) from the 1980s to the present using Landsat satellite imagery.

The goals of the re-measurement of the AIRIS plots are several. First and foremost we are interested in understanding how the vegetation in the Tanana River Basin has changed over a 30-year period. Second, we are interested in refining our methods so that we can better understand how to interpret satellite imagery in areas where we don't have either photo or field plots. Lastly, we are maintaining a focus on a key part of the country that has yet to have an FIA inventory established and we are hoping that this work will serve as a stepping stone to the ultimate goal of creating an inventory of all forested interior Alaska.

The FIA program has maintained an interest in inventorying the interior portion of the state. With the implementation of the pilot study in 2014 on the Tanana River Basin, the results from these multiple efforts could result in key information about the current status and trends of the forests of this important region. ◆

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NAIP Imagery Flown for Washington and Idaho in 2013

Washington and Idaho were flown in the summer of 2013 under the National Agriculture Imagery Program (NAIP). According to Mike McGuire with Assent GIS, Washington was collected with 1 meter resolution and Idaho was collected with 1/2 meter resolution. Washington state 2013 imagery is available for immediate download at: http://datagateway.nrcs.usda.gov/GDGOrder.aspx. The Idaho imagery will also be available at that website, although it may be a few months before processing is complete.

The imagery is in a MrSID format, allowing users to view the imagery on computers with GIS software, Pocket PCs with ArcPad, or other image viewer programs. The original format is in Universal Transverse Mercator (UTM) coordinates and meters for units.

The imagery was collected using digital sensors in aircraft. Every county in Washington and Idaho has full-image coverage available in the form of a Compressed County Mosaic. The MrSID file format allows users to view an entire county at one time. Because file sizes are four times as large with 1/2 meter resolution, the Idaho imagery will be compressed at a 60:1 compression ratio rather than the normal 15:1 compression. This will allow the file sizes to be comparable between one meter and half meter resolution.

For more information on the National Agriculture Imagery Program, contact Jon Aschenbach with Resource Supply, LLC at 503-521-0888 or jon@resourcesupplyllc.com.

Affordable Mechanical Fuels Treatment

(CONTINUED FROM PAGE 15)

biomass energy, accounted for about a fifth of the total product value. The fraction is relatively small because there was less of it and it has a lower unit price, but since delivery of energy wood to the landing is already "baked-in" to the cost of most whole tree harvest prescriptions, only delivery costs were attributed to energy wood, and these accounted for only 6-7 percent of all treatment costs. It rarely, if ever, makes financial sense to burn logging residues at the landing unless delivery costs are exceptionally high, which can occur when bioenergy facilities are rare or access to treatment areas is challenging (e.g., for chip vans).

When woody material removed by a fuel treatment is utilized for wood products and bioenergy, revenues contribute a great deal to off-setting treatment costs and, on most acres, can more than offset the costs of treatment activities and transportation of harvested material, although this varies geographically and whether stands are assumed to be treated only when all hazards have been mitigated or when even one hazard has been mitigated.

For example, in Utah, mean net revenues were always negative, and were negative in the northern and central Rocky Mountains when it was assumed that all hazards must be mitigated. Aspen had negative mean net revenues because of the low commercial values of harvested material (most trees in this type are utilized for energy wood in our scenarios). In most scenarios, net revenue was greater for pine and western larch than for Douglas-fir and true fir, and scenario assumptions are extremely influential. For example, let's compare two scenarios. The first required that all hazards be mitigated and specified that ties (in terms of composite hazard score) among treatments that achieve this goal be resolved in favor of the treatment with the lowest residual stand ptorch value. The resulting mean net revenue per acre for pine and fir was $825 and -$33, respectively. In the second scenario, where ties were resolved by choosing the treatment with the greatest net revenue, mean net revenues were $921/acre and $283/acre, respectively, for pine and fir. This highlights the importance of hazard and effectiveness definitions, as well as how to determine the "best" treatment when there is more than one way to achieve a given hazard score.

To be truly effective in mitigating fuel hazard, it is important to pursue all options that promote self-funding fuel treatments. Given the current and likely future federal budget climate, it is hard to imagine successful implementation of anything but treatments that pay their own way for the foreseeable future. The future of active forest management on public lands may well depend on reconciling ourselves as foresters and natural resource professionals to that hard reality. ◆

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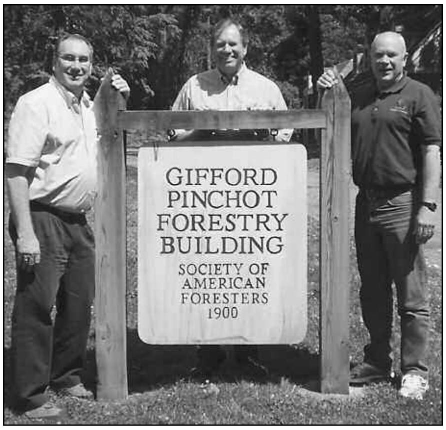
Council Meets During Convention

BY JOHN WALKOWIAK, BOB ALVERTS, AND JOHNNY HODGES

The 2013 Society of American Foresters (SAF) national convention was held Oct. 24-27 in North Charleston, SC. Thanks to the hard work of the National Office staff along with host Appalachian SAF, and despite concerns with the federal shutdown, registration still achieved over 1,500 participants. A great plenary session featured keynote speaker Eric Rutkow, author of the book *American Canopy, Trees, Forests and the Making of a Nation*, and many others who successfully pursued the conference theme "Silviculture Matters." Thanks to the donations of many SAF members, including items from the Pacific Northwest, over $10,000 was raised via silent auction for the Foresters' Fund. The student Quiz Bowl was a major success with 36 different teams competing with SUNY College of Environmental Science and Forestry winning it for the second consecutive year. Oregon State University finished in the final four.

The western US was well represented with award winners including: Jo Ellen Force of Inland Empire SAF for the Gifford Pinchot Medal; John Sessions of Oregon SAF for the SAF Award in Forest Science; Kasten Dumroese of Inland Empire SAF for the Technology Transfer Award; Wayne Giesy of Oregon for the SAF Honorary Membership; and Robert Sturtevant of Colorado-Wyoming SAF for the John A Beale Memorial Award. In addition, Field Forester awards were presented to Paul Wagner of Washington State SAF (District 1), Dale Claassen of Oregon SAF (District 2), and Marvin Levert of Montana SAF (District 4).

Council also used the National Convention as an opportunity to conduct business on Oct. 21 and 23. Council received an update from the Executive Vice President (EVP) Search Committee that a search firm has been identified to help locate the next SAF EVP. A new timeline has been set for the final candidates to be interviewed by Council at the March 2014 Council Meeting in Bethesda. Council also approved revisions/updates to five existing SAF position statements that included: Biological Diversity in Forest Ecosystems; Clearcutting; Forest Biotechnology; Protecting Endangered Species on Private Lands; and Urban Forestry.



Left to right: Council representatives John Walkowiak, Johnny Hodges, and Bob Alverts.

A budget report by the Finance Committee and National Office staff indicated that SAF is well within the approved 2013 budget, but 2013 will end with a deficit budget for the fifth consecutive year. No dues increases will occur in 2014. While the Finance Committee plans to present a balanced budget for 2014, costs associated with hiring a new EVP will make it challenging, so some hard decisions will need to be made at the upcoming December Council meeting. By 2015 we should have no problem achieving a balanced budget.

Former District 4 Council member Lynn Sprague chaired a "Committee on Committees" and presented Council with a final report on the status of the numerous SAF standing committees. The Committee on Committees recommended that Council provide clearer direction on what they expect of standing SAF committees and that these committees be held accountable annually for accomplishment or be dissolved. Council also reviewed and voted down a proposed MOU with the International Forestry Student Association (IFSA). IFSA was not only seeking cooperation with SAF, but also requested complementary registrations at national conventions, a non-voting seat at SAF Council meetings, and direct access to SAF student chapter members. Council felt the MOU was unnecessary and asked the SAF Student Congress to review opportunities with IFSA in the future.

Council also met with the House of Society Delegates (HSD) to discuss and receive input on business matters involving budgets, non-dues revenue development, Certified Forester program, forest policy opportunities, ongoing work for wise investment of the proceeds from the sale of the property, and support for the new Articles of Incorporation that was presented on the 2013 ballot. HSD also learned about opportunities to utilize National Office staff expertise on electronic communications. KY-TN SAF presented a resolution to HSD to move the National Office out of the Washington, DC metro area, but their motion was strongly defeated due to considerations for forest policy contacts with Congressional staff, communications with partner agencies and organizations that are located in the DC metro area, and that the property asset of the SAF Headquarters Building is a historic landmark.

Consultant Will Novy-Hildesley of Quicksilver Foundry of Portland, Ore., led both HSD and Council groups in continuing discussions on SAF's Brand Framework to bring clarity to the core purpose of our organization, the signals that we send to prospective members, and how SAF can align and focus our communications more effectively. Much work still remains for SAF to develop a better communications and governance for SAF's future.

The SAF National Convention for 2014 will be jointly held with the International Union of Forestry Research Organizations (IUFRO) as well as the Canadian Institute of Forestry on Oct. 8-11 in Salt Lake City, Utah. ◆

This Council report is a joint effort between SAF District 1 Council Representative John Walkowiak (253-320-5064; jewalkowiak@harbornet.com), District 2 SAF Council Representative Bob Alverts (503-639-0405; balverts@teleport.com), and District 4 Council Representative Johnny Hodges (970-218-3394; jah.16@live.com).

Policy Scoreboard

Editor's Note: To keep SAF members informed of state society policy activities, Policy Scoreboard is a regular feature in the Western Forester. *The intent is to provide a brief explanation of the policy activity—you are encouraged to follow up with the listed contact person for detailed information.*

WSSAF Position Statement Update. The Inland Empire SAF has adopted the WSSAF position statement on No-Net-Loss of Working Forests that the full WSSAF membership is currently voting on. WSSAF Member Bob Dick has volunteered to write a first draft of a policy statement on Olympic National Forest planning. WSSAF is looking for volunteers to take the lead drafting the following position statements that will expire in 2014: Addressing the Threat of Wildfire in the Wildland/Urban Interface; The Contribution of Washington Forests to Carbon Sequestration; Management of Federal Lands in Washington; and Washington DNR Trust Land Management (expires in 2013). Each of these statements needs to be updated to be compatible with our Working Forests Position Statement. Contact: Harry Bell, WSSAF Policy chair, harry@greencrow.com.

Federal Land Payments to Counties Update. Payments have been extended for one more year, at a reduced level. What comes next? Stay tuned to this column. Contact: Jay O'Laughlin, Inland Empire SAF, 208-885-5776, jayo@uidaho.edu.

Regulation of Biogenic CO_2 Emissions Update. A decision by the US Environmental Protection Agency on how the agency proposes to regulate carbon dioxide emissions from burning biomass for energy production has not yet been made. Your SAF Biogenic Carbon Response Team is still on the job. Contact: Jay O'Laughlin, Inland Empire SAF, 208-885-5776, jayo@uidaho.edu.

OSAF Comments on Eastside Federal Forest Bill. OSAF Chair Ron Boldenow sent a letter to Senator Ron Wyden about the Eastside Federal Forest Management bill (S. 1301) that he introduced this summer. The bill is similar to an earlier version that failed to move forward in the prior session of Congress. Although the bill highlights timber supply and local economic benefits, the OSAF letter raised concerns that its restrictive provisions more likely would impede these goals; for example, its riparian and diameter- and age-based cutting limits could become locks with very sticky keys. Other concerns were raised about how the bill directs the use of scientific and technical input and concepts, including limited consideration of the site-specific nature of forest conditions and the importance of local management and operations experience. Contact: Paul Adams, OSAF Policy chair, 541-737-2946, paul.adams@oregonstate.edu.

OSAF Completes More Position Statement Updates. The OSAF Executive Committee approved updated position statements on "Clearcutting" and "Active Management to Achieve and Maintain Healthy Forests," adding to "Salvage Harvesting on Public Lands," which was updated and approved earlier in the year. The modifications were relatively minor, and focused on updating the reference lists and background discussions. The positions remain important given ongoing concerns about wildfires, forest health, and negative perceptions of clearcutting. The latter issue was renewed by the O&C lands bill introduced by Rep. DeFazio, which would facilitate the use of "regeneration harvests." All members are encouraged to review OSAF's position statements (www.forestry.org/oregon/policy/position/) and use them to articulate a professional perspective when discussing forest resource issues with people outside the profession. Contact: Paul Adams, OSAF Policy chair, 541-737-2946; paul.adams@oregonstate.edu. ◆

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