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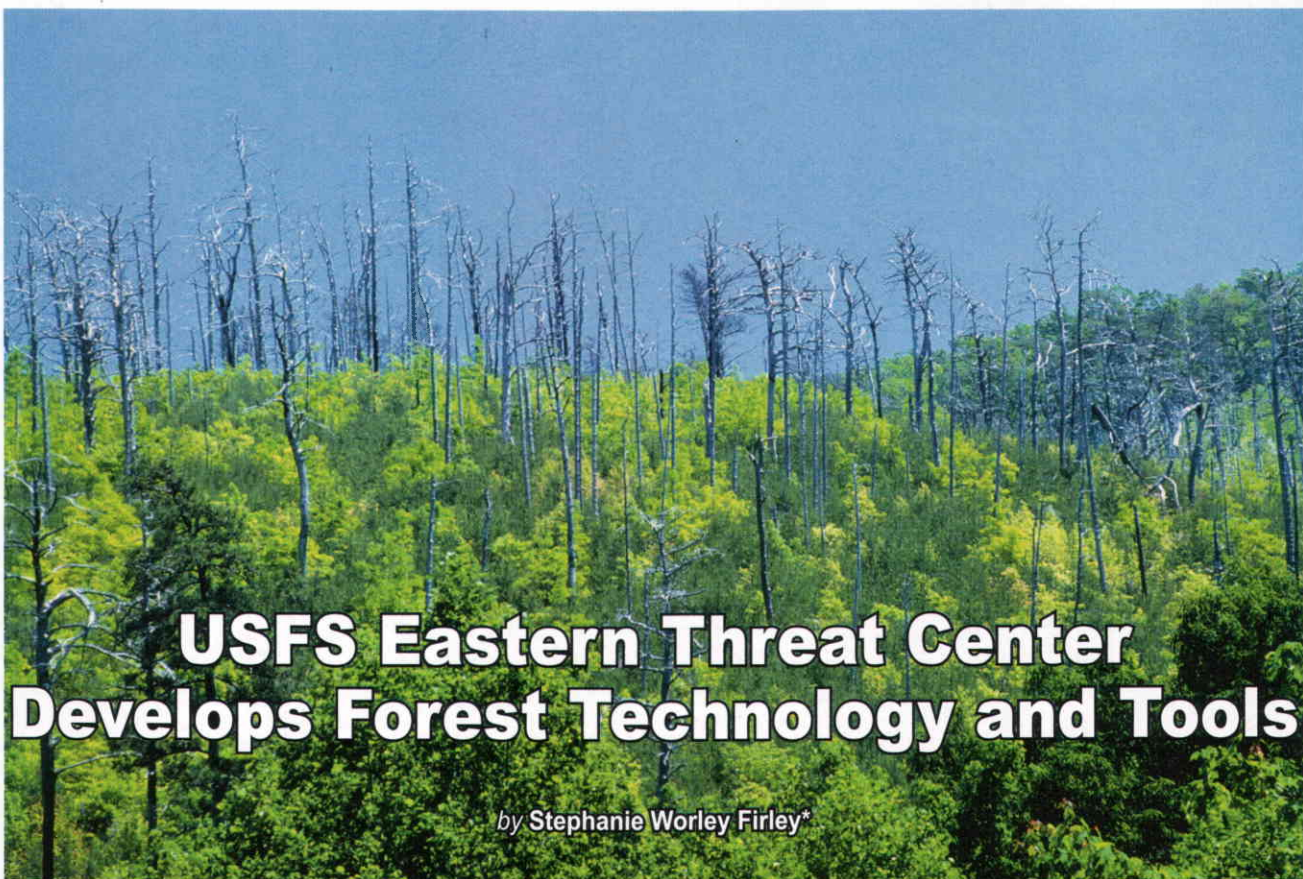
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SHARING IDEAS AND LEADERSHIP

USFS Eastern Threat Center Develops Forest Technology and Tools

by Stephanie Worley Firley*

A forest recovers following a wildfire. Forests are constantly changing due to natural seasonal rhythms, growth and mortality, and the effects of disturbance. *(USDA Forest Service photo).*

The need for a new approach to forest management became clear in the face of disaster. Decades of wildfire suppression had led to a gradual buildup of dense forests, thick with downed trees and litter. This slow accumulation of woody material helped fuel the large wildfires of the late 20th and early 21st Centuries. In 2002 and 2003, almost 11 million acres of U.S. forest land burned, thousands of homes and other structures were destroyed, and dozens of civilian and firefighter lives were lost. In response to these tragedies, President Bush signed the bipartisan Healthy Forests Restoration Act of 2003.

The Act required federal agencies to create new programs for improving forest health across the nation, including hazardous fuel reduction on federal lands to prevent catastrophic wildfires. Beyond wildfire prevention, the Act contained other provisions for woody biomass utilization, watershed forestry assistance, insect and disease treatment, and private land management support through the Healthy Forests Reserve Program. A final component of the Act addressed forest inventory and monitoring on public and private lands as well as the development of early warning systems for identifying and responding to forest threats. This prompted the USDA Forest Service to establish coordination centers to work with federal, state, and other partners to predict, detect, and assess individual and interacting threats to forest health in a whole new way.

Biological science information specialist with the Eastern Forest Environmental Threat Assessment Center in Asheville, North Carolina.

Since 2005, the Eastern Forest Environmental Threat Assessment Center has served as the coordination center for the eastern United States. (A sister center, the Western Wildland Environmental Threat Assessment Center, serves the western states.) The Eastern Threat Center is administered by Forest Service Research and Development, but is also supported by the agency's National Forest System and State and Private Forestry. With this structure, Center scientists and supporting staff take an all-lands approach to threat assessment, which is achieved through diverse partnership efforts. The Center collaborates with federal, state, and local agencies; universities; non-governmental organizations; and private companies to develop and deliver tools and technology to address forest threats.

"The Eastern Threat Center is committed to putting knowledge and technology to work, and engaging in partnerships that encourage scientific discovery," says Danny C. Lee, Center Director. "Our efforts are primarily focused on providing information useful to land managers, natural resource decision makers, scientists, and the general public." The resulting products and services, can help land managers evaluate and anticipate impacts from wildland fire, insects and disease, invasive plants, forest fragmentation and conversion, and climate change.

Recognizing and tracking forest change and disturbance

Forests are constantly changing due to natural seasonal rhythms, growth and mortality, and effects of disturbance. But forest land is often remote, which can make tracking forest conditions a challenging task. With partners spanning four federal agencies as well as university collaborators, Center

scientists developed a web-based tool, called ForWarn, to monitor forest change and potential disturbance in near real time. ForWarn can help users detect and identify forest disturbance caused by insects, diseases, wildfires, extreme weather, or other natural or human-caused events.

ForWarn uses NASA satellite imagery which is processed and delivered to users through the Forest Change Assessment Viewer *(page 15)*. The Assessment Viewer provides forest change maps—coast-to-coast snapshots of the U.S. landscape—that are updated every eight days. Users can view forest change compared to the last year, change relative to the last three years, and change that has occurred over the last decade to detect sudden disturbance events as well as more slow-acting disturbances or forest recovery. As ForWarn provides a strategic national overview of all types of forest change, it complements and focuses the efforts of existing forest monitoring programs, which can result in time and cost savings.

Connecting science with forest planning & management

The amount of existing and emerging research concerning climate change is overwhelming to say the least. Natural resource managers and planners are challenged to sort through this information to determine how projected climatic changes and related forest stressors could impact their land in order to develop strategies for sustaining healthy forests. The Template for Assessing Climate Change Impacts and Management Options (TACCIMO) is a web-based tool designed to connect users who are responsible for federal, state, and private forest land with science they can trust.

TACCIMO guides users through a searchable collection of climate change effects and management options taken directly from scientific literature. The tool also features a mapping application that provides nationally and locally
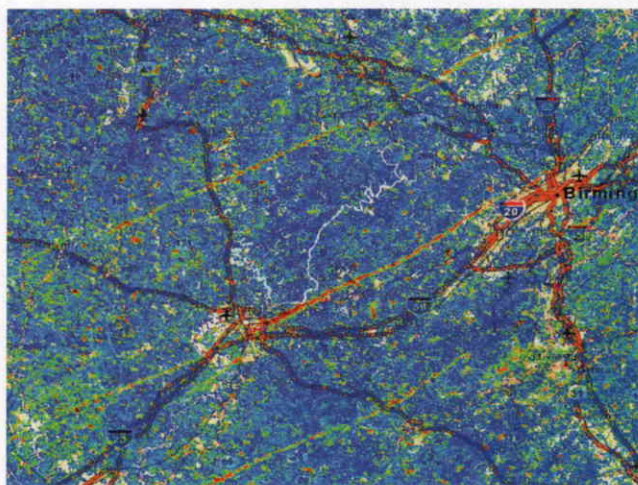
Red and yellow streaks on a forest disturbance map show the extent and intensity of tornado damage across Alabama in April 2011. ForWarn can help natural resource managers monitor forest change and recovery in near real time.

relevant climate data and other models helpful for evaluating climate change impacts on forests. Users can quickly generate summary reports for a specific location and natural resource concern in a consistent and organized manner.

Predicting water stress in a changing environment

Forest ecosystems provide many benefits and services, including clean water essential for ecosystem and human use. Water availability determines forest productivity, including the growth of wood and other marketable and non-marketable forest products, but must be balanced with human needs for water in homes, agriculture, energy and industry. The Water Supply Stress Index (WaSSI) model is a web-based planning

Eastern US forests are vulnerable to impacts from many environmental stressors. The hemlock woolly adelgid is responsible for widespread forest decline. *(USDA Forest Service photo).*
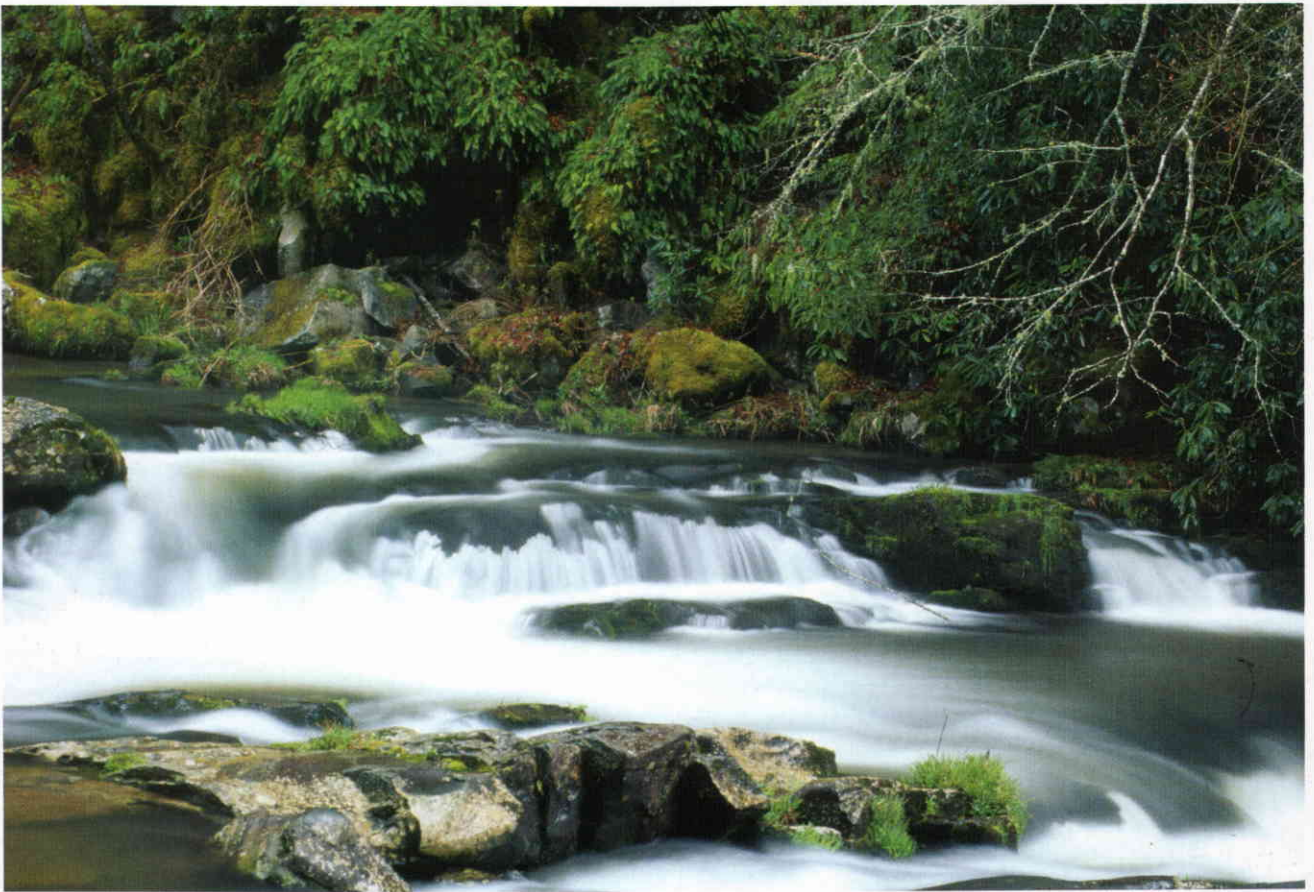
Forest ecosystems provide clean water essential for ecosystem and human use *(USDA Forest Service photo).*

tool that can help natural resource managers and planners consider the influences of human and environmental factors in order to evaluate balances and tradeoffs related to water availability.

WaSSI predicts how changes in climate, human population, and land cover may impact water availability and ecosystem productivity at the watershed level across the lower 48 United States and Mexico. WaSSI generates useful information to support informed decision making about water supplies and related ecosystem services in light of climatic, economic, and demographic change. WaSSI users can select from a variety of future climate scenarios, and adjust temperature, precipitation, land cover and water use factors to simulate an unlimited number of global change scenarios for any timeframe from 1961 through the year 2100. Simulation results are available as downloadable graphs, maps, and data files that users can save and apply to their unique information and project needs.

Examining the role of humans In the spread of invasive forest pests

Humans play an important role in the movement of invasive forest insects. Some forest pests can hitch rides in firewood, woody packing materials, and other untreated wood products, enabling them to establish new populations in previously uninfested forest areas. Center researchers and collaborating scientists are examining pathways for the human-assisted spread of forest pests to anticipate where and how often invasive alien forest insects are likely to be established in the United States.

Researchers have estimated annual rates of establishment of non-native forest insect species due to trade for more than 3,000 U.S. urban areas and Canada. They are also analyzing and mapping travel patterns of campers in the United States and associated firewood transport—a practice that can introduce forest pests into new and often remote areas. This information will assist U.S. and Canadian decision makers and offer guidance for border control efforts, post-border surveillance, and rapid-response measures, as well as help land managers prepare for and respond to invasive forest insect arrivals.

Supporting development of a national wildfire strategy

As with the Healthy Forests Restoration Act of 2003, governmental agencies and private citizens continue to make major investments throughout the United States to reduce human and ecological losses from wildfire. Unfortunately, no universal solutions exist for reducing

the threats of wildfire losses and achieving longer term fire resiliency. In 2010, the U.S. Congress required the federal agencies responsible for wildland fire management to work with states, tribes, and other interested groups to develop a National Cohesive Wildland Fire Management Strategy to guide future management and wildland fire investments.

Using the Center-developed Comparative Risk Assessment Framework and Tools, a structured risk assessment and decision process, Center scientists are helping regional strategy committees to evaluate the relative consequences of alternative wildland fire management plans. As these teams examine trade-offs and uncertainties, they are gathering important information to determine how to meet long-term landscape goals most efficiently and guide development of the national strategy.

Delivering useful and user-friendly information and tools

"Science you can use" is the guiding principle as Center researchers, staff, and collaborators develop and share information and tools with audiences in the eastern United States and beyond. "Additionally, we are expanding our collaborations with stakeholders, state and federal agencies, universities, non-governmental organizations, and interested individuals whose ideas help us better address forest threats," says Lee.

Visit *http://www.forestthreats.org* to learn more about Center products and services as well as other ongoing efforts and training opportunities. For more information or to request printed materials, contact Perdita Spriggs, Eastern Threat Center communications director, at (828) 230-3292 or *pspriggs@fs.fed.us.*

The destructive emerald ash borer can be transported in infested firewood. Eastern Threat Center researchers are examining pathways for the human-assisted spread of forest pests. *Photo by Troy Kimoto, Canadian Food Inspection Agency, Bugwood.org*

Getting started with the Forest Change Assessment Viewer

The Forest Change Assessment Viewer provides new forest change maps of the lower 48 United States every eight days. Follow these steps to access the tool and view the maps.

1. Open this URL in a web browser *http://forwarn.forest-threats.org/fcav.*

2. In the Table of Contents window on the left, click the tab heading "Forest Disturbance Detection Maps" to expand and view the data layers (MODIS NRT – MODIS Near-Real-Time). Notice that the "All-Year" baseline is automatically turned on (indicated by a yellow light bulb). Turn this off by clicking the yellow light bulb.

3. Look directly below for the section "Disturbance since 2010 – 1-Year Baseline" and click the light bulb next to the top-listed, or most current, forest change image.

4. Use the map controls to zoom and pan, or type a county name in the "Find Area" box in the top-right area of the viewer window.

5. Use the wrench icon to adjust the transparency of any layer to better view the

basemap or other map layers.

6. To view an area of interest with a different basemap, click the dropdown arrow next to the "Basemap" control in the top-center portion of the viewer.

7. For additional information and guidance for interpreting map images, click the User's Guide link in the lower left portion of the viewer.