

Forest ThreatNet

...sharing knowledge and tools needed to anticipate and respond to emerging forest threats

The Eastern Forest Environmental Threat Assessment Center

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From the Director

The Forest Service places great emphasis on safety throughout the agency. Unfortunately, despite our best efforts, accidents occur. On June 21, the Forest Service tragically lost two of our own. Dan Snider, 29, and Rodney Whiteman, 46, worked for the Morgantown, WV, Northeastern Area Forest Health Program office. They

were killed along with their pilot, Patrick Jessup, when their small plane crashed just short of the runway in Lock Haven, PA. Dan and Rodney were conducting aerial pest detection surveys at the time, probably looking for signs of gypsy moths or other insects in the Allegheny National Forest and surrounding areas. Dan was a former student of Bill Smith, EFETAC scientist, and once worked for the Southern Research Station in Research Triangle Park. More recently, Bill and Dan had worked together on various risk assessments in the Allegheny National Forest. Clearly, Dan and Rodney were exceptional individuals who will be missed by all that knew them. Our sincerest sympathies go out to Dan's wife and son, Rodney's wife and daughter, and their many friends and colleagues.

The loss or injury of any colleague or friend raises inevitable questions. What went wrong? What could have been done to prevent this? Early newspaper reports about the plane crash hinted at mechanical failure, but the investigation by the National Transportation Safety Board is not complete. The Forest Service will conduct its own review. Both reviews could lead to changes in procedures designed to lessen the risk of a similar incident.

The loss of Dan and Rodney reminds us that many of the activities we undertake as professionals involve risk. Each summer, we hire crews to gather data in a variety of field studies. These crews often perform arduous work in remote locations. The data they collect is important, but not nearly as much as their safety. Over the years, EFETAC has been very fortunate to not have had any serious injuries. I attribute much of that to the diligence of our staff, especially those with specific safety responsibilities— Michael Gavazzi, Mark Ambrose, and Ginny Burgess. Everyone has a role in making sure that we perform our work in the safest manner possible. Safety first is more than a slogan.

Until next time,
Danny C. Lee

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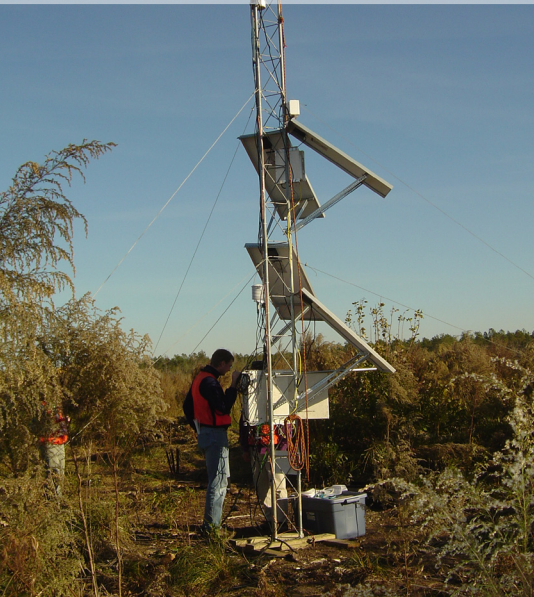


Forest ThreatNet

Reforestation Reflections

Scientists ponder carbon, water, and climate in managed forests

By Stephanie Worley Firley, EFETAC



Planting more trees and allowing degraded land to return to natural forest cover are widely discussed options for mitigating climate change impacts. Trees take in carbon dioxide—the greenhouse gas whose rising atmospheric levels have been implicated in increasing average global temperatures—and provide long-term carbon storage. However, some recent studies have suggested that greater forest coverage might actually *warm* the planet.

These studies cite albedo, the amount of sunlight reflected off earth's surfaces that is not absorbed as heat. With the albedo effect, lighter colored surfaces, such as snow and ice, reflect more sunlight (high albedo) than darker surfaces, such as asphalt, fields, and forests (low albedo). According to these studies, tropical areas of the world could become cooler as a result of reforestation, but temperate areas of North America and Europe may not respond in the same manner.

While forests indeed have a relatively low albedo, reforestation does not necessarily contribute to global warming, conclude scientists from the Southern Research Station, North Carolina State University, and University of Toledo in newly published research. Their findings come from data collected in two coastal North Carolina loblolly pine plantations where the interacting effects of forest management on carbon and water cycles have been examined since 2004. "We observed that 18-year-old trees on one research site do absorb more heat than recently planted trees on the other site. But low albedo and higher heat levels actually seem to increase the rates of forest evapotranspiration—a process that consumes energy

in converting liquid water to vapor—rather than heat the surrounding air," says **Ge Sun**, EFETAC research hydrologist and the study's lead author. "We argue that forest regrowth or establishment is not likely to increase the energy flow needed to heat the atmosphere as some other studies speculate—at least in conditions where water is not very limited."

This study is part of a larger collaboration through FLUXNET, a global network of towers instrumented to take measurements of water, carbon dioxide, and energy as they are exchanged between an ecosystem and the surrounding atmosphere. In contrast to other FLUXNET sites, these loblolly plantations are managed ecosystems. These plantations are also unique because they are former forested wetlands on organic soils with shallow groundwater originally drained for timber production. "This type of site has been historically underrepresented by FLUXNET," says Sun.

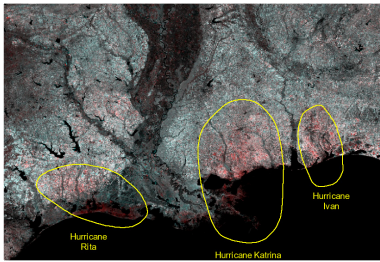
The research will continue with scientists tracking the changes in water and energy balances over the entire rotation of the plantations under various climatic conditions. "So far, Mother Nature has offered excellent opportunities for this long term study. For example, 2007 and 2008 were exceptionally dry years, and 2009 was a wet year. These data will offer insights into how droughts affect the conclusions derived from our previous studies," says Sun. "We also hope our landscape-scale research contributes to answering bigger questions, such as how land use change affects regional climate."



Title photo: EFETAC North Carolina State University cooperating researcher Asko Noormets downloads data from a tower on the recently planted loblolly pine plantation. Right: Eighteen-year-old loblolly pines on the coastal North Carolina research site.

Journal Highlights Forest Service Early Warning System

A national early warning system designed to assist land managers in rapidly detecting threats to forest health was featured in the cover article of the October 2009 issue of *Photogrammetric Engineering and Remote Sensing (PE&RS)*, the journal of the American Society for Photogrammetry and Remote Sensing (ASPRS). The article, entitled "Toward a National Early Warning System for Forest Disturbances Using Remotely Sensed Canopy Phenology," describes the vision and progress of the system in development by partners from EFETAC, Western Wildland Environmental Threat Assessment Center, and NASA Stennis Space Center.



The early warning system will simplify analysis of impacts from forest threats over large regions. Lasting effects from hurricanes can be viewed as a reduction in vegetation.

The initial stages of the early warning system include use of satellite imagery in combination with aerial and on-the-ground observations to monitor forest health. The next stage, and a key component of the system, is the incorporation of data on land surface phenology—the expected seasonal vegetation changes such as spring leaf out and fall leaf color change and drop—to create weekly maps of U.S. vegetation (e.g., forest) change.

"Land surface phenologies can be used to characterize normal, 'expected' conditions and thus can help a warning system determine where and when vegetation has changed," says **William Hargrove**, EFETAC research ecologist and lead author of the *PE&RS* article. "The goal of this system is to allow analysis of vegetation change on a weekly basis at a national scale to provide near real-time information on forest conditions as they are impacted by insects, diseases, wildfires, or extreme weather events."



William Hargrove

Researchers are employing the MODIS (Moderate Resolution Imaging Spectroradiometer) satellite to generate the land surface phenology data that underlie the weekly landcover maps. "Work thus far has been promising," says Joe Spruce, a senior scientist working at NASA Stennis Space Center. "We can clearly detect regional patterns of forest disturbance from the MODIS data." Soon, land managers and other interested users will be able to access these disturbance detection products online. "We think that timely regional forest change detection products in a format that is easily accessible will help provide new, previously unavailable early warnings of prevalent forest threats. This application will enable new ways to monitor vital signs of forests and to respond where threats occur," says Spruce.

For more information about the early warning system or to view the *PE&RS* article online, contact Bill Hargrove at (828) 257-4846, by email at whargrove@fs.fed.us or visit www.forestthreats.org.

Forest ThreatNet is a Quarterly Newsletter

The Eastern Forest Environmental Threat Assessment Center (EFETAC) is an interdisciplinary resource actively developing new technology and tools to anticipate and respond to emerging eastern forest threats. The Center is a joint effort of the Forest Service's Research and Development, National Forest System, and State and Private Forestry and housed within the Southern Research Station.

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Controlling Pests Can Be “Risky” Business

Scientists’ risk assessment tools important for forest management

By Bridget O’Hara, NEMAC

EFETAC biometrician **Bill Smith** and North Carolina State University cooperating researcher **Frank Koch** spend a significant amount of time compiling enormous amounts of data – understanding how forest pests spread – and have consequently developed a unique working relationship. Their 5-year partnership includes an unusual way to approach, and solve, a problem. Koch lends insight into the ultimate compromise. . . . “First, we think about possible solutions, and Bill suggests something completely outlandish. I tell him it won’t work, or will take way too much time or effort to implement. After a couple of days, I ultimately see a way to do what he suggested.”

Smith, who began his career computer programming with wire boards in the 1960s, sees patterns in numbers, and based on a lifetime of experience in numerous disciplines, can create unconventional yet workable concepts. Koch uses his expertise in spatio-temporal analysis, modeling, and data mining to execute a plan and, according to Smith, “can aggregate 15 sets of data in a beautiful way.” This partnership results in award-winning pest risk maps, model outputs, and methodologies for improving these outputs that provide forest managers a jump start on controlling pests nationally and internationally.

Pest risk maps offer a way to prioritize responses to emerging pest threats based on risk while incorporating uncertainty. To create these tools, Smith and Koch gather data sets describing pest risk parameters. Data include how healthy and affected host trees are spread across the landscape; environmental factors such as temperature, precipitation and altitude that may weaken or strengthen pests; and dispersal pathways that allow pests to travel from one forest to another.

They are particularly interested in dispersal pathways because, although invasive species are sometime spread unintentionally with human assistance, it has not been factored into most risk assessment efforts. “We have applied commodity flow and transportation network data, regional agricultural statistics, and similar data sources to identify and represent important human-mediated pathways for forest pest dispersal,” says Koch. “Natural resource managers use risk assessment maps to place detection traps, release biological control agents, or simply decide where devoting resources might be most effective.” Smith adds, “It helps that pest risk maps are also a visual aid, well suited to explaining the nature and degree of a particular threat for both managers and the general public.”

Their Redbay ambrosia beetle (*Xyleborus glabratus*) analysis demonstrates possible outcomes resulting from limited information and creative thinking. By assembling available data, Smith and Koch developed a fairly solid characterization of a recently detected pest and determined its likely range and expansion through time across the southeastern United States. The resulting journal article has been widely read and forest health specialists from several southeastern states have used these results to plan forest health activities. For additional information, please visit www.forestthreats.org/about/fhm.

Researchers Receive Top Honors for Risk Analysis Paper

A collaborative effort among the USDA Forest Service, North Carolina State University, and Canadian Forest Service scientists received top honors from the Society for Risk Analysis (SRA). EFETAC collaborative researcher **Frank Koch** and biometrician **Bill Smith** co-authored the paper titled, “Evaluating Critical Uncertainty Thresholds in a Spatial Model of Forest Pest Invasion Risk.” The paper explores the role of increased uncertainties in pest risk mapping and was among five papers selected in the 2009 Best Paper Awards category.

Top photo: EFETAC North Carolina State University cooperating researcher Frank Koch (left) and EFETAC biometrician Bill Smith discuss field data collection methods. Bottom: Smith and Koch develop risk maps useful to land managers and forest health professionals.



Center Highlights

Chinese Delegates Engage in Climate Change Exchange

EFETAC research hydrologist **Ge Sun** co-organized a North Carolina tour for 24 senior-level Chinese State Forestry Administration delegates in early December. The tour focused on carbon sequestration and climate changes issues and included stops at North Carolina State University (NCSU), the Southern Research Station in Asheville, the Great Smoky Mountains National Park, Weyerhaeuser Bioenergy Research/Demonstration Site in eastern North Carolina, and NCSU's Schenck Memorial Forest. The delegates engaged in several lectures given by NCSU professors and EFETAC and SRS scientists, highlighting ongoing research efforts in forest ecosystem management and sustainability.



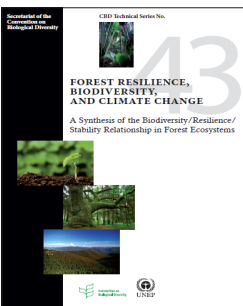
Researchers Developing Online Tool to Assist Resource Managers with Climate Change Adaptation

EFETAC scientists and forest planners from the Forest Service's Southern Region and Southern Research Station are combining talents and interests to develop the Template for Assessing Climate Change Impacts and Management Options (TACCIMO), a Web-based tool designed to align information needs with available and emerging climate research. TACCIMO allows users—including federal, state, and private land owners and managers—to connect scientifically reviewed climate change impacts and management options with forest planning. The TACCIMO tool generates customized reports for adapting to climate change and minimizing negative impacts. Visit www.forestthreats.org/tools/taccimo to learn more and to follow TACCIMO's progress.

Ecosystem Services Model to Expand Beyond U.S. Borders

EFETAC is developing the "Water Supply Stress Index – Carbon Biodiversity" model (WaSSI-CB) to assess interactions among water, carbon, and biodiversity, and will soon utilize data from across the Americas. With support from Forest Service International Programs, EFETAC ecologist **Steve McNulty** met with Brazilian agriculture and forestry officials in late 2009 to discuss the model's applications to that country's unique challenges related to biodiversity, climate, and land use change. Also, as chair of the North American Forest Commission's climate change working group, McNulty proposed WaSSI-CB's expansion to include Central America and Canada at a commissioners' meeting in Guadalajara, Mexico, this spring.

Closer to home, EFETAC scientists have begun a collaboration with North Carolina State University and North Carolina's Department of Environment and Natural Resources Wildlife Resources Commission to use the model in a finer scale examination of climate change impacts on North Carolina wildlife habitat.



Scientist Provides Far-Reaching Guidance on Climate Change and Water Issues

Steve McNulty worked with scientists from Canada and Australia to prepare a report commissioned by the Conference of the Parties to the Convention on Biological Diversity (CBD). The report, "Forest Resilience, Biodiversity, and Climate Change: a synthesis of the biodiversity/resilience/stability relationship in forest ecosystems," was developed to guide discussions at the monumental United Nations Climate Change Conference (COP15) in Copenhagen, Denmark, last December. While COP15 was underway, McNulty traveled to Washington, DC, to brief Forest Service Chief Tom Tidwell on climate change, water issues, and research in the eastern United States. This was McNulty's fourth briefing to a Forest Service Chief since 2002. The CBD report and the Chief's briefing paper are available at www.forestthreats.org.

EFETAC Comings and Goings....

Visiting Scholar Contributes to Southern Research Station Hydrology Research

Dr. Liangyi Rao, an associate professor of forest hydrology at Beijing Forestry University, will spend a year in the United States studying the effects of forest management and climate interactions on watershed hydrology. Working with **Ge Sun** and Jim Vose, SRS Coweeta Hydrologic Laboratory project leader, Dr. Rao will help Forest Service scientists synthesize long term data collected at research sites in North Carolina's mountains and coastal plain. The data will be used to develop new evapotranspiration models that can be applied internationally for understanding the impacts of climatic change on ecosystem services. EFETAC is hosting Dr. Rao, whose work is being funded by the China Scholarship Council.



Dr. Liangyi Rao

FHM Team Lead Bids Farewell

Bill Bechtold, EFETAC's National Forest Health Monitoring team leader, retired in December after 33 years with the Forest Service. He began his career with the agency's Forest Inventory and Analysis program and was integral in helping design and implement the national FHM program. Bechtold also served several years as the Southern Research Station's wellness coordinator, providing a broad range of wellness opportunities. His leadership and dedication will be greatly missed!



Bill Bechtold and Danny Lee

Lloyd Edwards joined EFETAC in August 2009 as a physical science technician through the Student Temporary Employment Program (STEP). He is working closely with research ecologist **Bill Hargrove** on a project examining the effects of urban heat on vegetation phenology in the continental United States. Presently Edwards is an honors graduate student at Appalachian State University (ASU) majoring in geography with a geographical information science (GIScience) concentration and will earn his Master of Arts from ASU in 2010.



Lloyd Edwards

John Buckley joined EFETAC in January as a forestry technician through the Student Temporary Employment Program. He is providing geographical information systems (GIS) support for several projects and is currently researching the effects of land use on erosion and sediment transport in the Jordan Lake watershed. Buckley is a Master's student at North Carolina State University where he studies GIS in the College of Natural Resources.



John Buckley

Peter Caldwell is a postdoctoral research hydrologist with EFETAC. His current research involves continuing the development of the WaSSI water supply and demand model, used to assess water supply stress in response to various disturbances including changes in climate, land use, and population. Caldwell received his BS (Mechanical Engineering, 1996) and PhD (Forestry) from North Carolina State University in Raleigh, NC.



Peter Caldwell

In the News....

Tree^{search}

New Publications and Products

For a complete list of EFETAC publications and products, please visit www.forestthreats.org or www.treesearch.fs.fed.us.

Hargrove, W.W., J.P. Spruce, G.E. Gasser, and F.M. Hoffman. 2009. Toward a national early warning system for forest disturbances using remotely sensed canopy phenology. *Photogrammetric Engineering and Remote Sensing* 75(10):1150-1156.

Qian, H. and **Q. Guo**. 2010. Linking biotic homogenization to habitat type, invasiveness and growth form of naturalized alien plants in North America. *Diversity and Distributions* 16:119-125.

Joyce, L.A., G.M. Blate, **S.G. McNulty**, C.I. Millar, S. Moser, R.P. Neilson, and D.L. Peterson. 2009. Managing for multiple resources under climate change: National forests. *Environmental Management* 44:1022-1032.

Noormets, A., M.J. Gavazzi, S.G. McNulty, J.-C. Domec, G. Sun, J.S. King, and J. Chen. 2010. Response of carbon fluxes to drought in a coastal plain loblolly pine forest. *Global Change Biology* 16:272-287.

Ambrose, M.J. and **B.L. Conkling** (eds.). 2009. Forest health monitoring 2006 national technical report. Gen. Tech. Rep. SRS-117, Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 118 p.

Wickham, J.D., **K.H. Riitters**, T.G. Wade, and P. Vogt. 2010. A national assessment of green infrastructure and change for the conterminous United States using morphological image processing. *Landscape and Urban Planning* 94:186-195.



Climate Change Resource Center Goes National

EFETAC is partnering to expand the Climate Change Resource Center (CCRC) into a national, web-based resource for land managers and decision-makers. The site includes publications and summaries of existing research efforts from all Forest Service research stations and the Eastern Forest and Western Wildland Environmental Threat Assessment Centers. Links and resources have been updated to include documents and websites relevant to eastern land managers. Please visit www.fs.fed.us/ccrc.

Researchers Lauded for Innovative Posters

Bill Hargrove and North Carolina State University and NASA Stennis Space Center collaborators received top honors for two posters at the annual Forest Service Forest Health Monitoring Work Group meeting held earlier this year in Albuquerque, NM. The posters highlighted research focused on forest genetics and climate change as well as a national forest threat early warning system and garnered Most Exciting Science and Best Graphics awards, respectively. View the posters online at www.forestthreats.org.

EFETAC Co-Hosts Air Pollution Workshop

Steve McNulty co-hosted the 42nd Air Pollution Workshop in Asheville, NC, in April. **Erika Cohen**, EFETAC resource information specialist, also served on the planning committee, sponsored by the USDA Forest Service, Environmental Protection Agency, and National Park Service. The annual workshop provides an informal setting for presentations and discussions of current research and issues pertaining to the effects of air pollution and climate change on agricultural crops, forests, and natural ecosystems.

Scientist Co-Organizes Landscape Ecology Symposium



Bill Hargrove co-organized a special symposium included in the 2010 U.S. Regional Association of the International Association for Landscape Ecology's (US-IALE) 25th Anniversary Symposium held in Athens, Georgia in April. "Land-Surface Phenology (LSP): A View through the Lens of Vegetation," assembled many leading experts in LSP and highlighted a rapidly developing method for revealing changes across a vegetated landscape, including new disturbances and post-disturbance recovery.

EFETAC Partners Emphasize CRAFTing Better Decisions



An article published in the Fall 2009 issue of *ArcUser Magazine*, titled "CRAFTing Better Decisions: Creating a link between belief networks and GIS," highlighted EFETAC's web-based Comparative Risk Assessment Framework and Tools (CRAFT). The article, authored by University of North Carolina Asheville's National Environmental Modeling and Analysis Center's Jeff Hicks and Todd Pierce, explained how CRAFT components interface with geographic information systems and enhance decision making for forest and natural resource managers. To learn more about this process please visit www.forestthreats.org/tools/craft.

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