Forest ThreatNet

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

Eastern Forest Environmental Threat Assessment Center | Volume 2 Issue 1 | Winter 2009

From the Director

The historic inauguration of President Barack Obama opened a new chapter in Federal land management. All Presidential transitions involve policy adjustments of some form, but the circumstances facing our new administration invite actions beyond the ordinary. For example, passage of the **American Recovery and Reinvestment Act of 2009** has led to increased Federal spending in an effort to boost economic recovery. A relatively small but significant piece of these economic stimulus funds is targeted at projects to improve forest health while helping provide jobs to American citizens. The Forest Service and other land management agencies have a large backlog of forest and rangeland treatments and infrastructure improvements that will benefit from this infusion of funds and workers.

Although increased funding may allow forest managers to gain ground on some of the more prominent and pressing forest threats, no one expects a temporary bump in funding to solve our forest health problems. Continued diligence and hard work are required to respond to the ever-increasing threats to forest health. This is where the information, technology, and skills provided by EFETAC and other Forest Service support units can help. Our scientists, staff, and partners bring expertise and tools in environmental assessment and planning that can help identify areas where active forest management, restoration, or watershed improvements can be effective. Such planning requires an integrated landscape approach that recognizes the spatial context of lands, the activities they support, and the environmental services derived from them. It also requires a rigorous and comprehensive approach to risk assessment and management, core tenets of the EFETAC philosophy.

> *"...increased funding may allow forest managers to gain ground on some of the more prominent and pressing forest threats...."*

In the following pages, we describe some of the tools we've developed recently and introduce you to several of our staff. It looks to be a busy year ahead for us as we step up to help our clients and partners meet the challenges before us.

Until next time,

Danny C. Lee

In this Issue

Message from the Director 1

Climate in Managed Forests: Could Loblollies Hold the Key? 2

SRS Welcomes New Assistant Station Director 3

Flying High for Forestry 4

Forest Fragmentation Creeps Across Scientific Boundaries 5

EFETAC Crown Indicator, Gene Research "Hot Topics". 6

EFETAC and Partners Featured During Chocolate Friday 6

In the News 7

Magazine Highlights Climate Change Research

EFETAC Scientist Lends Expertise to International Water Resources Journal

New Publications

Contact Us 8

Climate in Managed Forests: Could Loblollies Hold the Key?

University Partnership Focuses on Water and Carbon Use

By Stephanie Worley Firley, EFETAC

SGCP biological scientist Michael Gavazzi trains a graduate student at the eddy flux measurement site. (Photo by Ge Sun)

NCSU faculty Asko Noormets and Jean-Christophe Domec install sapflow sensors at the research site. (Photo by Michael Gavazzi)

A 70-ft. tower built in 2004 was instrumented to continuously measure carbon and water fluxes in a 15-year- old loblolly pine plantation on the coastal plain of eastern North Carolina. (Photo by Ge Sun)

Climate change issues, including altered patterns of precipitation and runoff, will pose great challenges to resource managers in the future. It is no surprise, then, that climate change and water are two key research areas for a partnership effort between EFETAC's Southern Global Change Program (SGCP) and North Carolina State University (NCSU).

Collaborative efforts by the SGCP research team and NCSU faculty **John King**, **Asko Noormets**, and **Jean-Christophe Domec,** from the Department of Forestry and Environmental Resources, focus on quantifying ecosystem-level exchanges of carbon and water as a function of stand age and climate in managed forests along the Lower Coastal Plain of North Carolina. Since 2004, researchers have been gathering data from loblolly pine plantations in which instrumented towers are continuously recording atmospheric carbon and water fluxes at the landscape scale using state-of-the-art technology known as the eddy covariance method. They are also monitoring sapflow sensors on individual trees that measure water use.

"The project's simple objectives are to quantify how much carbon dioxide plantations can absorb as well as how much water they use, and to provide new data to develop strategies to mitigate elevated atmospheric greenhouse gas concentrations through reforestation," says **Ge Sun**, SGCP research hydrologist. "We are also analyzing how nutrient cycling and carbon balances are affected when human activities like forest conversion and ditching (draining wetlands) change the hydrology of a site and the associated ecological processes."

According to Noormets, the data accumulated so far show that pine forests older than 14 years function as a large carbon sink, while recently planted pine plantations remain a strong carbon source through the first six years after planting. "In other words, older forests sequester (store) large amounts of carbon that would otherwise be present in the atmosphere," explains Noormets. "We have also observed that a 15-year-old pine plantation with a closed canopy uses—and loses—more water than a recently planted site. Annual climatic variability and recent severe drought in 2007 have led to the initiation of other studies to examine how changes in precipitation may affect carbon storage in drained ecosystems."

This project continues a previous 5-year collaboration with Jiquan Chen from the University of Toledo. In working with Chen through the U.S.-China Carbon Consortium (USCCC), chaired by SGCP team leader **Steve McNulty**, SGCP scientists have joined forces with a wide range of institutions in China, including Beijing Forestry University, Chinese Academy of Sciences, and the Institute of Botany of the Chinese Academy of Sciences. Now, because of the NCSU collaboration, the research scope is still expanding. The U.S. Department of Energy recently awarded King and Noormets a grant to add a new flux measurement site in the Alligator River National Wildlife Refuge to understand wetland carbon sequestration and water cycles across a hydrologic gradient in eastern North Carolina. "Our study that focuses on coastal wetland ecosystems is rather unique in the U.S. and promises to fill some of the knowledge gaps identified by the global change community. The work will be able to generate policy relevant findings in the next few years," says King.

Additionally, this carbon and water research has received much attention from the AmeriFlux and FluxNet communities that conduct similar studies around the world. "Data generated from the AmeriFlux and FluxNet sites contribute to continental and global synthesis on the impacts of climate change and management on carbon sequestration and water resources," says Sun. McNulty adds, "Research on global change issues requires a wide range of close global collaborations. Forest Service research benefits tremendously from the long-term collaborative work with NCSU. We value the opportunities to work with NCSU and welcome participation of other institutions on this project."

For more information, contact Ge Sun, GeSun@fs.fed.us or John King at John_King@ncsu.edu. To learn more about the U.S.-China Carbon Consortium, visit http://www.research.eeescience.utoledo.edu/lees/research/usccc/.

Southern Research Station Welcomes New Assistant Director

Mite-y scientist feels EFETAC's time is now

By Stephanie Worley Firley, EFETAC

Few people will ever have anything named after them. Even fewer will have their name given to a mite. **Kier Klepzig**, the Southern Research Station's new Assistant Director for Research, is one of those few.

In 2008, a fungi-carrying mite species associated with bark beetles was discovered by research entomologist emeritus **John Moser** and named *Caesarodispus klepzigi* in honor of Klepzig, who has long studied the symbiotic relationships among insects, fungi, and mites. Just as the interactions among these tiny organisms are amazingly complex, so are the interactions among larger scale forest threats. Klepzig's understanding of and fascination with the dynamics of multiple interacting factors make him a good fit to lead the three research work units within SRS's Threats to Forest Health science area, which includes EFETAC.

SRS new Assistant Station Director for Research Kier Klepzig examines an invasive insect (the Eucalyptus Weevil - Gonipterus scutellatus*). (Photo by Bernard Slippers)*

"This is an exciting time for EFETAC," says Klepzig. "The threats to our forests have never been greater, but that means there is a great need for what EFETAC can provide. Now that the Center is really up and running and developing some fascinating new approaches, we can really engage the folks who need our work. Our challenge is to make the most efficient use of what we have to tackle key issues and deliver answers our customers and cooperators can use. I look forward to facilitating this and bringing support to the efforts."

Klepzig joins the SRS headquarters in Asheville by way of Pineville, LA, where he has served as a supervisory research entomologist as well as project leader of the SRS Insects, Diseases, and Invasive Plants (IDIP) research work unit for the past ten years. Prior to his work with the Forest Service, Klepzig taught forest pathology and forest entomology at Southern University in Baton Rouge, but jumped at the chance to perform research on bark beetle-fungal interactions with the IDIP unit. "My PhD research had focused on just that topic, so I was thrilled to be able to continue the same line of research as a career," says Klepzig, who holds a PhD in entomology and forest pathology from the University of Wisconsin-Madison. "Also, the unit's southern pine beetle lab is really at the forefront of that research. Most of the really key, pioneering research on the topic was done there. That research history and the people who made it possible—some of whom were still working for the unit when I arrived—were big draws for me."

Klepzig feels fortunate to have been a part of the IDIP unit whose advancements in the understanding of bark beetles in southern forests have been immense. "In the process of tackling some tough questions, we also forged some very strong relationships with collaborators and partners. The sense of discovery and community and the contributions to science and society have been very rewarding," he says. Now, as Assistant Director for Research, Klepzig will be able to put his experience to work in a larger network of forest threats research. "I love the new challenges posed by this job, and I'm excited by the opportunity to work more closely with more people in the Station."

Despite an increasingly busy schedule, Klepzig finds time to pursue interests beyond research: seeing live music, watching independent films, eating good food, and playing basketball. And though his research career has produced an extensive body of work, Klepzig cites his children, Graham and Cassie, as his proudest achievements.

Forest ThreatNet
is a Quarterly Newsletter

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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Flying High for Forestry

GIS specialist has unusual view of forest change

By Karin Lichtenstein, NEMAC

Stephen Creed has a unique perspective of the forest—one that cannot be gained from life on the ground. This is because Creed, an EFETAC geographic information specialist, has spent a lot of time in the air studying the ground below. After receiving a bachelor's degree in aviation from Louisiana Tech University, he began his career as a pilot and flight instructor, where he cultivated a deep interest in maps and landscape patterns.

EFETAC geographic information specialist Stephen Creed began his career as a pilot and flight instructor.

Creed explains that "although I had always been interested in geography and maps, working in aviation helped lead me to geographic information systems (GIS). When flying, you constantly relate landscape patterns on the ground with navigational content on maps. I've always found this interpretive aspect of aviation fascinating, and after working on some aerial photography projects as a pilot, I became increasingly interested in GIS and remote sensing." In the fall of 1994, Creed enrolled in graduate school and received a master's in geography at Southwest Texas State University (now Texas State University) in San Marcos, TX. His research concentrated on remote sensing and using color infrared imagery to examine the susceptibility of the Kisatchie National Forest to pine beetle attack.

After receiving his graduate degree, Creed joined the U.S. Geological Survey National Wetlands Research Center in Louisiana, where he applied GIS and remote sensing to study wetlands loss and erosion along the gulf coast. He also served as an aerial survey pilot for the center, conducting imagery surveys and studying black bear migration patterns using aerial telemetry and GIS. Several years later, he found himself managing photogrammetric mapping projects for fire and recreation at the Forest Service Southwest Regional Office in Albuquerque, NM.

Creed collaborates with EFETAC ecologist Bill Hargrove to map forest change across the United States using MODIS satellite imagery.

With all of his experience in the sky, it is not a surprise that Creed now collaborates on a project with EFETAC research ecologist **Bill Hargrove** that uses remote sensing to map forest change across the continental United States. The project uses Moderate Resolution Imaging Spectroradiometer (MODIS) imagery and applies phenology, or seasonal vegetation change, data to forests. Creed explains, "Phenology data allow us to monitor how vegetation responds to climate cycles throughout a given year and then observe how the plants might react differently in following years using change detection." In addition to detecting forest threats, the data also allow them to determine the day of the year minimum or maximum vegetation activity occurs or how the length of growing seasons varies for a given year or location.

"One of the project's greatest advantages is allowing us to see changes on a broad geographical scale and compare patterns across many regions of the United States," Creed adds, making it clear his fascination with his "bird's eye view" of the earth and forest still lingers from his experience as a pilot.

Forest Fragmentation Creeps Across Scientific Boundaries

Riitters' research offers consistency to national studies

By Bridget O'Hara, NEMAC

Elbow room is what our forefathers were seeking when they colonized Turtle Island (the English translation of a Native American term for North America). As cities sprawl ever outward, smaller landowners have acquired more forest land for real estate development. New roads built to accommodate homes in these tranquil settings are impacting the distribution of forests and wildlife habitat in ways that researchers are struggling to understand.

When EFETAC landscape ecologist **Kurt Riitters** became involved with Montreal Process Criteria and Indicator development (http://www.mpci.org), forest fragmentation was identified as an important indicator of forest health. Unfortunately, the only available data to analyze the implications of fragmentation came from small localized studies. These datasets were extremely difficult to integrate, so Riitters worked to correct this problem by standardizing fragmentation metrics and producing nationally consistent data. This work has subsequently led to internationally consistent datasets that permit comparisons across nations and continents.

EFETAC landscape ecologist Kurt Riitters' research has brought consistency to national forest fragmentation data.

Riitters combines satellite imagery and computer technology to classify and display the types, locations, and spatial scales of fragmentation down to 30-meter resolution, for any region of interest. Because spatial patterns of *all* land-cover types (not just forests) have implications for many resource concerns, the metrics created by Riitters are applicable to any cover type (rangeland, for example).

"If we adopt a top-down approach and start with a standardized set of metrics at a continental scale, it may be possible to actually use what has been learned by countless historical studies examining the details that are so dear to many areas of ecology," says Riitters, who conducts research with EFETAC's National Forest Health Monitoring research team in Research Triangle Park, NC. "After several decades of testing, the 'up-scaling' of those details has not proven tractable. As a result, very little has been said about the likely impacts of fragmentation at a national scale." Basically, while the use of standardized fragmentation metrics by all ecologists cannot guarantee success when synthesizing results, it will make it more likely. Currently, many ecologists use different metrics, data, and/or scales of observations, which can create inconsistencies when attempting to synthesize results across species or geographic regions.

Standard metrics also create research opportunities that extend beyond biodiversity. Riitters adds, "Fragmentation, or more generally landscape pattern, is an indicator that is important for more reasons than just wildlife habitat and biodiversity, such as recreation and the spread of invasive species. For example, the common usage of a standard set of landscape pattern metrics will make it possible to talk about trade-offs between biodiversity and recreation." He concludes, "While the advantages are clear, the adoption of a standard set of metrics does not come without a price. Many specialists will have to sacrifice a little disciplinary preference in order to achieve interdisciplinary discussion on common grounds."

Google Earth Tool Targets Wide Audience

The extent that recreation, aesthetics, the spread of forest threats, and individual species are affected by forest fragmentation is not fully understood, but enough is known about the adverse effects of habitat loss and increased fragmentation to cause concern.

EFETAC landscape ecologist Kurt Riitters has collaborated with the European Commission Joint Research Center to develop an internet-based tool capable of displaying forest fragmentation data for any area of the United States, up to the continental scale. Riitters hopes this tool will be useful to landscape fragmentation analysts at all skill levels-- from grade school students to professional researchers.

Google Earth is required to view Riitters' Landcover maps:

1) Go to http://www.forestthreats.org.

2) Under "Data and Tools," click on "Landcover Maps."

3) Choose links as appropriate.

EFETAC Crown Indicator, Gene Research "Hot Topics" at Symposium

Climate Change, Fire, and Other Hot Topics was the theme of the 2008 national Forest Inventory and Analysis Symposium held last October in Park City, UT. EFETAC's FHM research team leader **Bill Bechtold** and North Carolina State University cooperator **Kevin Potter** participated in the conference. Bechtold presented "The Power of FIA Phase 3 Crown-Indicators to Detect Change," and Potter delivered "From Genes to Ecosystems: Measuring Evolutionary Diversity and Phylogenetic Community Structure." Before the meeting, Bechtold and FIA forest health specialists consulted with Mexican scientists interested in implementing a forest health monitoring system modeled after the FIA system. According to Bechtold, "FIA has the most advanced ground-based forest inventory and monitoring system in the world; it's always interesting to hear about the new and innovative uses to which the data are applied." More information about FIA and the symposium are available at http://www.fia.fs.fed.us/.

Scientists Highlight NASA Partnership, Invasive Research at Interagency Conference

EFETAC ecologists **Qinfeng Guo** and **Bill Hargrove** shared recent research through posters presented at the annual U.S. Department of Agriculture (USDA) Interagency Research Forum on Invasive Species held in Annapolis, MD, in January. Hargrove's poster, based on EFETAC efforts with partners from NASA Stennis Space Center and Oak Ridge National Laboratory, showed developments of the early warning system in place for monitoring forest changes using remote sensing, GIS, and satellite imagery. Guo's poster explained the utility of a national invasive plants database, an ongoing project with EFETAC's **Josephine Falcone** and **Joe Brownsmith** of the University of North Carolina Asheville's National Environmental Modeling and Analysis Center. "The annual Forum is an important event during which many researchers and land managers gather to report new findings, initiatives, and progress," says Guo. Hargrove adds, "Attending the Forum is a great way for USDA representatives to gain the most current information about invasive insects, diseases, and plants affecting U.S. forests."

EFETAC and Partners Featured During Chocolate Friday

Qinfeng Guo and collaborative partners **Karin Lichtenstein** with University of North Carolina Asheville's National Environmental Modeling and Analysis Center (NEMAC), and **Matt Hutchins** with Coweeta Hydrologic Laboratory, Wild South and NEMAC, presented their work at Chocolate Friday last October. The event was themed "Forest Threats," and Guo presented research on exotic plants in the United States. His presentation featured the major life history characteristics and common traits of plant species introduced into the United States and also focused on which habitats are more invasive than others and why. Lichtenstein described recent work with EFETAC on the Comparative Risk Assessment Framework and Tools (CRAFT). Hutchins presented "Climate Change in Western North Carolina: An analysis for understanding, planning and decision-making at the regional level."

Chocolate Friday is a monthly research and idea-sharing event that features presentations from UNC Asheville's NEMAC staff or University faculty, undergraduate research students, and visiting professionals and scientists. The event is held throughout the academic year at UNCA's Reuter Center—and yes, chocolate is served! To find out more about upcoming Chocolate Fridays visit http://orgs.unca.edu/nemac/.

In the News...

EFETAC in Review

The EFETAC team made progress in a variety of research, science delivery, and partnership efforts during the past year. Visit http://www.forestthreats.org for accomplishment highlights and additional publications.

New Publications

Threat Assessment

Efroymson, R.A., **W.W. Hargrove**, and G.W. Suter II. 2008. The Apache Longbow-Hellfire missile test at Yuma Proving Ground: Ecological risk assessment for helicopter overflight. Human and Ecological Risk Assessment 14(5):871-897.

Forest Health Monitoring

Wickham, J.D., **K.H. Riitters**, T.G. Wade, and C. Homer. 2008. Temporal change in fragmentation of continental US forests. Landscape Ecology 23: 891-898.

Southern Global Change Program

Sun, G., S. Liu, Z. Zhang, and X. Wei. 2008. Forest hydrology in China: Introduction to the featured collection. Journal of the American Water Resources Association 44(5):1073-1075.

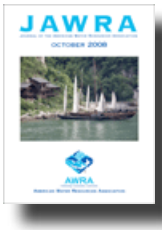
Sun, G., C. Zuo, S. Liu, M. Liu, **S.G. McNulty**, and J.M. Vose. 2008. Watershed evapotranspiration increased due to changes in vegetation composition and structure under a subtropical climate. Journal of the American Water Resources Association 44(5):1164-1175.

Magazine Highlights Climate Change Research

SGCP team leader **Steve McNulty** was featured in the November/December 2008 issue of *Blue Ridge Country* magazine. In writer Steve Nash's article, entitled "Double Vision: Climate Change Comes to the Mountains," McNulty discusses concerns about climate variability. Read more at http://www.forestthreats.org/.

EFETAC Connects with Landowners in Upstate South Carolina

EFETAC Director **Danny C. Lee** was the invited guest speaker for the Greenville Forestry and Wildlife Society meeting held at the University Center in Greenville, SC. Lee provided a Center overview, discussed forest threats, and led a Q&A following his presentation. EFETAC communications assistant **Stephanie Worley Firley** took the participants on a tour of the EFETAC Web site and felt, "these are important stakeholders with an interest in how EFETAC research and products can be useful."



EFETAC Scientist Lends Expertise to International Water Resources Journal

SGCP hydrologist **Ge Sun** recently served as guest associate editor for a special issue of the *Journal of the American Water Resources Association (JAWRA)*. Sun joined three international scientists from the Chinese Academy of Forestry, Beijing Forestry University, and the University of British Columbia to blend a collection of 11 papers featuring forest hydrology research in China. The special issue can be found in the JAWRA October 2008 edition. The collection of papers addresses the impact of management and climate change and variability on watershed hydrology and forest-water relationships across multiple scales and landscapes. The articles represent significant ongoing forest hydrology research and can serve as a benchmark for understanding forest-water relations in China.

SGCP Finds a Real "Treasure"

Emrys Treasure

Forestry technician **Emrys Treasure** joined the SGCP team in August 2008, having spent three years as a student intern working part-time during the school year and full-time during the summer field season. Treasure's projects include assessing carbon budgets in loblolly pine plantations (eddy flux), evaluating the effectiveness of streamside management zones in protecting water quality, determining the effects of prescribed fire on fuel loads, and gauging impacts of climate change and land use on water quality. Emrys graduated top of his 2008 North Carolina State University class with a bachelor of science in natural resources and a minor in environmental science.

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