

Forest ThreatNet

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

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FROM THE DIRECTOR...

A million shades of green. As I watch the annual springtime eruption of wildflowers, shrubs, and trees, this phrase often comes to mind. The eastern deciduous forests are truly amazing in both diversity and productivity, which is never more evident than in the spring. It seems as if the world is draped in green, with more different hues and shades than one could ever count. The profusion of life that heralds the changing seasons is truly one of the wonders of the natural world.

As any gardener knows, the amount and hue of green that one sees also tells a lot about the health and vitality of plants. A quick glance can suggest that plants need water, fertilizer, or perhaps are under siege by insects or pathogens. These same tell-tale signs can work for forests as well—at a scale not imagined by most gardeners.

For the past several years, we have worked with NASA and other partners to develop a satellite-based system for watching our nation's forests, looking for changes in greenness that might suggest either good or bad shifts in productivity or health. This system, known as **ForWarn** and highlighted on page 4, combines a relatively basic principle with advanced technology to deliver a powerful and user-friendly tool to scientists and land managers.

ForWarn is but one of several technologically advanced tools that we and our sister center, the Western Wildland



Environmental Threat Assessment Center (WWETAC), have been developing since our inception in 2005. In this issue, we highlight some of these tools, as well as some of the other activities that have been keeping us busy. We also introduce a few new faces, belonging to remarkable individuals that are bringing new skills and fresh ideas to our collective efforts. We have a great team here, and I'm very proud of what we have accomplished and enthusiastic about our work ahead.

Until next time,

Danny C. Lee



Forest ThreatNet

Forest ThreatNet

is published by the Eastern Forest Environmental Threat Assessment Center (EFETAC), 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 USDA Forest Service's Research and Development, National Forest System, and State and Private Forestry. The Center is headquartered with the Southern Research Station in Asheville, NC, and also has offices in Raleigh and Research Triangle Park.

Editor

Perdita B. Spriggs
EFETAC

Assistant Editor

Stephanie Worley Firley
EFETAC

Editorial Contributors

Erika Cohen, EFETAC

Nancy Grulke, WWETAC

Alan Ager, WWETAC

Contributing Graphic Designer

Rodney Kindlund
RodKraft Studio

Forest Science Benefits Water Resources in African Countries

by Erika Cohen, EFETAC

EFETAC is helping eastern and southern African countries improve water quality and quantity. These countries often suffer from extreme challenges that negatively affect local water resources – including population growth, extremes in weather, and poor farming methods. Researchers developed the Water Supply Stress Index-Carbon and Biodiversity (WaSSI-CB) model that quantifies the potential impact of land use practices on water resources, which can be used by conservation agencies in Africa to make sound short- and long-term land management decisions.

“We are excited about introducing WaSSI-CB in Africa,” says **Steve McNulty**, Raleigh team leader and research ecologist. “We have a real opportunity to positively influence water issues in Rwanda, Zambia, and Tanzania, which will also help us to continually improve its application throughout the United States and use by Forest Service land managers.”

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WaSSI-CB and the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) model, developed by the Natural Capital Project, together target both water quantity and quality. The models were recently applied in three Wildlife Conservation Society priority landscapes in eastern and southern Africa – the Nyungwe-Kibira Landscape, Rwanda; the Luangwa Valley, Zambia; and the Ruaha River Landscape, Tanzania. Water resources in these areas are stressed due to changes in climate and land management practices over the years.

“WaSSI-CB and InVEST will have several benefits in



Eastern Threat Center researchers Erika Cohen (center standing), Ge Sun (right), and Steve McNulty (back right) met with African leaders to discuss using WaSSI and InVEST models to address water quality and quantity issues.

Africa,” says Japhet Seulu, a Wildlife Conservation Society representative in Zambia. “The models will help us determine water availability, a critical lifeline for wildlife needed to sustain Zambia’s tourism industry, and provide information to help develop coping strategies that compensate for rain-starved crops.”

The nine-month project began in January 2011 with final results presented during a September workshop in Kigali, Rwanda, to key stakeholders from Rwanda, Tanzania, Zambia, and other watershed management authorities across Africa. Participants discovered potential for adding WaSSI-CB and InVEST to their decision making toolbox.

The Eastern Threat Center partnered with the Forest Service’s International Programs Office, the Daniel Boone National Forest (KY), the Wildlife Conservation Society, and the US Agency for International Development. The multi-disciplinary team included the Eastern Threat Center’s **Erika Cohen**, resource information specialist; Steve McNulty; **Ge Sun**, research hydrologist; and Matthew Wingard, Daniel Boone GIS coordinator. The team hopes to continue the project in 2012 and implement feedback received at the Kigali workshop.

Unwelcomed Pests Often Hitch A Ride

EFETAC and Canadian Researchers Investigate the Firewood Connection
by Perdita B. Spriggs, EFETAC

Firewood has ignited national debate, especially in campgrounds, largely because it carries unwanted forest pests across state borders and potentially even between the United States and Canada. Many of these non-native pests are well-known—hemlock woolly adelgid, emerald ash borer, Asian longhorned beetle—and have caused significant ecological and economic damage, including the deaths of millions of trees in the United States. Eastern Forest Environmental Threat

Assessment Center (EFETAC) research ecologist **Frank Koch** and Canadian Forest Service research scientist Denys Yemshanov are determined to tap into the mysteries surrounding alien forest pest invasions, such as those facilitated by firewood transport, and help land managers prepare for and respond to the spread of these unwelcomed guests.

The researchers' joint interest in invasive pests dates back to 2008, when their early models simulated pest invasions from entry locations through time, incorporating critical data related to insects' host, population growth, and movement. Now, Koch and Yemshanov's collaborative work, focused on assessing and mapping pest invasion risk, provides a suite of cutting-edge modeling tools and data products. Their novel research helps improve understanding and forecasting of risks and impacts particular to known, and emerging, forest invasive alien species.

"Research to develop appropriate risk assessment, prevention, and mitigation strategies has become increasingly complex," says Koch, who with Yemshanov has examined data from more than 7.2 million federal outdoor reservations over a five-

year period, involving 2,500 campgrounds across the country managed by the Forest Service, Bureau of Land Management, Army Corps of Engineers, and the Park Service. "Strategies must address multiple pests and incorporate environmental and economic factors over very large regions in North

America, such as climate, land use and other human and non-human-related activities." Koch notes that some national parks, like Shenandoah in Virginia, have instituted an Outside Firewood Ban to slow the spread, in this case,

of the emerald ash borer. The ban requires that visitors not bring any firewood into the park but gather or purchase wood onsite.

Unique to Koch and Yemshanov's risk assessments is the ability to incorporate uncertainty, factoring in critical information known and believed to be known about the invading species. Beyond their recent focus on the firewood issue, they are also investigating human-assisted introductions and spread in general, highlighting how activities such as trade, economic development, transportation, and recreation play a role in invasive pests establishing and expanding their populations.

Koch and Yemshanov's research is already helping land managers and natural resource decision-makers determine resource allocation and prioritization. They emphasize, "Linking the Canadian and US data helps to quantify cross-border movement of invasive species," which enables better coordinated and more effective pest surveillance, management, and regulatory strategies.



EFETAC ecologist Frank Koch (left) and Canadian Forest Service scientist Denys Yemshanov (right) are investigating the connection between forest alien pest invasions and firewood.

EFETAC Cooperating Scientists Recognized for Communication Products

Two North Carolina State University EFETAC cooperating scientists were honored in 2011 and 2012 for communicating Forest Service science. **Kevin Potter** received the Belle Baruch Foundation Award for best poster at the 31st Southern Forest Tree Improvement Conference. **Barbara Conkling** received a Forest Service Research and Development Quantitative Sciences Staff Director's Award for Forest Inventory and Analysis Excellence.

Conkling and Potter also received National Program Manager's Awards at the 2012 Forest Health Monitoring (FHM) April Workgroup Meeting in Tucson, Arizona. They were recognized for their outstanding efforts co-editing the annual Forest Health Monitoring National Technical Reports over the last eleven years. These reports provide the latest results from FHM detection monitoring of forest health indicators and highlight recently completed evaluation monitoring projects of some of the most significant forest health problems in the country.



EFETAC North Carolina State University cooperating scientists Barbara Conkling and Kevin Potter.

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Forest Service and NASA Release Web-Based Forest Disturbance Monitoring Tool

The Eastern and Western Threat Assessment Centers recently unveiled a product that helps natural resource managers rapidly detect, identify, and respond to unexpected changes in the nation's forests by using web-based tools.

ForWarn, a satellite-based monitoring and assessment tool, recognizes and tracks potential forest disturbances caused by insects, diseases, wildfires, extreme weather, or other natural or human-caused events. The prototype version of ForWarn has successfully operated since January 2010 and uses NASA MODIS (Moderate Resolution Imaging Spectroradiometer) satellite imagery to recognize and track changes in vegetation across the nation, providing a near-real-time view of potential forest disturbance and recovery.

ForWarn uses a web-based map tool, the Forest Change Assessment Viewer, to provide an 8-day coast-to-coast snapshot of the US landscape, interpret images, and create geographically relevant maps. For additional information, please visit www.forestthreats.org/research/tools/forwarn.

ForWarn



Western Wildland Threat Assessment Center Highlights

by Nancy Grulke, WWETAC Director

As the Western Center transitions through retirements and staff changes, I wanted to provide an update on our current structure and share our research focus areas.

Our current staff includes **Alan Ager** (wildfire risk assessment), **Nicole Vaillant** (fuels management tools), **John Kim** (dynamic vegetation modeler, part time), **Paige Fischer** (human dimensions of environmental threats), **Lisa Balduman** (technology information specialist), and **Terry Shaw** (emeritus scientist). We are also pleased to welcome acting WWETAC assistant director **Helen Maffei** from Forest Health Protection in the Pacific Northwest Region, **Marc Kramer**, Pacific Northwest climate change scientist, on a part-time basis to promote climate change communication within and among the regions, research assistant **Sean Schroeder**, student **Scott Lewis**, and program assistant **Jerry "Nick" Tarvin**. We have also made great progress in our four focus areas:

Landscape Assessment

Our landscape assessment progress includes, 1) an annotated bibliography of threats to western riparian ecosystems, 2) an analysis of existing incentive programs encouraging landowners to engage in restoration and protection of ecosystem services, and 3) a management landscape vulnerability assessment. Other assessments and tools target owl habitat changes, seed zones and climate change, and fuel management treatments.



Environmental Change

WWETAC completed two sociological studies that identified four types of private landowners based on land use and motivation that will require different incentives to encourage carbon sequestration. Two key syntheses were also produced – one highlighted forest ecosystems and climate change, and the other study reviewed ecological models responsive to climate change.

Invasives

Researchers developed a model to predict bark beetle outbreak risk in Washington and Oregon. WWETAC also published a synthesis focused on climate change impacts on forest disease.

Wildfire Risk and Fuels Management

WWETAC updated an existing tool for fuels management (ArcFuels), as well as developed a new assessment tool, Landscape Treatment Design. We also discovered several interesting human behavior results pertaining to wildfire risk. For example, private landowners, grouped by motivation, require different incentives to reduce wildfire risk.

For a complete look at current WWETAC staff and research efforts, please visit <http://www.fs.fed.us/wwetac/index.html>.

WWETAC Decision-Support Tools

by Alan Ager, WWETAC

The West-Wide Climate Change Mapper

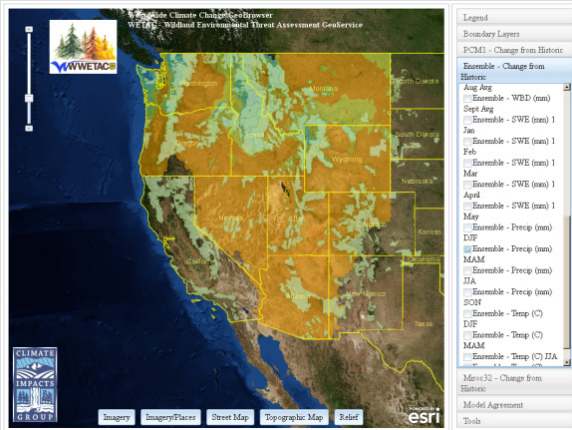
WWETAC developed a suite of mapping tools to facilitate wildland threat assessments. The *Climate Change Mapper*, a browser-based mapping system, provides a simple and convenient portal to downscaled climate change data.

The system currently contains climate change data generated by the Climate Impacts Group at the University of Washington. This downscaling effort was funded by a consortium of federal agencies (Forest Service Northern and Pacific Northwest Regions, US Fish and Wildlife Service, and the Forest Service Rocky Mountain Research Station - Boise Aquatic Sciences Lab). The data are intended for regional planning and assessments.

The Climate Change Mapper can be accessed at http://www.fs.fed.us/wwetac/threat_map/index.html.

The Western Threat Center also has a number of other geospatial tools, including the *Threat News Explorer* and the *Geospatial Search Engine*.

WWETAC Decision-Support Tools (cont'd)



The Climate Change Mapper displays over 100 data layers showing projected changes from historical (1916-2000) conditions to the mid-century (2030-2059).

The Threat News Explorer is a customized media search engine that locates and maps news stories on major forest threats, including wildfires, bark beetles, climate change, and other forest disturbances. The Geospatial Search Engine is a data mining tool that searches the internet for spatial data based on user-input keywords.

For more information on these and other WWETAC geospatial tools, please contact Alan Ager, aager@fs.fed.us, or Charlie Schrader-Patton at cschrader@fs.fed.us.

WWETAC Researchers Examine Wildland Urban Interface Fire Options

WWETAC researchers **Alan Ager** and **Nicole Vaillant** published a study examining tradeoffs between prioritizing treatments to protect the wildland urban interface (WUI) versus landscape restoration to create fire resilient forests.

Ager and Vaillant modeled a range of fuel management scenarios that placed WUI treatments around structures versus in the surrounding landscape to accomplish forest restoration objectives. Restoration scenario results showed that treating as little as ten to fifteen percent of the study area could diminish the loss of old growth trees by about 70 percent. Most importantly, simulations predicted that treatments three

to six miles away from the WUI could substantially lower the chances of a wildfire reaching homes and other structures.

As expected, treating forest stands in and around the WUI lowered the likelihood of burning around structures, but this outcome was accompanied by higher expected losses of large trees in the adjacent national forest. The researchers concluded that the perceived difference between protecting the WUI and dry forest restoration is due to the lack of landscape analyses of large fire behavior in previous studies. Both goals can be achieved in many instances by careful design of fuel treatment projects in the interface along with appropriate homeowner practices to reduce fuels in the home ignition zone.

The study represents a step toward building optimal fuel management to identify the most cost-effective ways to allocate funding for fire management. "Our hope is that policymakers can use our findings to develop new budget directions that will serve to encourage the designing of fuel treatment programs that consider broad landscape factors and meet multiple objectives, beyond single-issue risk mitigation," Ager says. "The study results should also be useful to planners in justifying the allocation of funds targeted for WUI protection for meeting wider ecological restoration goals with respect to wildfire and biodiversity conservation."

The paper can be found, along with similar fuel management studies, at www.arcfuels.org under "Case Studies."



Air tanker dropping retardant on the 2009 Huckleberry Fire with the Mt. Emily WUI study area in the background. Photo courtesy of Amber Mahoney, Umatilla National Forest.

Enhanced TACCIMO Tool Supports Eastern and Western Decision Makers

The Eastern and Western Threat Assessment Centers and partners in the Forest Service's Southern and Pacific Southwest Regions have enhanced the web-based Template for Assessing Climate Change Impacts and Management Options (TACCIMO).

TACCIMO links climate change forecasts, ecosystem impacts, and management options through a customized reporting format relevant to forest planners and managers within the Forest Service, other federal and state agencies, and non-governmental organizations.

New TACCIMO content represents natural resource issues in the eastern and western United States through an expanded and searchable climate literature database, streamlined reporting functionality, and additional support and training resources.

Visit <http://www.forestthreats.org/tools/taccimo> to learn more.

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CRAFT Supports Development of National Cohesive Wildland Fire Management Strategy



Wildland fire management approaches are held by diverse agencies, organizations, and individuals. The National Cohesive Wildland Fire Management Strategy is a broad-reaching effort designed to address these complexities and, ultimately, help society live better with wildland fire.

EFETAC's Comparative Risk Assessment Framework and Tools (CRAFT)—a planning and decision support system developed in partnership with the University of North Carolina Asheville's National Environmental Modeling and Analysis Center—provides the underlying process for developing the Cohesive Strategy.

EFETAC director **Danny Lee** and ecologist **Steve Norman** are working with national and regional teams to help identify objectives, explore broad management options, and to accurately predict the outcomes and tradeoffs of potential decisions related to wildland fire.

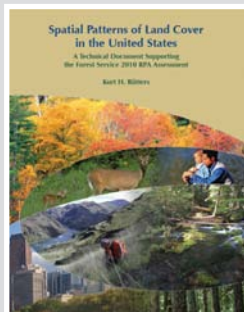
For more information on CRAFT and the Cohesive Strategy, see www.forestthreats.org/research/tools/craft and www.forestsandrangelands.gov/strategy/.

Center Highlights

EFETAC Research Supports Regional and National Efforts to Sustain Natural Resources

Forward-thinking natural resource management strategies result from collaborations among networks of partners and teams representing diverse areas of responsibility and expertise. EFETAC scientists and staff are contributing to several ongoing efforts to address natural resource management issues across all lands, including:

- The **US Global Change Research Program's National Climate Assessment** – EFETAC researchers **Steve McNulty** and **Ge Sun** are leading teams of federal and state scientists that are assessing how climate change will affect forest and water resources, respectively, across the southeastern United States. The completed Assessment is expected to be released in late 2012. For more information, visit www.globalchange.gov.



- Every ten years, the **Resources Planning Act Assessment** provides reliable information on the status, trends, and projected future of the nation's renewable resources. For the 2010 Assessment, EFETAC research ecologist **Kurt Riitters** assessed the

fragmentation and landscape context of US forest, grass, and shrub lands, and provided summaries of forest areas that qualified as protected land under International Union for Conservation of Nature criteria. See www.fs.fed.us/research/rpa for more information.

- The **Southern Forest Futures Project (SFFP)** anticipates and analyzes future challenges and opportunities for land management in the southern United States. EFETAC scientists **Steve McNulty**, **Jennifer Moore Myers**, **Peter Caldwell**, and **Ge Sun** authored the SFFP technical report's climate change chapter and, along with **Erika Cohen**, also co-authored a chapter on water and forests. Report findings are being incorporated into

EFETAC's Template for Assessing Climate Change Impacts and Management Options. Learn more at www.srs.fs.usda.gov/futures.

- The **Climate Change Adaptation and Mitigation Management Options (CCAMMO)** project analyzes forest management options for guiding natural resource decision making in a changing climate. EFETAC scientists contributed chapters on ecological and economic vulnerability and risk, water quality and quantity, and invasive species to the CCAMMO project. A peer-reviewed CCAMMO document will be released this year. Visit www.forestthreats.org/current-projects/project-summaries/ccammo for more information.

EFETAC Welcomes New Team Members



Frank Koch joined EFETAC as a research ecologist, focusing on forest pest invasion research with an emphasis on developing methods for mapping pest invasion risk based on species' biology and behavior.



Serra Hoagland joined EFETAC as a biological scientist. She was recently chosen as a participant in the highly competitive 2012 Wildlife Society Leadership Institute, designed to groom emerging young professionals to become exceptional leaders.

New North Carolina State University Cooperators



Rabin Bhattarai is a post-doctoral fellow studying the impacts of global change on hydrology and ecosystems under the Earth System Modeling Project, a National Science Foundation-funded project that will offer new

assessment tools for climate change research and management agencies.

Center Highlights (cont'd)

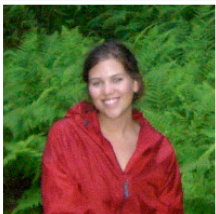
LeeAnna Young Chapman is studying reduction of climate prediction uncertainties. She also works with EFETAC's Water Supply Stress Index – Carbon and Biodiversity (WaSSI-CB) model as part of the Earth System Modeling Project.



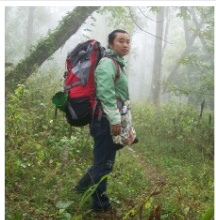
John Cobb is currently developing ArcGIS tools to derive soil moisture parameters for the WaSSI model.



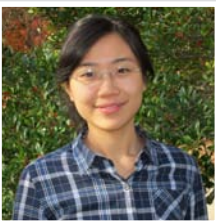
Lisa Jennings is a NCSU research assistant and content manager for EFETAC's Template for Assessing Climate Change Impacts and Management Options.



Wen Lin is working on a special USDA Food Research Initiative project involving research, education, and climate change mitigation and adaptation.



Jie Zhou is focusing on water and carbon fluxes between the atmosphere and forest ecosystems for a poplar plantation in northern China.



EFETAC Scientist Elected Landscape Ecology National President

EFETAC scientist **Kurt Riitters** was recently elected to a two-year term as president of the US Regional Association of the International Association for Landscape Ecology (US-IALE; www.usiale.org). US-IALE is the largest of 25 regional associations that

make up the international organization (www.landscape-ecology.org). Riitters' research over two decades has helped to advance the interdisciplinary field of landscape ecology while contributing directly to achieving EFETAC and Forest Service goals related to landscape analysis and assessment.



Kurt Riitters

He served previously as councilor-at-large of US-IALE, and is a member of the editorial board of the international flagship journal *Landscape Ecology*. According to Riitters, "This is a special honor because I have always considered US-IALE to be my natural home in the science world – the community is eclectic, rigorous, and grounded in the real world."

EFETAC Adopts-A-Highway

Two or three times a year, the EFETAC staff in Raleigh volunteers to pick up discarded roadside items. For ten years, the Raleigh group has participated in the North Carolina Department of Transportation's Adopt-A-Highway program, picking up more than 6,000 pounds of trash and recyclable items along the same two-mile stretch of highway. Group coordinator **Michael Gavazzi** says EFETAC is "excited to do something good for the community. We get so much gratification from transforming an area full of trash into a beautiful space again."

What are the most interesting items found? "Usually it's normal stuff, like broken CDs, fast food wrappers, and trash," remembers Gavazzi. "But, once we did find discarded love notes and a sack of costume jewels."



EFETAC adopted a highway in Raleigh, NC. Pictured from left are Steve McNulty, John Cobb, Jennifer Moore Myers, Emrys Treasure, Rabin Bhattarai, Michael Gavazzi, Peter Caldwell, and Ge Sun.

New Publications and Products

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

Koch, F.H., D. Yemshanov, R.D. Magarey, and **W.D. Smith**. 2012. Dispersal of invasive forest insects via recreational firewood: a quantitative analysis. *Journal of Economic Entomology* 105(2):438-450.

Guo, Q., M. Rejmánek, and J. Wen. 2012. Geographical, socioeconomic, and ecological determinants of exotic plant naturalization in the United States: insights and updates from improved data. *NeoBiota* 12:41-55.

Klepzig, K., Z. Hoyle, S. Westcott, and **E. Treasure**. 2012. Southern Research Station Global Change Research Strategy 2011-2019. Science Update SRS-SU-46. Asheville, NC: USDA-Forest Service, Southern Research Station. 24 p.

Forest ThreatNet

Contact Us:

USDA Forest Service

Eastern Forest Environmental Threat Assessment Center

Danny C. Lee, Director

Asheville

Southern Research Station
200 W.T. Weaver Boulevard
Asheville, NC 28804

(828) 257-4298

Research Triangle Park

Forestry Sciences Laboratory
3041 E. Cornwallis Road
Research Triangle Park, NC
27709

(919) 549-4000

Raleigh

Centennial Campus
920 Main Campus Drive
Venture Center II, Ste. 300
Raleigh, NC 27606

(919) 515-9489

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In the News....

EFETAC and Southern Research Station Produce Videos to Inspire Young Scientists



The Eastern Threat Center and the Southern Research Station (SRS) recently produced short videos—highlighting watershed,

southern pine beetle, flux tower, and social science research – for the 24-hour grand opening of the North Carolina Museum of Natural Sciences' new 80,000 square-foot wing, the Nature Research Center. The collaborative effort could expose more than one million multicultural students in grades K-12 to the wonders of forest science. Please watch the videos at www.forestthreats.org/products/photos-and-multimedia.



EFETAC Water Stress Tool Helps Union of Concerned Scientists Examine Energy and Water Issues

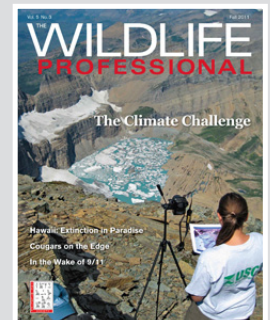
Power plants across the United States are contributing to water stress and impacting water quality according to a report released by the Union of Concerned Scientists (UCS), *Freshwater Use by U.S. Power Plants: Electricity's Thirst for a Precious Resource*. UCS researchers utilized results from EFETAC's Water Supply Stress Index (WaSSI) model to analyze current and future water demand and supplies for the report, which is the first in a series for the UCS Energy and Water in a Warming World Initiative. To learn more about WaSSI, visit www.forestthreats.org/research/tools/WaSSI/. For more information about UCS and to read the report, visit www.ucsusa.org.

Forest Fragmentation Research Highlighted in *Conservation Magazine*

Conservation Magazine featured an online article describing a forest fragmentation study led by EFETAC research ecologist **Kurt Riitters**. The study, published in the journal *Forest Ecology and Management*, reveals extensive fragmentation and the importance of management practices on privately owned land—which comprises the majority of forested acres in the East—for maintaining sustainable forest resources and biodiversity. Read "Picking up the Pieces" from *Conservation Magazine* and the original journal article entitled "Fragmentation of forest communities in the eastern United States" at www.forestthreats.org/news/in-the-news.

The *Wildlife Professional* Features Forest Service Climate Change Adaptation Efforts

The fall 2011 issue of *The Wildlife Professional*, a publication of the Wildlife Society, features several Forest Service projects that are helping forests, grasslands, and wildlife adapt to climate change. Included are two EFETAC-supported



efforts: the Template for Assessing Climate Change Impacts and Management Options and the Climate Change Resource Center. To access the issue and the article entitled "Role of the U.S. Forest Service," visit www.issuu.com/the-wildlife-professional.

Southern Research Station Utilizes Social Media for Sharing Forest Science

All the latest research, news, and events from the Southern Research Station – including EFETAC updates – can now be found on a new and frequently updated Twitter page as well as the new online magazine, *CompassLive*. To follow SRS on Twitter and to read *CompassLive* visit www.srs.fs.usda.gov.

