



## What's Happening in Our Forest? Video, Forest Health Index Have Some Answers

By Steve Wilent

People are always sending me links to YouTube videos and other clips on the web—sometimes more than one a day. Most of these I ignore. I simply don't have time to watch them. In fact, you could spend the rest of your life watching online videos and never see them all. According to YouTube, "48 hours of video are uploaded every minute, resulting in nearly 8 years of content uploaded every day."

However, the title of one video was interesting enough that I took a look: "What's Happening in Our Forest?" As the video begins, text appears superimposed on an image of a green lodgepole pine stand: "Something is happening to our forests." Then, time-lapse photography shows the stand turning red and fading to gray as the branches droop and needles fall. Then more text: "Why is this happening?"

Over the next four minutes or so, to the accompaniment of crisp piano-and-strings music and clever animation, three reasons are given:

1. Fire suppression. "Some forests naturally regenerate through fire. Fire suppression causes overcrowded forests, which leads to un-naturally intense wildfires and poor regrowth from scorched soil."

2. Management practices. "Past log-



The "What's Happening in Our Forest?" video from the Aspen Center for Environmental Studies offers a brief look at forest health in the West.

ging & mining, followed by a 'hands-off' policy, created a lack of species & age diversity, which leads to [animated bark beetles crawl on a tree]."

3. Climate change. "Warming temperatures lead to drought, which stresses and kills trees." Which leads to more carbon dioxide in the atmosphere.

"But wait! The forest is a part of the solution," the animated text continues. "We can sequester that carbon or make energy.

How? Where appropriate, trees can be removed from the forest and chipped into pieces. Those pieces (biomass) can be used as fuel for energy. Biomass = energy. The chips can also be turned into biochar. Biochar helps soil retain water & nutrients."

The video concludes with a simplistic, yet compelling message: "A balanced approach is a vital. Some forests should be

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### IN THIS ISSUE

#### Society Honors: Izlar receives Schlich memorial award

During the 2012 SAF National Convention, Bob Izlar was given a distinct honor in joining the ranks of Franklin D. Roosevelt and Gifford Pinchot to receive the Sir William Schlich Memorial Award. **Page 8.**

#### 2013 Leadership Guide

The SAF Leadership Guide appears annually in *The Forestry Source* so that the Society's members can more readily contact SAF leaders and representatives and offer their input about how the Society can achieve its mission. **Page 10.**

#### Science and Tech: forest ecosystem research team helps improve satellite data

Randolph Wynne, professor of forest remote sensing in Virginia Tech's College of Natural Resources and Environment, aims to improve the utility of Landsat data to forest managers. Wynne recently was selected by the US Geological Survey and NASA to be a member of the Landsat Science Team. **Page 12.**

#### Field Tech: the Rampage 6 rugged Android handheld: great hardware, but....

Other than the operating system and the main color of the case, the Rampage is the twin of Juniper Systems's Mesa: it is a shockproof, waterproof, handheld computer. However, there the similarity ends—and *Source* Editor Steve Wilent's trouble began. **Page 13.**

#### GIS for Foresters: Arnold Arboretum uses mobile mapping to increase access to botanical collections

Using a new mobile mapping application developed with ArcGIS, visitors to Harvard University's Arnold Arboretum can stroll through the lush garden with their smartphones and locate and learn more about the arboretum's unique botanical collection. **Page 14.**

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## City Foresters Continue 80-Plus Years of Stewardship

By Andrea Watts

"Expect change" is the advice from Loren Hiner, the city of Montesano's forester for the past five years and SAF member since 1983. Ron Schillinger, his predecessor of 20 years and former SAF member, agrees. As city foresters, they have experience dealing with not only the unexpected salvage harvests that change expectations of the stand's future, but also the changing demands of balancing forest management with environmental regulation, citizens'

opinions, and city council decisions.

While other cities in Washington State have forestland dedicated to protecting the city's watershed, the city of Montesano's Chapin Collins Memorial Forest also serves the additional roles of providing revenue and recreational opportunities. A 1931 expenditure of \$12,000 by the city for the purchase of 5,493 acres of cut-over timberland has yielded an investment that annually con-

(See "Foresters" page 4)



Loren Hiner (left), city forester for Montesano, Washington, with former city forester Ron Schillinger. The forest is named for a former president of the Montesano Chamber of Commerce.

## Commentary: The Outlook for Timber in 2013: A Motley Fool's View

By Matt DiLallo

Do you remember when you were a kid and your parents told you that money didn't grow on trees? That usually ended the discussion while also putting an end to your dream of a new toy that day. Unfortunately for you, what your parents told you was only partially true.

Sure, dollar bills don't grow on trees. The trees themselves, however, are worth big bucks, and the marketplace for timber and its associated products are a multi-billion-dollar global industry. For a good primer on the industry, be sure to check out fellow Fool Dan Newman's Timber 101 ([www.fool.com/investing/general/2013/01/14/the-real-growth-industry-timber.aspx](http://www.fool.com/investing/general/2013/01/14/the-real-growth-industry-timber.aspx)).

Timber as an asset class is a favored investment for many institutions. It has a lot to offer, as it's a lower-risk asset, which provides portfolio diversification and acts as a hedge against inflation risk. Unlike many of the other investment options available, it offers investors true "organic" growth, as the trees grow each year. Look-

(See "Outlook" page 5)



**Climate Connections and Connundrums**

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**Society of American Foresters**

The mission of the Society of American Foresters is to advance the science, education, technology, and practice of forestry; to enhance the competency of its members; to establish standards of professional excellence; and to use the knowledge, skills, and conservation ethic of the profession to ensure the continued health and use of forest ecosystems and the present and future availability of forest resources to benefit society.

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Climate change has been in the news and on the minds of many people, including some SAF members. One recently wrote in to say that climate change is "a crock."

It is not a crock (which my dictionary defines as "a lie; exaggeration; nonsense"). The evidence is irrefutable.

However, as I have told my Current Issues in Forest Resources students for years, we do not know everything, yet, when it comes to our climate.

(An aside: please note that the opinions expressed in the Editor's Notebook are mine and do not necessarily reflect the positions of SAF or of anyone else. I express them not because I have all the answers—I don't—but in an effort to stimulate discussion. You may agree or disagree, and constructive criticism—expression of your own opinion—is always welcome.)

Back to what we know and don't know about climate change. This paragraph is from "Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the US Forest Sector," recently released by the US Forest Service (see page 20):

"It is difficult to conclude whether recently observed trends or changes in ecological phenomena are the result of human-caused climate change, climatic variability, or other factors. Regardless of the cause, forest ecosystems in the United States at the end of the 21st century will differ from those of today as a result of changing climate."

Emphasis mine. The report ought to be required reading for foresters.

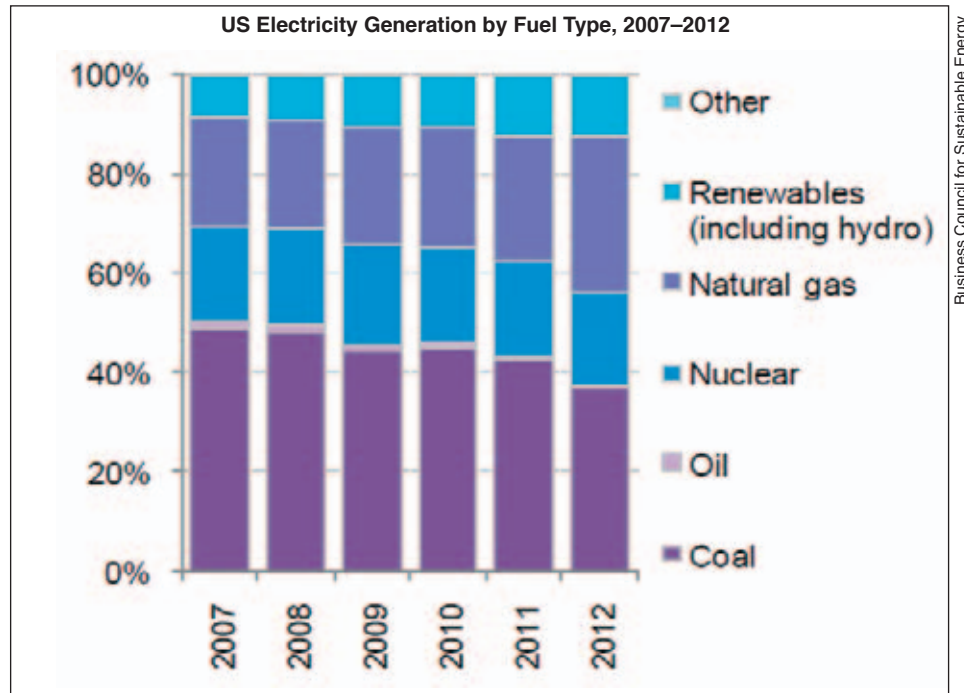
These questions are open to debate: How do we respond to observed and expected climate change? Should we respond?

For foresters, the answer is yes, we must respond. "Fortunately," wrote the authors of the new Forest Service report, "land managers who are currently managing forest ecosystems in a sustainable manner are often already using 'climate smart' practices. For example, thinning and fuel treatments implemented to reduce fire hazard also reduce intertree competition and increase resilience in a warmer climate."

Forest managers must continually re-evaluate such climate-smart practices and adopt new ones as we adapt to changing climatic conditions (and, of course, to economic, social, and other ecological conditions). We must continue evolving forest management as we have since 1900, to use terms from SAF's new core language (January, page 10).

What about the larger response to climate change? In a "Perspective" published in *Nature Climate Change* in October, "The Impacts of Climate Change on Terrestrial Earth Surface Systems," which is supported by 92 references, researchers Jasper Knight and Stephan Harrison suggest that it is too late to stop global warming by cutting emissions (full text at [www.nature.com/nclimate/journal/v3/n1/full/nclimate1660.html](http://www.nature.com/nclimate/journal/v3/n1/full/nclimate1660.html)).

"At present, governments' attempts to limit greenhouse-gas emissions through carbon cap-and-trade schemes and to promote renewable and sustainable energy sources are probably too late to arrest the inevitable trend of global warming," they wrote. "Instead, there are increasingly persuasive arguments that government and institutional focus should be on devel-



oping adaption policies that address and help mitigate against the negative outcomes of global warming, rather than carbon trading and cataloguing greenhouse-gas emissions."

President Obama didn't mention "forests" or "biomass" in his February 12 State of the Union address, which perhaps isn't surprising, and uttered the word "carbon" only once. The President did mention "climate change" three times and devoted a significant portion of the address to the topic, saying, "I urge this Congress to pursue a bipartisan, market-based solution to climate change, like the one John McCain and Joe Lieberman worked on together a few years ago. But if Congress won't act soon to protect future generations, I will. I will direct my Cabinet to come up with executive actions we can take, now and in the future, to reduce pollution, prepare our communities for the consequences of climate change, and speed the transition to more sustainable sources of energy."

The President's one mention of carbon came in this sentence: "And, over the last four years, our emissions of the dangerous carbon pollution that threatens our planet have actually fallen."

Indeed, they have. It was widely reported in early February that the *Sustainable Energy in America 2013 Factbook*, written by Bloomberg New Energy Finance for the Business Council for Sustainable Energy ([www.bcse.org](http://www.bcse.org)), shows that 2012 US carbon-dioxide emissions were at their lowest levels since 1994. Carbon emissions peaked in 2007 and have fallen by 13 percent since then.

Why? Primarily because we're using more natural gas and renewable fuels, including biomass, which emit smaller amounts of carbon dioxide, and less coal and oil, which release higher amounts. We're also seeing the benefit of increased energy efficiency: "Overall, energy demand decreased by 6.4 percent from 2007 to 2012, largely due to efficiency gains and despite economic growth," the report states.

So why do we need a "market-based solution to climate change"? California's cap-and-trade system, which has been covered in several articles in *The Forestry Source* and is perhaps a model for a national system, is a set of "regulations that will reduce greenhouse gas emissions to 1990 levels by 2020," according to the

state's Air Resources Board. The cap-and-trade regulations became mandatory for power plants and other large emitters in January; smaller emitters will fall under the regulations over the next few years. If US carbon-dioxide emissions have already declined to their lowest levels since 1994, why is this complex and controversial set of regulations necessary? As the trend away from coal and toward natural-gas power generation and greater efficiency continues, 1990-level emissions would be reached well before 2020, even if California suddenly abolished its cap-and-trade system.

Not only is a market-based solution proposed, but also a tax-based one. On February 14, Senators Bernie Sanders (I-VT) and Barbara Boxer (D-CA) introduced the Climate Protection Act and the Sustainable Energy Act, which would "make polluters pay for the damage they inflict on all of us while encouraging the transition to cleaner fuels," according to the senators. "This \$20 fee for each ton of carbon dioxide pollution will reduce emissions to 20 percent below 2005 levels by 2025." The fee, which is a tax by any other name, is projected to raise more than \$1 trillion in new revenue over the next decade.

Did the senators see the report showing that carbon-dioxide emissions are already at their lowest levels since 1994, a level achieved without a national cap-and-trade system or a carbon tax?

In last month's Editor's Note, I opined that "negative carbon tax" payments or tax credits might offer an incentive to landowners to keep forests as forests. I ought to have said that, *if we must have a carbon tax, as seems likely*, then here is one way to structure it. You may have a different opinion about that suggestion. You may have a position on a \$1 trillion carbon tax or a national cap-and-trade system in general, each of which may do some good but also may produce significant unintended consequences. You might argue that such actions are vital even if US carbon-dioxide emissions are falling, since overall world emissions are still trending upward.

The subject is open for discussion. Contact me at [wilents@safnet.org](mailto:wilents@safnet.org) to submit a letter or Commentary for publication or just to have your say. Or voice your position via SAF's LinkedIn page, [www.linkedin.com/groups?gid=2877778](http://www.linkedin.com/groups?gid=2877778).



## Video

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left alone. Others actively managed and restored. This creates biodiversity and that makes for a healthy and thriving forest. Which leads to a healthy and thriving planet! We have a choice. We can sit back and do nothing ... or we can become informed stewards of the land."

In the final few seconds, the source of the video is displayed: The Aspen Center for Environmental Studies (ACES, [www.aspennature.org](http://www.aspennature.org)), which is based in Aspen, Colorado.

For many foresters, "environmental" is a red flag, an indication of an organization that opposes active forest management. However, in talking with Jamie Cundiff, ACES's forest programs manager, I found that this isn't always the case. What follows is a portion of our conversation.

### What are ACES's forest programs all about?

ACES is primarily an education and outreach organization. We've been around since 1970, doing mostly environmental education for kids, but also some programming for adults. We are not only doing public outreach on forest health issues, but we also are collaborating to get on-the-ground forest restoration work done locally in the Roaring Fork Valley, which encompasses about 640,000 acres of forest under multiple jurisdictions. We have lands managed by the US Forest Service and Bureau of Land Management, as well as open-space lands owned by counties and cities. ACES is trying to bring all of those entities together so that we have a unified vision for moving forward on how to manage our forested lands.

### With the fires that happened here in Colorado this summer, as well as the bark beetle epidemic, we see this as an amazing teachable moment.

### Why was "What's Happening in Our Forest?" produced, and who is the target audience?

Initially, the target audience was the local general public, but then we realized that it applied to a lot of our Western forests, and before we knew it, the video was spreading beyond the valley. The goal of the video is to communicate some of the more-nuanced aspects of what's happening in the forest to the general public. With the fires that happened here in Colorado this summer, as well as the bark beetle epidemic, we see this as an amazing teachable moment. The general public likes to ski and go hiking, but they aren't necessarily aware of what's going on in our forests. We hope the video will encourage them to care more about the big changes that we're seeing. We also see it as an opportunity to tell the climate story, how climate is impacting our forests, and to show that there are ways that we can turn some of these problems into solutions.

### Solutions that may involve active forest management?

Aspen is a really interesting place, because you have all of these incredibly expensive properties in the wildland-urban interface. The people that own those homes don't necessarily want to see active management—they have the forest as their backyards, and they like it the way it is. So in places like this, before we can do work, we have to take baby steps. The first step is education and outreach, and then you do some small-scale educational restoration projects. Then you might be able to get some meaningful, larger-scale restoration work done in the wildland-urban interface.

### Have you had any feedback about the video?

It's a little early to tell, but it has been positive. It's not like all of a sudden there's been a call for more biomass [harvesting] here in Aspen. These things take a lot of time. But it is helping the public understand why these things are happening. For example, in the Smuggler Mountain Open Space area [owned jointly by the city of Aspen and Pitkin County], we did some very small, but very high-profile restoration treatments—gambel oak mastication, removing conifers that were encroaching on an aspen grove, and a lodgepole patch cut along Smuggler Mountain Road, a heavily traveled route right outside of town. When you can couple things like this video with these small-scale projects, over time you see a shift, a larger acceptance of these kinds of projects.

### ACES is developing a forest health index. Is that another effort at education and outreach?

The goals of the index are, first and foremost, to provide a method for tracking change in forest health over time. We also think it will be a useful tool in informed community decisionmaking. We also want to support forest-resource management and planning on a landscape scale.

Currently, we are tracking 20 different metrics, and we're planning to track them on an annual basis. They fall under four categories: ecology, climate, disturbance, and human interaction, because we believe that all of those factors affect forest health. In the ecology realm, we're tracking things like average annual growth and mortality, using the Forest Service's Forest Inventory and Analysis dataset. We're looking at stand density. We're looking at avian migration and plant phenology, which will be citizen-scientist supported through programs such as Project Budburst. Under climate, we're tracking things like frost-free days in Aspen, extreme temperatures, precipitation as rain versus snow, and, so far, we've installed two soil-moisture monitoring sites. In the disturbance realm, we're tracking things like the number of acres of forest that show insect and disease infestation, or have a high fire risk. Human interaction involves air quality, visitors to the wilderness, timber harvesting and other management objectives, and so on.

Each one of these metrics, which we're tracking on an annual basis, will be assigned a score, from zero to 100. This is where it gets tricky. How do you relate a 65 in air quality to a 65 in average annual growth and mortality, on a meaningful, credible basis? We have a science advisory board that we're working very closely with in developing this index. Eventually, we will have a dynamic, interactive website where you can get one overall score for the Roaring Fork Valley, and that score will be broken down by the four categories and by individual metrics. We'll be able to



Active management plays a role in maintaining forest health, according to the "What's Happening in Our Forest?" video.

see how those metrics change from year to year. In addition to this kind of snapshot view, we're planning to release an annual "state of the forest" report that goes deeper into the data and their implications, and we hope that the first report will be released this fall.

### Might this index be useful in other areas?

The initial focus of the forest health index is the Roaring Fork watershed, but we anticipate the replication of these methods to other communities.

The bottom line is that there are troves of data being collected by land managers, but the data are not very accessible to the public. What we're looking to do is present all that data in an easy-to-understand, accessible way for the general public.

"What's Happening in Our Forest?" is available at <http://youtu.be/y1vQAWmduM4>. For more information about ACES's Forest Health Index, see [www.aspennature.org/restore/forest-ecosystem-health/forest-health-index](http://www.aspennature.org/restore/forest-ecosystem-health/forest-health-index).

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## Foresters

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tributes 15 percent of the city's revenue.

"We are stewards of [this] resource," Hiner said, and his statement describes a commitment to sustainability dating back to 1947, when foresters Lewis B. Snelling and F. L. Nethery wrote the first forest management plan for their city forest. Nethery said their work was "the starting and continuation of a plan of sustained yield management that will assure a perpetual income for the City of Montesano for 80 years or more after this body of Councilmen are gone and forgotten." Because of the dedication of succeeding foresters, this is still a reality years later. Of course, that doesn't mean there haven't been challenges.

In 1994, Schillinger realized that the passage of state environmental regulations would affect logging operations, so with citizen input, he revised the forest management plan to address wildlife and water quality issues, as the city forest encompasses four major watersheds. This prompted the policy of having 100- to 150-foot riparian buffers on fish-bearing streams, anticipating and exceeding the buffers required by Washington's forest practices rules. Other methods also used to reduce sedimentation following logging operations include reconstructing older, substandard roads; placing new roads along ridges; and planting willows on unstable hillsides.

Yet in 1998, it was recognized that more-specific management goals, such as harvest levels, needed to be outlined. A group of Montesano citizens, called the Tree Team, addressed the recreation, fi-



Montesano, Washington, city forester Loren Hiner at a trail map of the city's public forest.

nancial, wildlife, and forestry mission of the city forest, with the goal of finalizing management goals that were good for the city forest and its citizens, Schillinger said. The updated plan was released in 2000 and has "a good balance and has been working," Hiner added.

That doesn't mean Hiner and Schillinger don't face criticism when logging occurs, even though it is understood that every acre of the 4,201 acres of productive land will be logged. Schillinger recalled receiving complaints from neighbors that the view from their property is now of a clearcut. Loren added that people don't want logging along their favorite trails.

The city forest's sustainable annual cut is 2.5 to 3 million board feet from 80

to 85 acres, which returns a gross profit of about \$800,000 to \$1 million. Annual management costs for city forest operations run about \$250,000. The second sale sold in 2012 was the first planned third-growth harvest, a 50-year-old hemlock stand. But changes of the forest-products market has required Hiner to adapt the harvest schedule to situations as they arise. Because it is increasingly difficult to sell larger trees, as only older mills can accommodate large-diameter logs, the harvest schedule has been accelerated in the past few years to liquidate the larger 80- to 90-year-old cohort. This year, Hiner arranged for two timber sales, the first of which was the sale of the city's last second-growth stand, comprised primarily of Douglas-fir with

an average diameter at breast-height of 38 inches. While Hiner was "sorry to see [the large trees] go," he was also glad to see them go, as the mission of the city forest is a working forest, not a city park.

A review of the rotation-age returns in 2010 by Hiner and Schillinger also prompted another change in their forest management practices. The harvest age, originally set at 50-60 years, was lowered to 45 years, enabling 89 acres of sustainable harvest a year with a projected 3.1 million board feet total harvest volume. "We can grow big stuff," Hiner said, because of the forest's high-quality sites, but reducing the rotation age allows the foresters to adapt to a changing market that doesn't demand large trees.

The city forest is now third-growth, a mixture of Douglas-fir, western hemlock, western red cedar, red alder, and Sitka spruce, and this year is seeing the planting of the first fourth-growth. Vegetation control is used but not fertilization, as Hiner describes the sites as 1 and 2 classifications, with deep, fertile soils that hold moisture, so fertilizer would be an unnecessary expense.

Another noticeable change in the city forester's responsibilities came after 1978. Previously, the city followed the practice of banning public access to the forest to protect its watershed, but the city council decided that the forest is "too valuable of a resource" to not share with the people, Schillinger said. After the 1978 decision, the city forester now manages the forest for recreational activities as well as timber revenue. Schillinger played a role in increasing

("Foresters" continued on page 5)

## Benefiting from Change: Realizing the Value of GIS in Forest Management

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## Outlook

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ing into the year ahead, there are three major structural changes underway in the industry that investors need to watch.

### The Canadian Supply Shock

The mountain pine beetle epidemic that's been ravaging Canadian forests will continue to take its toll. For decades, the annual allowable cut in British Columbia was around 70 million cubic meters; however, that number bumped up to nearly 90 million cubic meters from 2005 to 2010 to utilize dead and dying trees. The allowable harvest has been falling rapidly over the past couple of years, and by 2015 the BC government projects sustainable harvest levels to be in the 50 to 60 million cubic meters through 2075.

Since peaking in 2008, we've seen a shrinkage of nearly 10 million cubic meters in the allowable cut. Another 20 million to 30 million cubic meters in reductions over the next couple of years means one thing: The US timber industry will need to fill in much of the gap. This is especially important for those companies with timberlands on the West Coast, because of the increased demand from China.



### The Chinese Demand Shock

Like it is with most commodities, China is the world's largest importer of timber. Since 2003, exports of North American lumber have increased 20 times, and exports to China represented 7 percent of North American lumber production in 2011. That's likely to continue to increase for the foreseeable future, with West Coast producers seeing the greatest lift from this trend.

Taken together, the supply impact from Canada with increased exports to China will have a major impact on the timber market. It's estimated that 12 percent to 22 percent of the North American lumber market will be affected by these structural changes in the market. Some timberland-related companies will see a greater impact from these trends.

Topping the list, with nearly two million acres in its US West business, is Weyerhaeuser. The company has one of the largest acreage positions with access to the lucrative export markets. However, just a quarter of its revenue is generated from its timberlands segment. Moreover, just a third of its acres are in the US West.

Another, less-direct option for investors is Brookfield Infrastructure Part-

ners. While only representing 14 percent of Brookfield's revenue, all 419,000 acres of the company's timberlands are in coastal locations with access to Asian markets. In 2012, exports represented 39 percent of the company's total volume. After deferring 2.9 million cubic meters of harvest volumes due to unfavorable pricing the past few years, the company now sees the opportunity to increase its long-run sustainable yield to 120 percent for the next decade to take advantage of the eventual recovery of log prices. This will add a nice boost to earnings.

While nearly three quarters of its revenue is derived from its performance fibers business, Rayonier will also see an uptick in its West Coast operations. The company owns 389,000 acres in Washington State and has a 26 percent equity interest in Asia Pacific Forest Resources. The New Zealand-based venture manages approximately 332,000 acres of timberlands. While approximately 65 percent of the harvest is sold to domestic mills, the bulk of the balance is exported to Asia. Rayonier has been one of the best-performing timber investments of the past decade, and an improvement in timber prices should continue that trend.

Finally, with 492,000 of its 6.6 million acres along the West Coast, Plum Creek Timber will also see an uptick from these structural changes. It exported 215,000 tons in 2011 and expects to have delivered 400,000 tons in 2012. Not only will the company benefit from exports, but it sees the structural changes in the market to give the equivalent boost of 600,000 housing starts.

### Someday, Housing Will Recover

Which leads me to the third and final major structural change: housing. After the housing boom went bust, the industry has spent the past several years underinvesting in new home construction. The slow recovery is finally starting to show signs of picking up, with starts rising from an annual rate of 851,000 in November to an annual rate of 954,000 in December. As this trend continues, it will lift timber prices and the stocks of those that sell it.

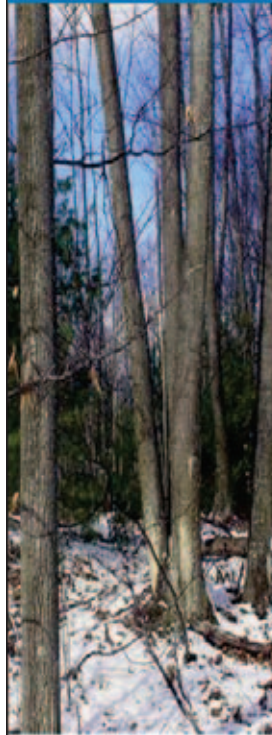
Of the major timber players, few have the leverage to housing as Weyerhaeuser. In addition to its well-positioned timberlands, it will enjoy further leverage, as another 45 percent of its revenue comes from its wood-products division. Finally, the company owns several small homebuilders, which when taken together represent a top 20 homebuilder.

### Foolish Bottom Line

The year 2013 looks to be the beginning of a long-term bullish trend for the timber industry. Jeremy Grantham, co-founder of the Boston-based investment house GMO, sees timber prices rising 6.5 percent annually for the next seven years based on rather tame inflation of just 2.2 percent. Because timber is a strong hedge against inflation, it could perform even better. That's good news for timber investors, who'll likely see decent boosts in dividends this year, again putting to rest that notion that money doesn't grow on trees.

*The Motley Fool contributor Matt DiLallo has no position in any stocks mentioned. The Motley Fool recommends and owns shares of Brookfield Infrastructure Partners. The Motley Fool's disclosure policy is available at [www.fool.com](http://www.fool.com). This article originally appeared on The Motley Fool's website on January 25, 2013. Copyright 2013, The Motley Fool. Used by permission. All rights reserved.*

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(“Foresters” continued from page 4)

public access by advocating for trails through the forest in response to citizens' requests; the city council at the time thought the logging roads were sufficient. Each year, more than 100,000 visitors spend time at Lake Sylvia State Park, which is located between the city forest and the city of Montesano proper, many of them hiking or biking on the city forest's 16 miles of developed trails and more than 40 miles of gravel road.

Recreational opportunities available within the city forest include hunting and fishing, hiking and biking, firewood cutting, and berry and mushroom picking. While the public access does bring such troublesome effects as marijuana growing, dumping, and metal theft, these behaviors haven't warranted a review of the public access policy, Hiner said. He was recently awarded a \$30,000 grant from the Washington state Recreation and Conservation Office for trail rehabilitation and the building of new interpretive signs for the trails.

Even though the city of Montesano has had a full-time forester on staff since 1975, this doesn't mean Hiner or Schillinger aren't challenged as to why the city is employing a forester instead of contracting out the position. Schillinger recalled a city council meeting when a logger asked, “Why do we need a forester, when we aren't doing any logging this year?” which is why the additional responsibility of being an educator is also an important part of this job: explaining how manag-

ing a forest involves change. We “have to keep telling the story over and over,” on how a forest works, Schillinger said. And as Hiner reports to the city council on the management of the city forest, he has to constantly educate, even taking the council members on annual tours.

In spite of the debate over having a full-time forester on staff, the city does recognize the value of forestland. In 2012, the city increased the forest's size for the first time through an acquisition of an adjacent 112 acres from Weyerhaeuser. Hiner would like to see such a practice continue when there are adjacent parcels that contribute to the city's strategic mission of maintaining a sustainable forest.

“Owning timberland is still a good investment,” he said.

The benefit of being the city of Montesano's city forester, Hiner and Schillinger agree, is being able to see the results of their work. Schillinger said he “appreciated the whole thing,” from the logging operations to the policy work. Hiner, who spent most of his career in the Cle Elum area, where trees grow slower in the drier climate, said that “it's a real joy to work and see the fruits of your labor” after planting seedlings and watching them grow.

*Andrea Watts is a graduate student at the University of Washington's School of Environmental and Forest Sciences, where she is studying silviculture and science communication. Contact her at [andwatts@live.com](mailto:andwatts@live.com). For more information about Montesano's city forest, visit [www.montesano.us/index.aspx?nid=940](http://www.montesano.us/index.aspx?nid=940).*



## SAF: Are a Few Repairs Needed?

After months of contemplation and countless attempts to find an answer as to how SAF can become a great society that everyone will want to be a part of, I've found that finding an answer is like searching for a needle in a haystack. But to find the answer, a tool is needed: finding a needle in a haystack is a lot easier with a magnet or a metal detector. For SAF to be great, the needed tool is differentiation, just as the Master Logger Program is used to say to the public that loggers are professionals. SAF needs to brand itself with a mark of professionalism that makes the average landowner choose a forester who is a part of SAF over one who is not.



After going to the national convention in Spokane, Washington, I came to the realization that the echoes in New England were true: SAF is a dying breed. The typical bell curve distribution is skewed off to the right when looking at the age of SAF members. This is a problem that has been addressed multiple times at many, if not all, meetings. SAF does not actively promote itself, so how can members expect people to know who they are if our name is not put out there? It's like a presidential candidate running for office without advertising—the odds of getting into office are slim to none. Similarly, the odds of the general public knowing about SAF is about the same. Anyone outside SAF is

none the wiser of the potential services that SAF has to offer.

If SAF were a car, it would have 140,000 miles on it, bald tires, and faded paint. First thing that needs to be done is to change the oil. SAF's goals are like the oil that keeps everything running smoothly, and without these goals the engine driving SAF would seize up and stop working. So, what are SAF's goals? Should SAF be actively trying to get young professionals hooked on all of its benefits? Should the name Society of American Foresters be known as having the best foresters? Should SAF be integrating itself into the schools to get people more in touch with nature and make people more environmentally minded? Should SAF be the central hub that coordinates all of the natural science fields? These are all important questions that need to be

taken into consideration to keep the SAF car running smoothly.

The next thing is to change the tires. SAF needs younger members integrated into its ranks to give the Society the grip and energy that allow dirt to fly when SAF spins its tires. Also, SAF's car needs a facelift; a new coat of paint will do wonders. SAF needs to get its name out there and let people know it is a player in the natural resources field.

What you invest in a vehicle is what you get out of it. To keep SAF going, a few little repairs are needed, repairs that will help SAF run smoothly as an outstanding Society. As the old saying goes, "You can't help another until you first help yourself." SAF, it is time to focus inward for a bit.

*Casey Elmer is a junior at the University of Maine, where he is a forest operations science major.*

## Thoughts about SAF after 53 Years of Membership

Like any organization, SAF is wrestling with several issues—some critical (e.g., declining membership) and some not so critical (e.g., how good is the *Journal of Forestry*?) to organizational survival and functionality. It has been so since the beginning in 1900, with only the issues and concerns varying with the times.

The Society was formed to advance the science and practice of forestry in the United States. That mission is still part of who we are, or should be, but it is buried in more profuse language that seeks to expand the mission statement by adding superfluous wording that injects goals, objectives, and strategies into the basic idea of what we're all about. However, at our very core, we should still be about advancing the science and practice of forestry. We need to know all about trees

**We need to continue advancing the science and practice of forestry. That is at our very core, and we need to stay with it.**

(and forests), and how to best make them sustainable over time. Why? Because they provide benefits to people, even though many folks may not realize what those benefits are.

I realize that my viewpoint may be simplistic, but I believe that many organizations try to get too complicated over time, and can actually veer from those core beliefs, or reasons for why they were formed. We get too embroiled in minutiae, and forget the real reason(s) why we banded together in the first place.

I believe we need to espouse a motto that says, "We're foresters. We know trees, and we know forests. People can

rely on us to advise and help guide them with the stewardship of individually and cooperatively owned forest properties." And: "Our name is SAF, and sustainable forestry is our game."

How we actually go about advancing "science" and "practice" involves the details of what the Society does. Advancing science requires us to have educated members. Thus, we accredit universities and schools that teach what we consider to be a minimum level of basic forestry education; we run a Certified Forester program that provides standards for continuing the education of foresters after graduation from college; we advocate for basic and applied research by organizations that delve into learning all about trees and forests; and we encourage the use of the latest technological developments for forest management and research applications, through sponsored demonstrations, seminars, webinars, etc., at membership meetings. Membership meetings themselves are one of our most important tools for providing educational opportunities for members. We also publish various journals and books that provide information and knowledge to members and others about research results and forestry applications.

Advancing the practice of forestry may be a little-tougher nut to crack, but we try. Our code of ethics was developed to provide guidance for our own members concerning how they should act when promoting and practicing forestry to benefit society and resources; forest policies are developed and provided to others for broad guidance on how we believe forests are best managed for a wide array of benefits; and we advocate (whenever and wherever possible) for the wise use of all forest resources, while at the same time utilizing management techniques that enhance and preserve the basic resources of the forest.

We take seriously our role as stewards of the forest, both as individuals and as an organization.

When I first joined SAF, we were deal-

ing with some of the same issues that are befuddling us today. Recruiting and retaining members has always been an issue, and the importance ebbs and flows with the times. We worry that the public doesn't understand us or appreciate what we do. Forest-management decisions made by others seem to be infringing on our long-held credo that we know what's best for the forest. The list can no doubt go on—pick your favorite issue or complaint. We've probably dealt with it before and may again.

In any event, I don't have many answers. As with most nagging issues, there are usually a variety of causal factors that contribute to the problem dragging on and on. Membership is a good example. We've lost members for a variety of reasons:

1. There are fewer jobs available for foresters than in the past, and trained foresters leave the profession to find other work. Most probably drop their membership.
2. Forestry schools and employers are placing less emphasis on being an SAF member—some because of economics (e.g., employers no longer provide financial support for membership), and some because of changing employment practices due to fair employment legislation (e.g., prospective employees can no longer be required to belong to SAF as a condition of employment).
3. Jobs within the US Forest Service that were once open to only foresters are being filled by individuals with other professional backgrounds.
4. There's always an element, within any profession, who don't want to be bothered with belonging to a professional organization if they don't have to be. To them, it's not a calling, it's just a job.
5. There are some who think it's too expensive—no matter what the cost.
6. Yet another element believes they don't get anything out of it, so they don't

participate. Of course, they never invest anything in the organization, so how can they get anything out of it? A conundrum with no solution!

Thus it goes, on and on, not only with membership, but with most chronic pains and issues faced by SAF.

The Society is currently in a process of trying to better define our core values and developing a "brand." What can I offer to the discussion? Very little, I'm afraid, because I believe we're in pretty good shape if we stick with what we've had since the beginning, and with what we've developed over time to support the vision of our founders.

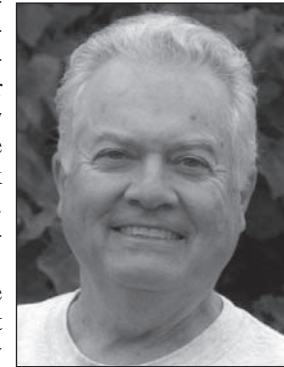
Our mission is still valid and relevant—we need to continue advancing the science and practice of forestry. That is at our very core, and we need to stay with it. Can we find more and better ways (programs) to do it? Probably. But we need to do it in ways that satisfy us and make us proud of what we do. Let the chips fall where they may with others, including our critics. Our primary clients should be the forests, the resources contained therein, and those within our profession who toil to accomplish the mission. We should keep our outreach efforts as simple as possible without denigrating our message(s). We've done good things in the forest and have benefitted society in many ways. Let's make sure people know that, and let's not be apologetic.

The bottom line, for me at least, is to believe in, practice, and promote the following "brand":

We are the Society of American Foresters. We take seriously our responsibilities to the forest resources of America. To do less would be a gross disservice to the resources and to our fellow citizens.

Our professional background and personal honor demands no less.

*Eugene L. Brunk lives in Jefferson City, Missouri.*





# A Primer on Forest Carbon Projects under California's New Offset Program

By Kyle Holland

Via California's new greenhouse gas cap-and-trade program, monetizing forest carbon is now a real opportunity for many landowners. As you have read in *The Forestry Source*, the pioneers of the forest carbon marketplace have learned from earlier experiences with voluntary carbon programs. The new program, which is administered by California's Air Resources Board (ARB), reflects lessons learned from the Chicago Climate Exchange and the Climate Action Reserve. (See "The Business Case for California Forest Carbon Offsets," January.)

Likewise, our experiences at ecoPartners Carbon in developing and verifying forest carbon projects unveil additional insights about the relative importance of certain project components. This article presents our perspective on generating carbon for sale and the factors that affect project design.

## Opportunity for Foresters

Demand for forest projects under California's offset program is expected to be strong—perhaps the best opportunity for conservation funding in this decade. These financial incentives are expected to be on par with timber. This presents an opportunity for foresters to expand their professional abilities and services.

Landowners realize the greatest benefits of the program when they have a professional forester's assistance to properly manage carbon and timber over time. Indeed, the ability to diversify revenue via both timber and carbon—to balance and optimize these two revenue streams according to current market conditions—is key to the economic feasibility of a forest carbon project and an argument in itself for developing a project.

**These financial incentives are expected to be on par with timber. This presents an opportunity for foresters to expand their professional abilities and services.**

Although the commodity is different, the sales process for carbon is similar to timber: carbon is sold to an emissions entity just as timber is sold to a mill. Some timber sales are complex, requiring appraisal services, legal considerations, scheduling, and consideration of a landowner's multiple objectives. Carbon sales are likewise complex, so the services provided by knowledgeable foresters are critical to success.

This analogy extends to risk as well. What if I can't find a buyer at the right price? What if my sale falls behind schedule on delivery? Foresters apply a variety of strategies to mitigate these risks for timber sales, many of which are applicable to carbon sales.

Foresters must have a thorough understanding of landscape patterns and management constraints in order to design a forest carbon project and to facilitate a carbon sale. In addition, they must have the technical expertise to estimate carbon stocking, the common-practice value, and the baseline model.

## Components of a Carbon Sale

Carbon sales share many of the same complexities and risks as timber sales. However, carbon is treated differently than timber under California's offset program. Unlike timber sales, carbon sales do not generate scale receipts. Carbon is sold as a number of metric tons in an electronic registry and is never actually measured by a physical scale. This quantity sold is the difference between what would have happened without the project (the "baseline," a hypothetical scenario) and what actually happens with project implementation. With this approach, special procedures are required to ensure that the number of tons in the registry is verifiably correct.

Three requirements are most critical in our experience, from least to most important: the baseline model, the common-practice value, and the carbon inventory. As one would expect, the common-practice value and baseline model are used to construct the baseline, and the inventory is used both for modeling the baseline and determining the actual quantity of carbon in the forest. Foresters must address these components before any carbon can be sold.

**Common-Practice Value.** The common-practice value and baseline model are affected by the landscape patterns of forest management surrounding the project; these patterns are classified into assessment areas. Assessment areas vary by geographic region, species composition, and productivity. Areas are defined under the ARB program, and each is assigned a carbon level based on regional US Forest Service Forest Inventory and Analysis measurements. Because most projects encompass multiple assessment areas, these multiple values must be aggregated into one common-practice value, which establishes a floor for the project's baseline model. That is, the carbon level predicted by the baseline model must be above the common-practice value.

**Baseline Model.** The baseline model is a forest growth-and-yield model that quantifies what could have happened (in terms of carbon) in the absence of the project. The model demonstrates that the carbon in the forest could have been reduced to the common-practice value, given all constraints to management, including regional silvicultural and legal constraints. Carbon for sale is the difference between the carbon estimate from the inventory and the quantity predicted by the baseline model.

**Carbon Inventory Requirements.** Inventory costs represent the largest investment in most carbon projects, and therefore also the greatest opportunity to realize savings through thoughtful and innovative inventory design.

Carbon inventories require a level of precision greater than typical forest inventories. Often, existing inventories must be supplemented with (or sometimes replaced by) additional and more precise measurements of tree biomass to estimate forest carbon. Obtaining an estimate of carbon at the required level of precision (<15-percent SEM at the 90-percent confidence level) usually necessitates more plots than usual. The plots are also likely to be distributed across an entire forest ownership, which may cause logistical



Kyle Holland, president and senior forester at ecoPartners Carbon (center), during a recent forest carbon inventory.

concerns. One traditional approach to reducing sample size and facilitating logistics is to stratify the forest area. (See "Guidelines Help Family Forest Owners Enter Carbon Market: Stratification Keeps Inventory Costs, Number of Plots to a Minimum," November 2009.)

A carbon inventory includes four primary measurements that determine carbon in an individual tree: species, diameter, height, and biomass defect. The first three of these measurements are required for the mathematical model provided for individual tree biomass approved by the offset program. Defect reduces the gross allometric predictions for missing carbon. Other measurements may be required to determine the common-practice value, demonstrate that a project meets ARB's definition of "natural forest management practices," and complete the baseline model. All of these measurements must be considered carefully before beginning any inventory fieldwork.

**Verification (the True-Up).** Periodically, the project must undergo third-party verification to ensure the carbon numbers reported to the registry are accurate and meet all the requirements of the program. Just as stumpage is effectively audited by the scale, a verifier audits the carbon data. If the technical components of the project are found to be incorrect, then the project is not eligible to sell carbon. Auditors re-measure a subset of inventory plots, so it is helpful to permanently monument plots for relocation.

## The Reward

Although these requirements and the verification process require foresters to be meticulous, their efforts are usually rewarded by the first carbon sale from the project. Typically, this initial "flush" is the largest sale during a project's lifetime and can be viewed as a reward to the landowners for previous management practices that led to higher-than-average carbon levels in their forest.

To effectively participate in the program, landowners and foresters must understand the required steps to sell forest carbon. More important, although carbon sales and timber sales require similar pro-

cedures, foresters must understand that carbon is treated in fundamentally different ways than is timber. To maximize revenue over time, forest owners should appreciate how carbon and timber are complementary to each other: a forest carbon project does not exclude timber production, but rather provides an opportunity to diversify traditional revenue streams with carbon.

*Kyle Holland, CF, is president and senior forester at ecoPartners Carbon (www.ecopartnersllc.com). You can reach him at 415-634-4650.*

*For more Forest Carbon Marketplace articles, visit the Climate Change/Carbon page on the SAF website at www.eforster.org/fp/climatechange.cfm.*

## Biomass Carbon Neutrality Explained

The World Business Council for Sustainable Development (WBCSD) recently released "Issue Brief: Biomass Carbon Neutrality," which provides basic explanations of the biomass carbon cycle, the benefits of using biomass, the concept of carbon neutrality, the debate over whether biomass is carbon neutral, and biomass carbon accounting.

According to the report, using biomass-derived fuels and materials instead of more fossil fuel-intensive alternatives is one approach to mitigating increases in atmospheric carbon dioxide. However, the benefits of using biomass are under question, with the debate often centered on whether biomass is "carbon neutral."

The WBCSD, which bills itself as "a CEO-led organization of forward-thinking companies that galvanizes the global business community to create a sustainable future for business, society and the environment," also released a companion presentation designed for policymakers.

The report and summary for policymakers is available at [www.wbcd.org](http://www.wbcd.org).



# Society Honors: Izlar Receives Schlich Memorial Award

By E. Lynn Burkett

During the 2012 convention, Bob Izlar, CF, was given a distinct honor in joining the ranks of Franklin D. Roosevelt and Gifford Pinchot to receive the Sir William Schlich Memorial Award. Among his many accomplishments, Schlich established the British timber reserves, wrote management plans for systematic forest management on public and private lands, established a forestry department at the Royal Indian Engineering College, wrote *The Manual of Forestry*, and founded the School of Forestry at Oxford. The award named in his honor recognizes individuals who have made broad, outstanding contributions to the field of forestry, with an emphasis on, but not limited to, forest policy and national or international activities.

Izlar works as director of the Center for Forest Business at the University of Georgia. He lives in Danielsville with his wife, Janice, and has a grown daughter and son. I recently talked with Izlar about the award.

## Why do you think you were nominated and chosen for this award?

My focus for the past 40 years has been to try and form strong relationships in forestry internationally. I have made friends in forestry worldwide, but especially in Sweden, Germany, and Finland. It hit me that I was having an impact when I was at a Swedish trade show and I met a guy from Australia. He said, "I've read your work and I like it." To say the least, I was stunned. Just think, someone halfway around the world recognized my name and then took the time to acknowledge me. Foresters are truly like



Bob Izlar, CF, gives his award speech at the 2012 SAF National Convention in Spokane, Washington.

family; we share many commonalities. We were all tortured through school with chemistry, mensuration, dendrology, learning Latin names, learning aspect, and then keeping all of that straight. That is the foundation of our profession and a common language we share.

## Can you draw any similarities between you and previous awardees?

I certainly do not put myself in the same category. One of my good friends, John Heissenbuttel, was the recipient before me. I have worked closely with John for the past 30 years, so, hopefully, some of his professionalism rubbed off on me. I recognize all the names of the previous re-

ipients, because of their legendary status and professional impact that has touched my life. They contributed to education and made great strides in forestry professionalism and conservation.

## What does this award mean to you personally?

One of my very dearest friends, Fred Haeussler, SAF president in 1986, started this process and nominated me. He did not live to see the results of his efforts or to see me receive it. He was a great mentor throughout my life.

## What led you down the forestry path?

The start of my career was pretty traditional, with two years in the Army and then an entry-level industry job. I was young and saw so many people in advanced positions. I thought, "How will I move beyond this small, rural town to make a difference? Everyone is smarter than I am." I guess that hard work and perseverance can overcome an incredible amount of stupidity.

## Who helped you along the way?

I was blessed with some wonderful mentors like Fred Haeussler and Ken Ralston, who took me under their wing. They saw something in me that I did not see in myself. They were guides and pushed me into things I may not have thought about doing, such as serving in an SAF leadership role. At one time, I was the secretary of SAF's Capitol Chapter in Jackson, Mississippi.

## What advice did they give you?

"It's not who you know, it's who knows you."

## What advice would you give someone wanting to break into a forestry or natural resources profession?

Have a passion for what you want to do. Even if you are intellectually limited like me, you can overcome a tremendous amount if you believe in your life's work and if you are willing to sacrifice and work hard. You must understand that we operate in a political environment where you have to have a solid understanding of the forces that shape what we do and what we don't do, and those forces may not have a clear understanding of forestry or, for that matter, anything related to a biological, natural environment. Never stop learning.

## Do you have any parting thoughts?

The Schlich award is representative of what we are really about. By naming it after a British forester, SAF reflects our heritage and the solid work to lay the foundation for our country and for what we do now. It is emblematic of what SAF is about: building relationships; knowing your professional responsibility from an educational and practical standpoint; and also how we operate in a much broader environment of policy, which is determined by a lot of people outside our profession who do not understand it as we do. None of us succeed in our careers without a lot of help—I could not have done this on my own.

E. Lynn Burkett is the district manager of the Bureau of Land Management's Lakeview District in south-central Oregon.

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These scholarships will be administered through The Society of American Foresters.

Ben Meadows is proud to be a part of SAF's efforts to educate future natural resource professionals.

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## SAF Welcomes New and Returning Members

The following individuals either joined or reinstated their membership within SAF during the month of January 2013.

Kristofer A. Alberga, Bloomingdale, NY  
 Craig M. Allen, Troy, MT  
 David H. Allen, Trenton, NC  
 Janice L. Allen, Trenton, NC  
 Nathan Allen, Lansing, NY  
 Antonio Artman, Summerville, SC  
 Heather Austin, Bend, OR  
 Darrel J. Bakken, Helena, MT  
 Bruce M. Barr, Placerville, CA  
 Sam Barrett, Nacogdoches, TX  
 Matthew Bauer, Lake Charles, LA  
 Micah-John Beierle, Lubbock, TX  
 Jake D. Blaufuss, Westwood, CA  
 Dana R. Bloome, Athens, GA  
 John L. Bowers, Taylors, SC  
 Aaron Boyd, Ahoskie, NC  
 Alec Brown, Durham, NC  
 Robert Burdick, Corvallis, OR  
 Daniel L. Castellucci, Alliance, OH  
 Michael A. Chilson, Leonardsville, NY  
 Jeremy S. Cochran, Chariton, IA  
 Courtney D. Compton, Hainesport, NJ  
 Dale R. Covey, Groveton, NH  
 Lawson T. Creekmore, Apex, NC  
 Grant A. Curry, Chavies, KY  
 Miranda Curzon, Saint Paul, MN  
 James M. Danielson, Boise, ID  
 Sam E. Decker, Seattle, WA  
 Shawna M. Dillon, Auburn, WA  
 Brady N. Do, Corvallis, OR  
 Eric Dooley, Auburn, AL  
 Christopher R. Fife, Colebrook, NH  
 Corey J. Figueiredo, Naples, NY  
 Stephen D. Fowler, CF, Statesboro, GA  
 Christian G. Gearwar, Lake George, NY  
 Jennifer Gelsinsky, Stevens Point, WI

Brandon Gilbert, Visalia, CA  
 David A. Gillespie, Chatham, IL  
 Ben Graham, Rock Hill, SC  
 Lynwood Graham, Burgaw, NC  
 Valerie C. Grant, Kneeland, CA  
 Mason Greene, Athens, GA  
 Marvin L. Griffin, Lawrenceville, GA  
 Naomi Gruber, Flagstaff, AZ  
 Eric Hansen, New Haven, CT  
 C. W. Harris, Gladstone, VA  
 Thomas Harris, Greensboro, NC  
 William L. Headlee, Ames, IA  
 Michael Holder, Clarksville, TN  
 Tim Hommes, Eureka, CA  
 Anwar Hussain, Anchorage, AK  
 Greg Hutson, Maryville, TN  
 Brian James, Vardaman, MS  
 Adam L. Jewell, Sedro Woolley, WA  
 Benjamin Johnson, Knoxville, TN  
 Kevin J. Kiniery, Fort Bragg, CA  
 Avery Kool, Corvallis, OR  
 Michael LaMana, CF, RCA, Toms River, NJ  
 Brian Lee, Bozeman, MT  
 Garrett R. Lewis, Brown Summit, NC  
 William W. Lewis, Gainesville, FL  
 Corey Magdziak, Bessemer, MI  
 Eugene R. Mahar, Bangor, ME  
 Michael L. March, Carbonado, WA  
 Daniel McKeague, Vallejo, CA  
 Steve S. Mitsuyasu, Enumclaw, WA  
 Ina Monter, Palestine, TX  
 Oscar N. Nilsson, Raleigh, NC  
 Jaakko Nippala, Raleigh, NC  
 Eric G. Nyhus, Corvallis, OR  
 Jeffrey J. Oldson, McArthur, CA  
 Jamie L. Overton, Richmond, VT  
 Mario R. Pagni, Ames, IA  
 Dustin L. Partsch, Kent, WA  
 Emily B. Peters, Saint Paul, MN

Rod W. Pfeifle, Olympia, WA  
 Michael A. Pierce, Monticello, AR  
 Connor M. Pompa, San Luis Obispo, CA  
 Stephen P. Prestridge, Starkville, MS  
 Jessie Prucnal, Ware, MA  
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## Forest Ecosystem Research Team Helps Improve Satellite Data

By Lynn Davis

Randolph Wynne, professor of forest remote sensing in Virginia Tech's College of Natural Resources and Environment, aims to improve the utility of Landsat data to forest managers. Wynne recently was selected by the US Geological Survey and NASA to be a member of the Landsat Science Team. He joins a team of scientists and engineers who will provide technical and scientific input on issues critical to the success of the interagency Landsat program.

Landsat is a series of US scientific satellites that have been imaging the Earth's surface for 40 years.

"Landsat is a versatile tool that is used by farmers, scientists, and city planners," said Matt Larsen, US Geological Survey associate director for climate and land use change. "It's used by a broad range of specialists to assess some of the world's most critical issues—the food, water, forests, and other natural resources needed for a growing world population. This team will help the Landsat program reach its highest potential."

**Because leaf area trajectory is related to productivity, we can tell where trees are growing well and where they are not.**

Membership in the Landsat Science Team comes with funding for proposed research. Wynne's award from the Landsat Science Team is for \$200,000 for the first year, renewable for four additional years, totaling almost \$1 million.

"My research goal is to improve our collective ability to monitor, model, and manage the Earth system—and, in particular, forest ecosystems—through improvements in both the preprocessing and analysis of multitemporal Landsat data," said Wynne, who serves as codirector of the Center for Environmental Applications of Remote Sensing. "Since Landsat was first launched in 1972, we have gained an unparalleled view of the Earth's surface," he added. "That Landsat archive, which used to cost \$500 to \$600 per scene, is now publicly available for free. It is a sea change in the way we can use these data."

A scene is an area measuring 185 kilometers (115 miles) by 185 kilometers. Virginia, for example, is made up of 15 slightly overlapping scenes.

"The advent of no-cost Landsat data enables an unparalleled increase in our understanding of the Earth system," said Wynne. "However, there are gaps in our ability to morph Landsat sequences into periodic time series." His research will test different means to fill the gaps.

"Every 16 days, we get a new picture of a scene from the satellite," he said. "But that doesn't mean the data will be usable. For instance, there are clouds and cloud



Mountain pine beetle damage in the Rocky Mountains of Colorado is evident in this Landsat image. The areas where the insects have caused trees to die appear as dark brown, whereas healthy trees appear as dark green. Randolph Wynne's research project will refine and develop methods for detecting changes in forests through time using Landsat data.

shadows. We are testing prototype solutions for getting rid of clouds."

Wynne's research team is using a common cloud-removal algorithm to remove some of the clouds and shadows. Then members will test crowdsourcing, in

which they post the problem online and invite people to bid to do the somewhat labor-intensive job of finding the remaining clouds in the images.

*("Research" continued on page 15)*



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# The Rampage 6 Rugged Android Handheld: Great Hardware, But....

By Steve Wilent

You may recall my review of Juniper Systems's Mesa rugged notepad in the November 2011 edition. I was and continue to be impressed with the Mesa's toughness; its large, bright screen; and, with the Windows Mobile 6.5 operating system, its ability to run Esri's ArcPad, Trimble's Solo Forest mapping software, Fountains America's PocketDog data collection software, and other tools that many field foresters rely on. I summed up my review by stating that "the Mesa may well be ideal for your forestry mapping projects." In May of last year, Juniper partner SDG Systems LLC introduced the Rampage 6, a version of the Mesa running on the Android operating system, and I jumped at the chance to take it for a test drive.

As I've said in previous Field Tech columns, Android and Apple's iOS operating systems, while used primarily as the brains of "smart" mobile phones, give natural-resources professionals a great deal of low-cost, portable computing power via apps, or applications, such as Esri's free ArcGIS for Android and iOS. One reason that Android has such promise is that it was developed by Google and a consortium of 84 other companies, called the Open Handset Alliance. The alliance includes high-tech-industry heavyweights such as Intel, Motorola, Sony, and Samsung Electronics, all of which have huge stakes in maintaining and improving Android. What's more, because Android is an "open-source" operating system, meaning that the source code is freely available to app developers, hundreds of thousands of apps have been developed since Android version 1.0 was released in 2008—more than 700,000, according to Google—many of which are free or cost less than \$10.

In contrast, Microsoft seems disinterested in upgrading Windows Embedded Handheld 6.5 (WEH), formerly known as Windows Mobile 6.5. As with other Microsoft operating systems, WEH is not open-source, meaning that software developers must pay for the privilege of writing software that runs on WEH and thus must charge more for their products. Of course, some of those products are much more powerful than the typical Android or iOS app, so a higher cost is warranted. For now, WEH has the advantage of being able to run ArcPad and other powerful software that Android can't (yet).

In January, SDG sent me a top-of-the-line Rampage 6 Geo 3G (\$3,995), which includes a 2- to 5-meter GPS receiver, a GSM (data-only) phone, Wi-Fi, Bluetooth, a camera, and dual batteries. The \$2,995 base model includes only Wi-Fi, Bluetooth, and a single battery. All models come with 256 MB of RAM, 4 GB of internal flash memory, and an SD/SDHC slot for additional data storage. SDG's website ([www.sdgsystems.com](http://www.sdgsystems.com)) states, "The outdoor-rugged durability means that the Rampage 6 can be used in a variety of applications, including Forestry, Field Service, and Utilities."

Other than the operating system and the main color of the case, the Rampage (gray or military green) is the twin of the Mesa (orange): it is a shockproof, waterproof, handheld computer. However, there the similarity ends—and my trouble began.



Santiago Figueroa

SDG Systems's Rampage 6, a version of Juniper Systems's Mesa rugged handheld with the Android operating system, running GPS Status and Toolbox, a free app available via Amazon Appstore and Google Play.

### The Trouble with Apps Apps

The unit I received came with Android 2.3.7 (known as Gingerbread), which was released on September 2011. Google and the alliance have upgraded the operating system several times since then (4.2.1, aka Jelly Bean, is the most recent release as of this writing). The main app I aimed to use was ArcGIS for Android, which Esri says works with Android 2.3 and up, so I figured that the sailing would be smooth. It wasn't.

Android apps are available from online "stores," such as Google Play and the Amazon Appstore; you use store-specific apps that facilitate purchasing and downloading other apps from those stores. However, Google Play isn't supported on the Rampage. Why? In a Rampage FAQ, SDG stated that "many of our customers do not want Google Play on the rugged device, so they can control what apps are installed." As far as I'm concerned, this is disappointing, because Google Play offers many more apps than other stores. SDG's FAQ notes that "Alternative markets like the Amazon Appstore, GetJar, or SlideME can be installed to provide functionality that is similar to Google Play." GPS Essentials, an excellent app that I have on my phone, and OruxMaps (see "OruxMaps: Mapping with Android Devices," January) are available via Google Play and GetJar, but not Amazon Appstore or SlideME. Neither GetJar nor SlideME carry ArcGIS for Android. (Although I found OruxMaps listed on the traditional, desktop-computer version of GetJar's Web site, OruxMaps did not appear when I searched for it on GetJar's mobile site via the Rampage, so I could not download it. Maybe there's a workaround, but I don't know of one.)

I used the Rampage's Web browser to navigate to the Amazon Appstore website to download the AppStore app. On my Samsung phone, this process took only a few seconds. However, all of my attempts to install the AppStore app on the Rampage failed. Frustrated, I did a bit of

Google sleuthing and found that other folks have had the same trouble with phones and tablets from other manufacturers. Eventually, I stumbled on a tip that solved the problem: I downloaded an old version of the AppStore app (1.07) from a third-party site, which installed quickly and works well. This glitch may not be SDG's fault, but the company would save its customers considerable exasperation by addressing it in some fashion, perhaps by installing that old version of the AppStore app before shipping the Rampage, or at least mentioning this problem in its documentation.

### Graphics Glitch

With the AppStore app installed, I downloaded and installed ArcGIS for Android without a hitch, and it started and seemed to run well. However, my troubles weren't over. On any attempt to open a map or imagery from ArcGIS Online, the app crashed and presented the following message: "Sorry! The application ArcGIS (process com.esri.android.client) has stopped unexpectedly. Please try again." I tapped Force Close and tried again. And again. Same result. Just to be sure that this wasn't something I was doing wrong, I started ArcGIS for Android on my phone and found that maps and imagery opened properly.

At this point, I did what other Rampage users would likely do: I sent an e-mail, via the SDG website, to SDG's technical sup-

port team. An answer came back very quickly, to SDG's credit, but it wasn't the answer I was looking for: "ArcGIS 2.0.5 requires OpenGL ES 2.0 to render the maps. The Rampage 6 does not have hardware support for OpenGL, so rendering a map will cause the map process to crash. Since it is a hardware limitation we have not been able to provide a workaround." OpenGL ES, or Open Graphics Library for Embedded Systems, is used on many video games, tablets, and Android and Apple phones, including, apparently, my Samsung phone.

If I had just spent four grand on a Rampage only to find that one of the premier mapping apps wouldn't work on it, I'd be very disappointed.

That said, some Rampage users won't want to use ArcGIS. For them, OruxMaps or another app might meet their needs (though I couldn't test OruxMaps to see if it runs on the Rampage). In such cases, the Rampage will no doubt serve them well. When SDG solves the hardware and software compatibility problems I've described, and I'm sure that it will, the Rampage will be a strong competitor in the forestry rugged handheld market.

As for Android, it remains a promising operating system. When more—and more-powerful—apps are available to natural-resources professionals, and one day they will be, Android may well be the operating system of choice in the rugged handheld market.

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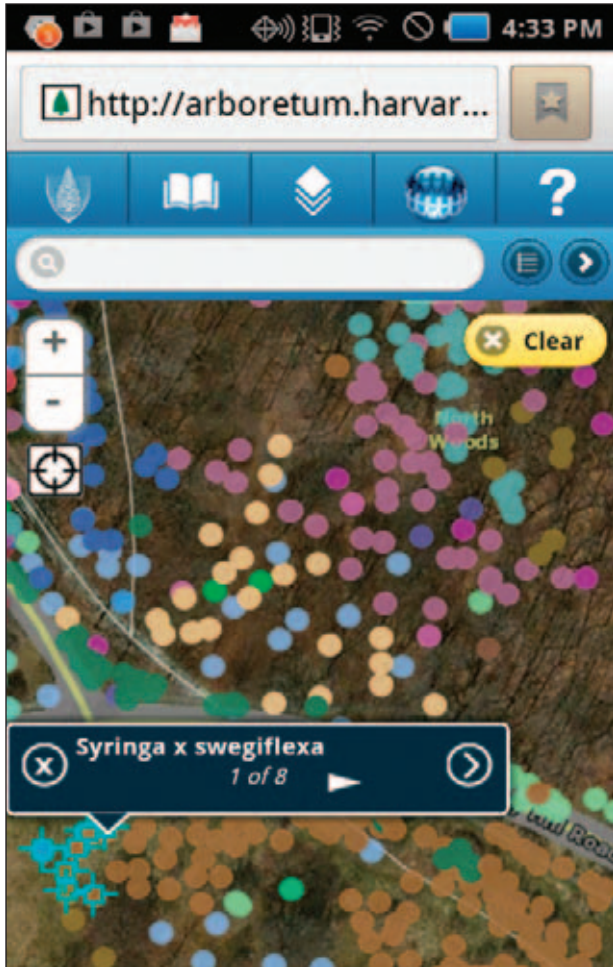
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By Matthew DeMeritt

Using a new mobile mapping application developed with ArcGIS, visitors to Harvard University's Arnold Arboretum can stroll through the lush garden with their smartphones and locate and learn more about the arboretum's unique botanical collection. By tapping icons on the smartphone screen, they can find trees and plants, such as a full-moon maple in the North Woods area, the witch hazel near Hemlock Hill, and the Japanese beautyberry in the Leventritt Shrub and Vine Garden.

The arboretum launched its Mobile Interactive Map (MIM) in May 2012, making it easier for everyone from scientists to visitors to explore its collections in person or virtually. Designed to educate visitors and assist in research, the application provides detailed information on botanical species, including their natural history and taxonomic placement, using a simple map-based interface. (MIM is a web-based app that can be accessed via any mobile-phone browser at [arboretum.harvard.edu/mobile](http://arboretum.harvard.edu/mobile).)



In the Mobile Interactive Map app (MIM), developed by the staff at Harvard University's Arnold Arboretum, about 15,000 dots—each representing a plant—populate a basemap of the arboretum grounds.

Since its founding in 1872, the 265-acre Arnold Arboretum in Boston, Massachusetts, has grown botanical species from all over the world to conserve and study. Today, the arboretum cultivates more than 2,000 species, representing some 15,000 individual trees, shrubs, and vines.

The arboretum's value lies not only in the diversity of its plants, but also in the scientific research they support and inspire. It has earned a reputation for rigorous record-keeping that painstakingly tracks the life of each accessioned plant from its beginning to its eventual end.

"Every individual plant in our collection has a special story," said Michael Dosmann, curator of living collections. "Our curatorial work focuses on preserving and sharing those stories, as well as keeping tabs on all of our plants spatially and over time."

Many species are native to other countries, including Russia, China, and Germany, and have been bred, cultivated, and studied for centuries.

#### Developing the Mobile Interactive Map

Bringing MIM online via the mobile application or any

desktop browser was a giant leap forward in making the breadth of the arboretum's collection available to the public. Jason Sardano and Donna Tremonte, GIS developers at the arboretum, used ArcGIS API for JavaScript and jQuery Mobile, a touch-optimized web framework, to build the mobile web application. MIM also functions as a desktop application, enabling not only arboretum visitors to use it on their smartphones, but also anyone with online access. The browser-based application gives those interested in botany and the Arnold Arboretum the ability to search the collection, find plants that are currently in bloom, and plan self-guided tours to specific areas, such as the conifer and crab apple collections and the shrubs and vines of the Leventritt garden.

In MIM, about 15,000 dots—each representing a plant—populate a basemap of the arboretum grounds. Tapping one of those dots activates a pop-up window that contains more-detailed information on that specific plant—its age and condition, where the arboretum ac-



MIM provides many details about each plant at Harvard University's Arnold Arboretum (left), as well as photos of leaves, flowers, stems, and other parts (right).

quired it, its latitude and longitude in the arboretum, and other information.

"There are several layers that can be turned on and off. Among them is a 'Plants by Family' layer that color codes the 15,000 dots to represent different [plant] families," said Tremonte. "Users can also choose to color the plants by 'Country Collected.'"

In addition to providing a bird's-eye view of the botanic and geographic diversity of the collections, MIM is a mash-up of data inputs from other sources, including JSTOR, Flickr, and Google Images. MIM also links to external data maintained by other botanic gardens, the US Department of Agriculture, and additional organizations.

Improving access to that data opens new possibilities for research by connecting botanists with authoritative resources on plant taxonomy, scholarship, and conservation through a single platform.

"The portal allows visitors to access important information maintained—curated—by experts at other institutions, such as the USDA," said Dosmann. "This allows the arboretum to put accurate and timely information into visitors' hands, but eliminates our need to maintain [that] data internally."

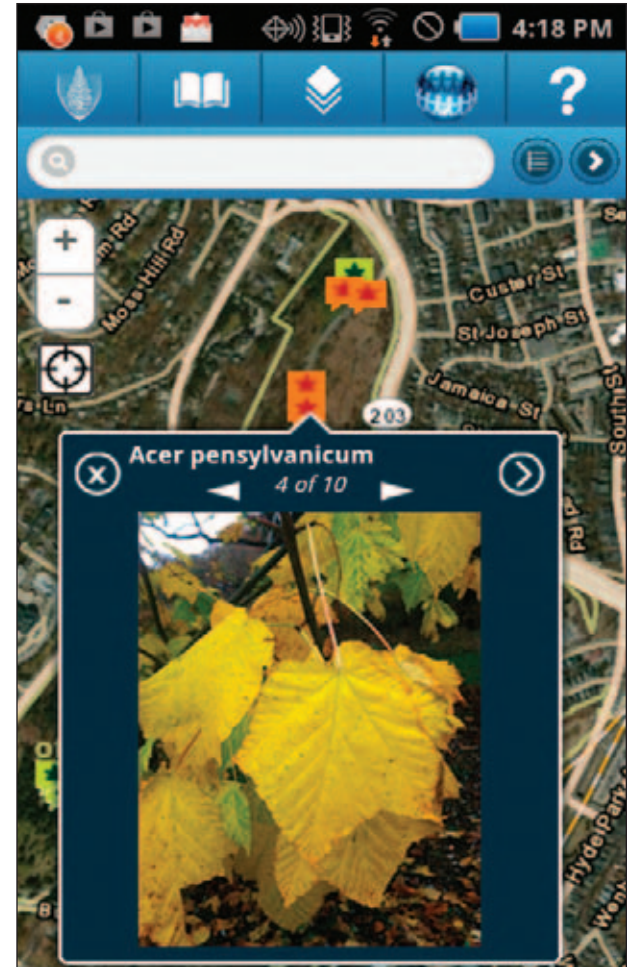
Besides being an academic resource, MIM leverages

social media that allow users to interact with the application. "The app accesses the photo-sharing services of Flickr to deliver photos for many of the plants and to allow the user to upload and view their own photos on the map," said Tremonte. "We are also currently working on adding in Facebook and Twitter interaction."

Users also can perform custom plant searches, quick searches, and spatial queries. The search function utilizes the onboard GPS functions of the mobile device and can show the distribution of queried plants throughout the grounds.

#### Digitally Mapping the Collections

Since the 1980s, Arnold Arboretum's living collection has been digitally mapped and documented using a combination of various software packages. Curatorial staff currently use a suite of ArcGIS for Desktop and Esri mobile GIS software applications, coupled to a dedicated plant-records software package known as BG-BASE. To



broaden scientific access to collections data, the arboretum launched a desktop interactive map called Collections Researcher in 2011 ([map.arboretum.harvard.edu](http://map.arboretum.harvard.edu)).

Built by arboretum Putnam research fellow Brian Morgan, who collaborated with arboretum IT and curation staff, the Flex-based desktop application served as a kind of prototype for the arboretum's future mobile application designs. The applications are a key component of Harvard's broader initiative to expand access to its resources for science and education.

"Bringing Collections Researcher online signifies a giant step in our efforts to share our remarkable collections with the world," said arboretum director Ned Friedman. "We aim to ensure that everyone—from genomicists to environmental biologists, and citizen scientists to the visiting public—can access our plants and the biology that lies behind them."

Matthew DeMeritt is a writer with Esri. This article originally appeared in the January 2013 edition of Esri's ArcWatch newspaper ([www.esri.com/esri-news/arcwatch](http://www.esri.com/esri-news/arcwatch)) and is used here by permission.

For more GIS for Foresters columns, visit the GIS and Remote Sensing page in the professionals area of the SAF website at [www.safnet.org/fp/GIS.cfm](http://www.safnet.org/fp/GIS.cfm).



("Research" continued from page 12)

Research team members professor Kevin Boyle and associate professor Klaus Moeltner, both of Virginia Tech's College of Agriculture and Life Sciences Department of Agricultural and Applied Economics, are recruiting undergraduate students to fine-tune online training modules for cloud identification. They will also test undergraduates who have different levels of experience for this task to determine relevant experience and skill level, and look at the influence of pay scale on the quality of the final product.

Another technique being tested is to provide the missing image data using a Fourier regression—that is, by creating a model based on data from previous shots.

#### Detecting Change

An important issue being addressed by Wynne's research team is the ability to be alerted "on the fly" when there are significant changes to a landscape.

"Once a truly periodic time series has been generated, one of the most important questions in land-use science is whether we can flag changes to land use and land cover at or near the time at which they occur," said Wynne. "Whether the application is disaster management or agricultural productivity, urban expansion or forest loss, detecting these changes is critical to understanding a wide variety of Earth system processes."

Research team member Evan Brooks, an instructor in the Department of Forest Resources and Environmental Conservation, along with his colleagues at Virginia Tech and Boston University, have developed an approach that has proved capable

of detecting even subtle changes, such as forest thinning.

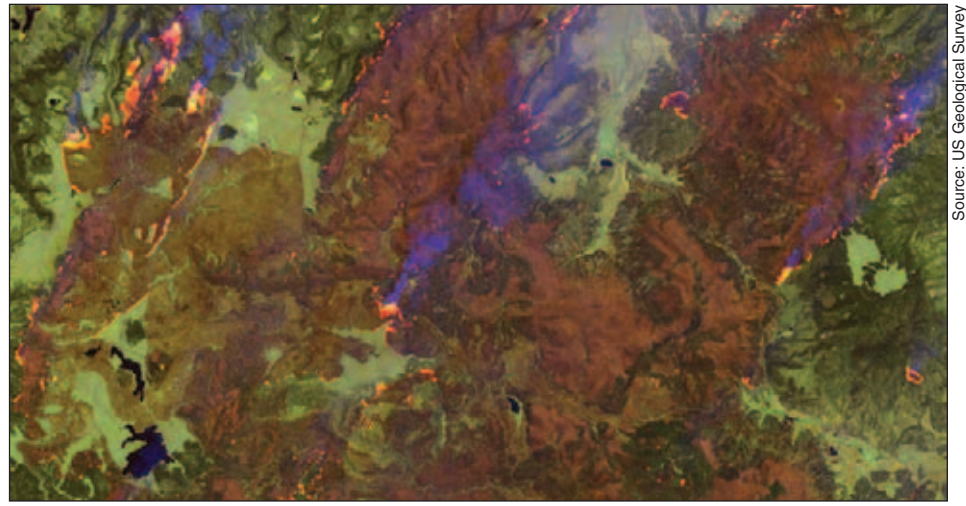
"In a nutshell, once a periodic time series has been generated, statistical control charts, such as have been used for decades in industrial engineering, can be used to detect 'out-of-control' observations, which in this case represent change in surface material type or condition," said Brooks.

Based on their past work, the researchers will use two control charts: one to detect large, sudden shifts, such as forest fires, and one to detect subtle, gradual shifts, such as forest thinning. Research trial areas are long-term forest productivity plots and actively managed industrial forests in Alabama, Louisiana, South Carolina, and Virginia.

"Our team of scientists has a wealth of practical experience in forestry applications of Landsat and other remote sensing data," said Wynne. "We will help the Landsat program develop advanced methods or strategies for large-area land-change assessments, pioneer new applications of Landsat data sets resulting from the free data policy, and increase the value of Landsat for addressing societal issues."

Concerning applications to forestry, "We are asking whether multitemporal clustering, or scenes taken over time, help us look at forest growth," he said. "For instance, if a forest was planted in 1988, can we use Landsat to monitor it? Because leaf area trajectory is related to productivity, we can tell where trees are growing well and where they are not."

"The ability to do this is novel and interesting," Wynne continued. "It allows us to look at site-specific information in a way we never could. For instance, we can help the landowner decide which area of



Landsat image of a portion of the Wallow Fire in Arizona, June 8, 2011.

Source: US Geological Survey

their property might be particularly responsive to fertilization."

The researchers are also trying to develop analysis techniques that will allow Landsat to be used to distinguish hardwood competition in pine stands.

"The experience of my research team members is essential, and the people from federal agencies and other universities on the Landsat Science Team bring individual expertise and create a synergistic relationship so that the science and the data are of high quality," Wynne said.

In addition to Boyle, Moeltner, and Brooks, Wynne's research team includes university distinguished professor Harold Burkhart, professor Thomas Fox, assistant professor Valerie Thomas, and research scientist Christine Blinn from the Department of Forest Resources and Environmental Conservation, and John Coulston, supervisory research forester for the US Forest Service's Forest Inventory and Analysis Program.

Some of the team members traveled to Vandenberg Air Force Base in California to attend the February 2013 launch of Landsat 8, which will include several system upgrades.

"A major upgrade is the move from a 'whisk broom' sensor to a 'push broom' sensor, where a long array of detectors is pushed along rather than using a scanning mirror," said Wynne. "This is a big change, because the sensor is over a particular point longer and there is a better signal-to-noise ratio. Landsat 8 will also have two new spectral wavelength bands: one to identify high cirrus clouds and the other that is sensitive to changes in water quality."

The Landsat Science Team is also working to jumpstart Landsat 9, "to ensure this valuable data stream remains available for the wide variety of applications that depend on it," Wynne added.

Lynn Davis is the public affairs director at Virginia Tech's College of Natural Resources and Environment.

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The Society of American Foresters' 2014 National Convention will be held with the World Congress. A variety of joint sessions and side events will make this a truly memorable event!





# SAF Congratulates the 2012 Student Poster and Presenter Award Winners

The 2012 SAF National Convention was held October 24–28 in Spokane, Washington. The convention program highlighted contemporary forest-management issues and the scientific basis of forest stewardship and resilience under the theme “Resilient Forests.” Spokane was an apt location to hold a forestry conference dedicated to the theme of resilience, for it was in the forests to the east of Spokane that the most devastating fire in US history raged little more than a century ago—the forests have proven resilient, yet the causes and results of that “Big Burn” have had a continuing influence on forest-management practices in the United States.

## 2012 Student Poster Awards

The SAF Forest Science and Technology Board instituted the Student Poster Award at the 2002 SAF National Convention to encourage students to present research that helps answer the questions that foresters ask every day. Any interested undergraduate or graduate student who is the primary author of each poster is eligible for the award. The top three student posters were evaluated based on originality, understandability, and presentation. In Spokane, 44 students authored posters.

## 2012 Student Presentation Awards

The SAF Forest Science and Technology Board instituted the Student Presentation Award at the 2009 SAF National Convention to encourage students to present research that helps answer the questions that foresters ask every day. Any interested student who is the primary author of the presentation is eligible for the award. The top three student presenters were selected by a panel that evaluated them on originality, timeliness, usefulness, clarity, and presentation. In Spokane, 21 students were evaluated for presentations in the scientific and technical sessions.

Presentation and poster abstracts were reviewed against the following criteria; abstracts were required to meet Criterion 1 and at least one of the other five to be considered for inclusion in the program.

- **Clarity:** the thought/expression/concept should be reasonable and comprehensible.
- **Scientific Approach:** including definition of the problem, hypothesis, methodology, application, results, analysis.
- **Practice of Forestry:** should bridge the gap between science and decisionmaking in the field of forest management.
- **Originality:** should report preliminary or novel results on limited data sets or applications of existing methodologies to new areas.
- **Contemporary Topics:** relevant to the convention theme and track themes that will appeal to a large number of attendees and contribute to professional development.
- **Policy:** local, regional, national, or international policy or program analysis using quantitative or qualitative data analysis.

## The winners of the 2012 Student Poster Awards are:

**1st Place**  
**Jonathan Sullivan, Yale School of Forestry and Environmental Studies**  
**Market Potential for Bamboo as a Biomass Material**

**Abstract:** The United States is one of the leading importers of bamboo and bamboo commodities, with the majority of materials originating in China. The total export trade of bamboo has shown an average annual growth rate of 17% between 1992 and 2008. Bamboo is a versatile fiber material that has been utilized for paper products, clothing, activated charcoal, fuel pellets, biomass, and for food. As forests are more frequently being considered for biomass sources, bamboo plantations serve as a viable alternative. Bamboo shows favorable fuel characteristics such as low ash and alkali index. Although the heating value is lower than other woody biomass, bamboo still presents a viable alternative given its high productivity and low cost of capital for implementation. This work explores the potential of bamboo as a biomass energy resource, comparing traditional sources of biomass in targeted subtropical regions within the United States to the financial considerations of bamboo plantations.

**2nd Place**  
**Dalila Maradiaga, Kansas State University**  
**Comparing Riparian Woodlands in Three Northeast Kansas Lake Watersheds**

**Abstract:** This project is part of a larger, multi-agency study aimed at reducing sedimentation of federal reservoirs. From August 2010 through May 2012, we conducted field assessments of riparian forests in the watersheds of three northeast Kansas lakes (Atchison County, Banner Creek, and Centralia). GIS data showed the predominant land use in the watersheds is agricultural, with Atchison and Centralia dominated by cropland, and Banner dominated by grassland. The plot dimensions were 50'x30' (LxW) measured from the top of the streambank. A total of 44 plots were assessed across the three watersheds. Data collected in each plot were used to determine the Basal Area (BA) per acre and Trees per acre (TPA) by species. Results showed strong differences in BA (square feet) and TPA among the three watersheds. The mean BA in riparian woodlands of Centralia watershed was 155 ft<sup>2</sup> (dominated by cottonwood (*Populus deltoides*) with some honeylocust (*Gleditsia triacanthos*); while Atchison and Banner averaged 120 ft<sup>2</sup>. Atchison BA was dominated by honeylocust and walnut (*Juglans nigra*), whereas Banner BA was dominated by hackberry (*Celtis occidentalis*) and bur oak (*Quercus macrocarpa*). However, Atchison watershed had the highest number of TPA (194) when compared to Banner (177), and Centralia watershed (135). Overall, the forest regeneration (seeding and sapling) was primarily composed of hackberry, with hickory saplings the most common in the Banner watershed. Black walnut and oak species only accounted for 10 percent, 8 percent, and 1 percent of seedlings per acre in Atchison, Banner, and Centralia, respectively.

**3rd Place**  
**Ashley Wells, University of Idaho**  
**Burn Severity and Vegetation Response in the Selway-Bitterroot Wilderness Area, 1900–2007**

**Abstract:** Quantifying how the proportion of area burned severely has changed over time is critical to understanding trends in the ecological effects of fire. Although in-

creases in wildfire extent and number of large fires are well documented, we know little about multidecadal trends in burn severity, patch size and implications for species diversity. We analyze the change in proportion of area burned severely across 542,747 hectares in the Selway-Bitterroot Wilderness Area in Idaho and Montana, USA, using 30-meter fire perimeters and burn severities inferred from 1984–2007 satellite imagery from the Monitoring Trends in Burn Severity project and 1900–2000 aerial photography. We analyze field data that was collected from 20 sites burned in 2000, a year of widespread regional fires, to quantify vegetation response within severely burned patches at 10 m, 40 m and 80 m distance from an unburned edge. We expect that as burn severity increases, so will the patch size, with implications for plant species diversity. We hypothesize that conifer seedlings will be less dense as the distance from unburned edge increases. Vegetation response has been found to be greatly impacted by burn severity and patch size, but the effect of patch size has not been widely studied and longer-term studies are needed. Understanding how proportion of area burned severely is changing over time, using a large spatial scale and long temporal scale, will assist ecologists and land managers to better understand vegetation response post fire, and will help to inform predictions for future fire effects.

## The winners of the 2012 Student Presentation Awards are:

**1st Place**  
**Marlyse Duguid, Yale University**  
**The Influence of Ground-Disturbance and Gap-Position on Understory Plant Diversity**

**Abstract:** The forest understory contains the majority of vascular plant diversity in eastern temperate forests, and its diversity, composition, and dynamics contribute directly to ecosystem function. While managers have traditionally viewed the understory as affecting forest regeneration or wildlife, there is increasing concern about impacts of management on understory diversity, and a growing recognition of the range of goods and services it provides. In this study we monitored response of understory diversity to microsite position and degree of ground-level disturbance within experimental gaps for ten years. We did this at four sites with distinct soil types and topographic positions of a glacial geology in Southern New England that were categorized as i) mesic, ii) mid-slope, iii) outwash, and iv) sandy-skeletal. We analyzed differences in patterns of species richness, Shannon diversity, and evenness across sites and through time. Understory species richness was generally enhanced by gap formation. Gap position was the most important factor influencing species richness across all sites, but the patterns of diversity and evenness were site specific. Ground-disturbance was more influential on drier sandy sites, and more pronounced earlier in the experiment. Temporal differences were also evident across sites, with richness stabilizing at all sites 10 years after gap creation, with the exception of the sandy-skeletal site, which was still increasing. Resource

managers who are interested in protecting and enhancing understory species diversity need to consider site when planning silvicultural treatments, as the response of the understory community to disturbance can vary greatly with site.

**2nd Place**  
**Marcella Campione, Utah State University**

**Habitat Typing: A Useful Tool for Future Forest Management**

**Abstract:** Habitat typing is one commonly used classification system for predicting site quality that focuses on the presence and absence of herbaceous and shrub species that are used to characterize the potential climax overstory of a site. In 2010, ten years after the original sampling, a subset of plots was revisited within the Western Upper Peninsula of Michigan. The sampling effort was expanded to include spring ephemerals, additional environmental variables, and exotic European earthworm populations. Non-metric multidimensional scaling (NMS) ordination was used to graphically determine how habitat types differed between years (2000 vs. 2010) and between seasons in 2010 (spring vs. summer). Overstory trees per hectare decreased from 2000 to 2010, but the number of herbaceous species sampled increased. This increased richness was mainly due to an increase in early successional and exotic herbaceous species. Earthworms were observed in all habitat types; earthworm densities generally increased as the potential productivity as indicated by habitat type increased. Ongoing assessment of these sites will allow scientists and managers to observe how exotic species, a changing climate, and disturbance regimes may impact forest dynamics.

**3rd Place**  
**Kristofer Covey, Yale University**  
**The Production and Emission of Methane in Trees**

**Abstract:** There is intense debate about whether forests contribute substantially to global methane emissions. Although trees act as conduits for methane release from soils to the atmosphere, the debate centers on whether vegetation directly produces methane by an uncharacterized, abiotic mechanism. A second mechanism of direct methane production in plants occurs when methanogens “microorganisms in the domain Archaea” colonize the wood of living trees. In the debate this biotic mechanism has largely been ignored, yet conditions that promote anaerobic activity in living wood, and hence potential methane production, are prevalent across forests. We find average, trunk-gas methane concentrations 15,000 ppm in common, temperate-forest species. In upland habitat (where soils are not a significant methane source), concentrations are 2.3-times greater than in lowland areas, and wood cores from both sites produce methane in lab-assays. Emission rate estimates are 24 and 52 ng CH<sub>4</sub> m<sup>-2</sup> s<sup>-1</sup>; of similar magnitude to the soil sink in temperate forest. Although preliminary, applying these rates suggests forests may contribute 30 to 65 Tg of CH<sub>4</sub> y<sup>-1</sup> to global emissions. Microbial infection of trees may result in globally significant methane emissions.

For more information, contact Carol Redelsheimer, director of Science and Education, (866) 897-8720, ext. 240; redelsheimerc@safnet.org.



## In Memoriam

**S. Gayley Atkinson, CF**, 95, died January 9. Atkinson served as a US Navy officer in World War II and helped deliver Allied soldiers to the beach at Normandy. In recognition for his efforts, Atkinson received the highest decoration given by the French, when he was knighted in the National Order of the Legion of Honour in 2008. He earned a bachelor's degree in 1941 from the School of Forestry at Pennsylvania State University and a master's degree in forestry in 1947 from Yale University. After a brief stint with the Davey Tree Expert Co., he formed his own business, S. Gayley Atkinson, Consulting Forester, specializing in tree spraying and care and forestry consultation. Among the clients that sought his consultation from 1947 to 2000 were the Hemlock Arboretum in Philadelphia and the *Farm Journal*. Saplings he planted are now mature trees on the campuses of Drexel and Arcadia Universities. He joined SAF in 1945.

**Linda M. Hague Carruthers**, 72, died January 12. Carruthers graduated from Michigan State University with a degree in journalism and went on to attend graduate school at Michigan Technological University to study forestry. She was a member of Phi Sigma Society and was on the Deans Honor List in forestry. She worked as a journalist, an equestrian trainer, and a musician, and for the Michigan Department of Natural Resources and the National Park Service. She joined SAF in 1998.

**Thomas R. Glassford**, 64, died February 23, 2012. Glassford served four years in the US Air Force and, afterward, graduated from the University of Idaho. He then began an illustrious career with the US Forest Service, serving in Idaho and Oregon and teaching US Forest Service courses across the country. Glassford joined SAF in 1990.

**William P. Hall III**, died December 1, 2012. Hall served in the US Navy on the USS *Topeka* from 1944 to 1946 in the Pacific theater. He graduated from the New York State Ranger School, part of the New York State College of Forestry-Syracuse, in 1948 and had a 44-year career with the Vermont Department of Forest and Parks, from which he retired as Chittenden County forester. He also worked for the US Forest Service in Montana and the United States Military Academy at West Point. Hall was a bobsled driver and served as captain for the US Olympic bobsled team in the 1972 Winter Games in Sapporo, Japan. Hall joined SAF in 1966.

**Robert E. "Bob" Hittle**, 64, died April 10, 2012. Hittle graduated from Purdue University in 1969, and was a certified forester. He worked for the Indiana State Highway Department, after he graduated as a landscape architect. He later worked for D.E. McGillen as an environmental specialist. He retired from American Structure Point in 2009. Hittle was active in the Boy Scouts of America and was a member of Ducks Unlimited. He joined SAF in 1969.

**Donald R. Theoe, CF**, died December 18, 2012. Theoe received a bachelor's and master's degree in forestry from the University of Washington and held many positions during his career, including the

Charles Bullard Fellow at the Harvard Forest and several positions within the Washington State Department of Natural Resources, including director of forest stewardship, which he held until his retirement. Working with Washington State University Extension, Theoe helped to develop and launch the state's very first Forest Stewardship Coached Planning short-course. An active member of SAF, Theoe served in a variety of positions, including Washington state society chair (1979-1980), House of Society Delegates chair (1982), and SAF District I Council member (1988-1990). He was named Washington SAF Forester of the Year in 1978 and was a candidate for SAF vice-president in 1990. His last SAF assignment included serving on the District 1 SAF Fellows Committee. In addition to SAF, Theoe was an active member in many forestry organizations, including the American Forestry Association, Canadian Institute of Forestry, Forest History Society, National Woodland Owners Association, Washington Farm Forestry Association, Washington Tree Farm Program, Western Forestry and Conservation Association, and Xi Sigma Pi. Near the end of his career, the American Tree Farm Program recognized him as the National Tree Farm Inspector of the Year. In retirement, Theoe became a forest owner and Certified Tree Farmer, and served as the chair of the Washington Tree Farm Program. He was president of the Washington Farm Forestry Association, and he and his wife, Florence, were recent nominees for Washington State Tree Farmers of the Year. Theoe joined SAF in 1960 and was named Fellow in 1984.

**Richard Wengert** died January 28. Wengert graduated from Purdue University, where he obtained a bachelor's degree in forest management and, upon graduation, was drafted into the US Army and served in Korea. He had a 39-year career with the US Forest Service, during which he started as a smokejumper in 1950. He ended his agency service as supervisor of the Daniel Boone National Forest. Also, for 24 years he served as a member of or as fire boss of the National Fire Overhead Team that was used in wildfire suppression efforts nationwide. Wengert received several awards and honors during his career, including Forest Conservationist of the Year from the League of Kentucky Sportsmen; the Leadership Award for Conservation and Recovery of Threatened, Endangered, and Sensitive Species on the Daniel Boone National Forest from the US Department of Agriculture; certificates of appreciation from the Kentucky Department of Fish and Wildlife Resources and US Senator McConnell; the Leadership Award from the US Job Corps; the Presidents Award from the Kentucky Forest Industries Association; and the Conservation Award from the Kentucky Environmental Quality Commission. Wengert retired in 1993 and, in 1996, he started a business as a consulting forester. He was an active lifetime member in the League of Kentucky Sportsmen, Purdue Alumni Association, American Legion, Veterans of Foreign Wars, and the National Rifle Association. He was also a member of Kentucky Forest Industries Association, Kentucky Association of Consulting Foresters, Association of Consulting Foresters of America, National Arbor Day Foundation, American Chestnut Association, Ducks Unlimited, and the Korean War Veterans Association. He joined SAF in 1952 and was named SAF Fellow in 1990.



## Give Young Leaders in Forestry the Opportunity to Experience the National Convention

### Consider contributing to the Bob and Ann Gregory Award Fund

G. Robinson (Bob) Gregory was a pioneer in forest economics and resource development, but always thought of himself as a forester. Bob had a special interest in assisting low-income countries develop their forest resources in thoughtful ways for the good of society. With his wife, Ann, Bob traveled much of the world consulting for the Ford Foundation, the United Nations Food and Agriculture Organization, and host countries on matters related to forest development. Ann's intuition and social awareness of the cultural attributes of each country were integral to Bob's success in partnering with individuals, governments, and companies in various cultures and countries.

The Gregory Award seeks to mark the achievements of the Gregorys' remarkable career and further their interest in international relations by providing economic assistance to outstanding students or professionals from outside of the US and Canada to attend the annual conference of the Society of American Foresters and have meaningful engagement with foresters on this continent.

Contributions to the Gregory Award Fund are tax deductible. See your personal tax advisor for full details.

Visit [www.safnet.org/commerce/annualgiving.cfm](http://www.safnet.org/commerce/annualgiving.cfm)

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C/O The Gregory Award Fund  
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**Job ID: 12301029**  
 Position: Assistant/Associate Professor of Silviculture  
 Company: University of Arkansas—Monticello  
 Location(s): Monticello, Arkansas  
 Posted: February 14  
 Job Function: Faculty in Forestry/Natural Resources  
 Job Type: Full-Time  
 Contact: Rhonda Parris  
 Email: parris@uamont.edu  
 Phone: (870) 460-1052

**Job ID: 12291254**  
 Position: Silviculture Forester  
 Company: The Campbell Group  
 Industry: Forest Management  
 Job Function: Forester  
 Location(s): North Bend, Oregon  
 Posted: February 12  
 Job Type: Full-Time  
 Job Duration: Indefinite  
 Min Education: BA/BS/Undergraduate  
 Min Experience: 2–3 Years  
 Required Travel: 0–10%  
 To apply: <https://www.campbellgroup.com/index.aspx>

**Job ID: 12290471**  
 Position: Assistant/Associate Professor  
 Company: The University of Georgia  
 Industry: Forestry/Natural Resources Academia  
 Job Function: Faculty in Forestry/Natural Resources  
 Location(s): Athens, Georgia  
 Posted: February 12  
 Job Type: Full-Time  
 Min Education: PhD  
 Min Experience: None  
 Required Travel: 0–10%  
 Contact: Bruce Borders  
 Email: borders@uga.edu  
 Phone: (706) 542-6205  
 Fax: (706) 542-8356  
 To apply: [www.forestry.uga.edu/](http://www.forestry.uga.edu/)

**Job ID: 12283202**  
 Position: Harvest Logistics Planner  
 Company: Weyerhaeuser  
 Industry: Forestry  
 Job Function: Other  
 Job Type: Full-Time  
 Job Duration: Indefinite  
 Location(s): Columbus, Mississippi  
 Posted: February 11  
 Min Education: Associate's Degree  
 Min Experience: 2–3 Years  
 Required Travel: 0–10%  
 Salary: \$45,000–48,000/yr

**Job ID: 12252852**  
 Position: Senior Forester, Stewardship  
 Company: Hancock Forest Management  
 Industry: Forest Management  
 Job Function: Forester  
 Location(s): Harpersville, Alabama  
 Posted: February 8  
 Job Type: Full-Time  
 Job Duration: Indefinite  
 Min Education: BA/BS/Undergraduate  
 Required Travel: 25–50%  
 Contact: Jean Squire  
 Email: ssquire@hnr.com  
 Fax: (617) 210-8509  
 To apply: [www.johnhancock.com/careers](http://www.johnhancock.com/careers)

**Job ID: 12252727**  
 Position: Purchase Stumpage Manager  
 Company: Irving Woodlands, Inc.  
 Industry: Land Management

Job Function: Procurement Forester  
 Job Type: Full-Time  
 Location(s): Aroostook County, Maine  
 Posted: February 8  
 Job Duration: Indefinite  
 Min Education: Associate's Degree  
 Min Experience: 3–5 Years  
 Required Travel: 50–75%  
 Salary Type: Yearly  
 Contact: Douglas Cyr  
 Phone: (855) 534-9663  
 To apply: [www.jdirving.com/jdirving-Careers.aspx](http://www.jdirving.com/jdirving-Careers.aspx)

**Job ID: 12240338**  
 Position: Silviculture & Forest Management Tenure Track  
 Company: Cal Poly State University  
 Industry: Forest Management  
 Job Function: Faculty in Forestry/Natural Resources  
 Location(s): San Luis Obispo, California  
 Posted: February 7  
 Job Type: Full-Time  
 Job Duration: Indefinite  
 Min Education: PhD  
 Required Travel: None  
 Contact: Lisa Wallravin  
 Email: lwallrav@calpoly.edu  
 Phone: (805) 756-6390  
 Fax: (805) 756-1402

**Job ID: 12234191**  
 Position: Assistant/Associate Professor of Geospatial Science  
 Company: University of Arkansas—Monticello  
 Location(s): Monticello, Arkansas  
 Posted: February 7  
 Job Function: Faculty in Forestry/Natural Resources  
 Job Type: Full-Time  
 Contact: Rhonda Parris  
 Email: parris@uamont.edu  
 Phone: (870) 460-1052

**Job ID: 12213325**  
 Position: Forester/Assistant Forester  
 Company: Hancock Forest Management, Inc.  
 Location(s): Hope, Arkansas  
 Posted: February 5  
 Industry: Forest Management  
 Job Function: Forester  
 Job Type: Full-Time  
 Contact: Jean Squire  
 Email: ssquire@hnr.com  
 Fax: (617) 210-8509  
 To apply: [www.johnhancock.com/careers](http://www.johnhancock.com/careers)

**Job ID: 12213308**  
 Position: Forester/Assistant Forester  
 Company: Hancock Forest Management, Inc.  
 Industry: Forest Management  
 Job Function: Forester  
 Location(s): Fields, Louisiana  
 Posted: February 5  
 Job Type: Full-Time  
 Job Duration: Indefinite  
 Min Education: BA/BS/Undergraduate  
 Min Experience: 0–1 Year  
 Required Travel: 0–10%  
 Contact: Jean Squire  
 Email: ssquire@hnr.com  
 Fax: (617) 210-8509  
 To apply: [www.johnhancock.com/careers](http://www.johnhancock.com/careers)

**Job ID: 12213303**  
 Position: Forester/Assistant Forester  
 Company: Hancock Forest Management, Inc.

Industry: Forest Management  
 Job Function: Forester  
 Location(s): Elizabeth, Louisiana  
 Posted: February 5  
 Job Type: Full-Time  
 Job Duration: Indefinite  
 Min Education: BA/BS/Undergraduate  
 Min Experience: 0–1 Year  
 Required Travel: 0–10%  
 Contact: Jean Squire  
 Email: ssquire@hnr.com  
 Fax: (617) 210-8509  
 To apply: [www.johnhancock.com/careers](http://www.johnhancock.com/careers)

**Job ID: 12213288**  
 Position: Assistant Professor, Forest Hydrology  
 Company: Michigan Technological University  
 Industry: Forestry/Natural Resources Academia  
 Location(s): Houghton, Michigan  
 Posted: February 5  
 Job Function: Faculty in Forestry/Natural Resources  
 Job Type: Full-Time  
 Min Education: PhD  
 To apply: <https://www.jobs.mtu.edu/postings/807>

**Job ID: 12201508**  
 Position: Forest Engineer  
 Company: Lone Rock Timber Management  
 Industry: Forest Management  
 Location(s): Roseburg, Oregon  
 Posted: February 4  
 Job Function: Other  
 Job Type: Full-Time  
 Job Duration: Indefinite  
 Contact: Julie Shoufler  
 Email: jshoufler@lrtc.com  
 Phone: (541) 673-0141, ext. 300

**Job ID: 12198564**  
 Position: Resource Forester  
 Company: Plum Creek  
 Industry: Land Management  
 Location(s): Crossett, Arkansas  
 Posted: February 4  
 Job Function: Resource Forester  
 Job Type: Full-Time  
 Min Education: BA/BS/Undergraduate  
 Min Experience: 2–3 Years  
 Contact: Human Resources  
 To apply: <http://plumcreek.contacthr.com/2771251>

**Job ID: 12171774**  
 Position: Utility Forester  
 Company: Utilimap Corporation  
 Industry: Forestry Consulting  
 Job Function: Forester  
 Entry Level: Yes  
 Job Type: Full-Time  
 Location(s): Atlantic City, New Jersey  
 Posted: February 1  
 Job Duration: Indefinite  
 Min Education: None  
 Min Experience: 0–1 Year  
 Required Travel: 10–25%  
 Salary: \$15.00–18.00/hr  
 Contact: Lauren  
 Email: Ltrimmer@utilimap.com  
 Phone: (636) 533-4016  
 Fax: (636) 533-4056  
 To apply: <http://ch.tbe.taleo.net/CH11/ats/careers/requisition.jsp?org=UTILIMAP&cws=1&rid=34>

**Job ID: 12146821**  
 Position: FMS Forestry Technician

Company: The Campbell Group  
 Industry: Forest Management  
 Job Function: Forest Technician  
 Location(s): North Bend, Oregon  
 Posted: January 31  
 Job Type: Full-Time  
 Job Duration: Indefinite  
 Min Education: Associate's Degree  
 Min Experience: 5–7 Years  
 Required Travel: 0–10%  
 To apply: <https://www.campbellgroup.com/index.aspx>

**Job ID: 12084840**  
 Position: Urban Forestry PhD Position  
 Company: University of Missouri  
 Industry: Forestry/Natural Resources Academia  
 Location(s): Columbia, Missouri  
 Posted: January 24  
 Job Function: Other  
 Min Education: Master's Degree  
 Required Travel: 0–10%  
 Contact: Jason Hubbard  
 Email: hubbartj@missouri.edu  
 Phone: (573) 884-7732  
 Fax: (573) 882-1979  
 To apply: <http://web.missouri.edu/~hubbartj/>

## Continuing Education Calendar

Looking for the Continuing Education Calendar? Unfortunately, we couldn't run it in this issue due to a lack of space. However, be sure to visit the events calendar on the SAF website at [www.safnet.org/calendar/index.cfm](http://www.safnet.org/calendar/index.cfm). There you can search for events by location, topic, and date, as well as apply for continuing forestry education credits for your own event!





# Call for Presentations

## *Silviculture Matters*

In 1903 at the first National Convention of the Society of American Foresters in Washington, DC, President Theodore Roosevelt challenged our young profession to implement a vast program of practical forestry on a large scale, to ensure sustainable forests and the values they provide for a growing nation.

Over the ensuing century, the actions of a committed profession have enabled exactly that to occur by applying the art and science of silviculture - through enviable scientific advances in high-yield plantation silviculture, as well as the growing sophistication and complexity of silvicultural systems for natural forest ecosystems.

These advances have not been without controversy, as the profession and the public have debated both the objectives and the tactics of modern forestry. As we highlight silviculture as the central focus of contemporary forest management for diverse stewardship values, we recognize that its practice depends on all forest sciences, ranging from basic biology to human dimensions.

We invite you to offer a paper or poster at the 2013 Convention to inform the conversation and to ensure that our profession and its practitioners continue to live up to Roosevelt's challenge to the profession. Individual presentations, panels, and posters will be accepted in the following natural resources topic areas:

- Recreation
- Forest Ecology
- International Forestry
- Social Sciences
- Inventory & Biometrics
- Soils & Hydrology
- Education & Communication
- Geospatial Technologies
- Urban & Community Forestry
- Wildlife Management
- Entomology & Pathology
- Utilization & Engineering
- Policy
- Silviculture
- Fire
- Economics
- History

### Submit Your Presentation at [www.safconvention.org](http://www.safconvention.org) before March 31, 2013

Presentation submissions deadline: March 31, 2013

Notification of acceptance: May 2013

Poster submissions deadline: September 8, 2013

Acceptance notification: September 22, 2013

For more information, and complete track descriptions, visit [www.safconvention.org](http://www.safconvention.org) and click on Presenters.

All presenters must register for the convention.



Society of  
American Foresters

**National  
Convention**

North Charleston, SC  
October 23 – 27, 2013





# Changing Climate, Changing Forests: New Science Assessment Looks at What to Expect

Chapter 1 of the US Forest Service's recently released assessment of how climate change has and will affect forests begins with a succinct and straightforward statement: "Projected changes in climate (temperature and precipitation means and extreme events), increased atmospheric carbon dioxide (CO<sub>2</sub>), and increased nitrogen deposition are likely to affect US forests throughout this century."

This introduction to "Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the US Forest Sector," was written by David L. Peterson and James M. Vose, researchers at the Pacific Northwest and Southern Research Stations, respectively. Along with Peterson and Vose, Toral Patel-Weynand, a national coordinator for bioclimatology with the agency, is the third of three editors of the report, which drew on hundreds of scientific papers examining a wide range of subjects.

The introductory paragraph continues: "Effects will be both direct (e.g., effects of elevated CO<sub>2</sub> on forest growth and water use) and indirect (e.g., altered disturbance regimes), and will differ temporally and spatially across the United States. Some of these effects may already be occurring. For example, large insect outbreaks and large wildfires during the past decade (Bentz et al. 2009, Turetsky et al. 2010) are a wake-up call about the potential effects of a rapidly changing climate on forest ecosystems. Individually and in combination, these two major disturbance phenomena are reshaping some forest landscapes and may be causing long-term, possibly permanent changes in forest structure, function, and species

composition (Hicke et al. 2012, McKenzie et al. 2004). Combined with other stressors, such as invasive species and air pollution (McKenzie et al. 2009), and a legacy of fire exclusion and other land management activities, maintaining resilience and restoring forest ecosystems in the face of climate change will be a major challenge for the 21st century and beyond (Peterson et al. 2011)."

Dave Cleaves, the agency's climate change adviser, said the report helps to frame the discussion about climate change in two new ways.

"One is that it posits climate change as part of a stressor complex that includes a combination of stressors that forest managers already deal with," said Cleaves. "There's always the big question of attribution: Did climate change cause it or not? That's really not the question. Climate is always going to be a part of that stressor complex, so the question is how we're going to deal with that stressor complex, which may be changing faster now, from region to region. The report paints a picture that's more in line with why foresters are foresters—it puts the problem into a solvable frame."

Cleaves is the primary spokesperson for the agency on climate change. He was formerly the agency's associate deputy chief of research and development.

The report also connects adaptation and mitigation, Cleaves said.

"The carbon chapters [in the report] show that you really can't contribute to emissions reduction through carbon sequestration unless you have a healthy forest. And a healthy forest depends on being able to adapt to changing conditions," he said. "There's really no separation in a



Roy Renkin, National Park Service

According to "Effects of Climatic Variability and Change on Forest Ecosystems," a new report from the US Forest Service, climate change will likely increase epidemics of forest insects and pathogens and related tree mortality. In recent years, a mountain pine beetle infestation killed many trees on Avalanche Peak, on the border between Yellowstone National Park and the Shoshone National Forest in Wyoming.

forester's world between adaptation and mitigation. In a separate discussion, you can talk about carbon markets, but they are really dependent upon the carbon sequestration, an ecosystem service that is dependent on the health of the forest, which is part of our adaptation response."

Separate sections of the report examine specific climate change effects, such as disturbance regimes, insects and pathogens, invasive plants, hydrological processes, and forest tree species distributions. Each section provides summaries of key findings and key information needs. In disturbance regimes, for example, one key finding is that the annual area burned and length of the fire season will likely increase throughout the

United States, altering the structure, function, and, potentially, the species composition of forest ecosystems. One key information need is quantification of the effects of increased fire occurrence on natural-resources conditions and ecosystem services, including wildlife, water, fisheries, and carbon dynamics.

"Some foresters may still be kind of afraid of this issue. The words 'climate change' carry baggage, and some people won't look past that," said Cleaves. "Our hope is that, with this report, people will look at the science—the report is science-based."

The 280-page report is available at [www.treesearch.fs.fed.us/pubs/42610](http://www.treesearch.fs.fed.us/pubs/42610).

## The Forestry Source

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