Volume 10 • Issue 4

Forest Products Laboratory's

Newsline

FALL 2011

Lords of the Ring Profiler

FPL Innovation Sheds New Light on Tree Growth

By Rebecca Wallace, Public Affairs Specialist

Research sometimes has a way of taking unexpected turns. Case in point: Forest Products Laboratory (FPL) engineer Tim Scott began a study on ethanol from biomass and ended up developing a tool for forest management and climate-change studies.

In 2006, Scott was working on a research project near Bend, Oregon, in the Pringle Falls Experimental Forest on the east range of the Cascade Mountains. "We were looking at the composition of wood from trees in severely overcrowded forests to see if they would be a suitable raw material for ethanol production," explains Scott.

These forests consisted of roughly 1,000 trees per acre, about 10 times the desired number of trees for a healthy, productive forest. Under such conditions, tree growth is extremely inhibited. A severely suppressed tree may add only 2 to 3 fibers per year in radial growth, whereas a tree under normal growing conditions may add 50 or more fibers per year.

For the ethanol study, Scott and his team sampled lodgepole and ponderosa pines of many different diameters. They found that even though the diameters varied widely, the trees were close to the same age. Moreover, the larger trees, which were assumed to be growing at a more normal rate, actually were suppressed in the last 40 years or more of their growth.

"What we assumed by looking at the exterior of a tree did not always match up to what we found once we were able to study the tree's rings," says Scott.

Studying a tree's rings can give you a fairly accurate determination of how old a tree is and how much mass it accumulates over time, but when there are 50 or more rings within a half-inch section, making such determinations can be difficult.

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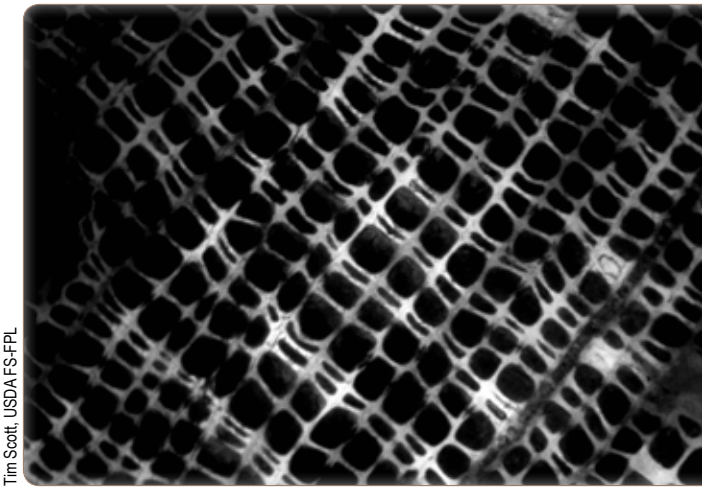

Tim Scott, USDA FS-FPL

Tim Scott, USDA FS-FPL

Above: A bright, high-contrast image of the cellular anatomy of wood produced by the Ring Profiler. Below: Suppressed growth trees can contain decades of growth rings in a half-inch section of wood.

In this issue

Steve Schmieding, USDA FS-FPL

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Upcoming Events

Sustainable Disaster Relief Housing: Swift and Durable Construction Solutions in Times of Need

October 27–28, 2011, National Arts Centre,
Ottawa, Ontario, Canada

The International Conference on Sustainable Disaster Relief Housing will bring together experts in the field during a day and a half of presentations in conjunction with an Exhibition Hall.

Three main sessions will fill out the program in an effort to

1. clarify current and future needs, and critically evaluate current response scenarios;

2. identify housing solutions and understand the various stages involved in supplying and executing those solutions; and

3. ensure preparedness strategies by learning from what hasn't worked in order to mitigate future delays

For more information visit http://www.forestprod.org/sustainablereliefhousing/index.html

Breaking News: Presidential Honor for FPL Scientist

President Obama named USDA Forest Products Laboratory engineer Samuel Zelinka as a recipient of the Presidential Early Career Awards for Scientists and Engineers. Zelinka is one of 94 recipients for the 2011 award, the highest honor bestowed by the United States government on science and engineering professionals in the early stages of their independent research careers. Watch for more on Sam's research and award in the next issue of NewsLine.

Wood You Believe?

USDA FS Rocky Mountain Region

Bristlecone pine

- The world's oldest trees are 4,600-year-old Bristlecone pines located in the western United States.
- Dill, lemongrass, and rosemary– essential oils from common plants are ideal natural pesticides for wood products.
- Good timber does not grow with ease. The stronger the wind, the stronger the trees.

Rural Community Endeavors to Eliminate Termite Problem with Help from FPL

By James T. Spartz, Public Affairs Specialist (SCEP)

Rachel Arango knows her bugs. As an entomologist for the USDA Forest Service, Forest Products Laboratory (FPL) in Madison, Wis., Arango worked with FPL's Rick Green to help purge one small Wisconsin town's large termite population, saving its citizens tens of thousands of dollars while purchasing peace of mind.

Using a novel community-wide approach—a unique combination of environmentally sensitive treatments and applications over several years—Arango and Green collaborated with private businesses, local citizens, and state agencies to combat this tenacious pest. Because of this work, the number of reported termites dropped very quickly after the first year, and no termite activity has been detected since fall 2009.

"It was a really big problem," says former Endeavor village clerk June Schumacher, who coordinated with Arango and Green in 2006 when the project started. "Rachel and Dr. Green were very committed. They really went above and beyond," says Schumacher. "Anywhere we thought there might have been termites, they put bait traps. They've done a great job."

Endeavor is a struggling but determined village of about 450 people in central Wisconsin. Citizens first noticed termite activity in the mid-1980s; initial infestation was likely due to stowaway insects on railroad ties or some other imported timber. Though particular districts in large metropolitan areas, such as the French Quarter in New Orleans, have been the focus of extensive ongoing termite bait programs, the project in Endeavor is an otherwise unique case of the community-wide eradication approach in the United States.

"Community-wide termite treatment is not at all common," says Arango. "This project really needed to be approached differently than traditional termite treatment."

The relatively isolated location and confined nature of the five distinct colonies, tens of thousands of termites, in and around the village center made Endeavor an ideal candidate for community-wide eradication efforts.

Drawing on a history of termite research established by retired FPL scientist Glenn Esenther, Green and Arango developed a three-stage eradication program in coordination with Randy Kalk and Dan Keohane of Alternative Pest Solutions in Madison, Wis., and Phil Pellitteri of the University of Wisconsin–Madison's entomology department.

Rebecca Wallace, USDA FS-FPL

Rebecca Wallace, USDA FS-FPL


Tivoli Gough, USDA FS-FPL

"Without Dan this project never would have gotten off the ground," says Green. "The folks at Alternative Pest Solutions are big supporters of the community-wide approach." The research team, Green says, coordinated to "employ the most ecologically friendly methods for detection and treatment of termites, using the least amount of toxic chemicals possible." Eradication, it is hoped, will improve property values and provide other long-term benefits for residents in this economically depressed rural community.

The financial savings per household for citizens of Endeavor is "very difficult" to estimate with such a community-wide approach, says Kalk of Alternative Pest Solutions. Homeowners in Endeavor who would have otherwise needed to contract with extermination services individually, says Kalk, have likely saved "tens of thousands of dollars in repair costs" by participating in this project.

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Broken Bat Incidents Down by Half in Major League Baseball Thanks to FPL Research

By James T. Spartz, Public Affairs Specialist (SCEP)

As the 2011 Major League Baseball season rallies into the playoffs, an unlikely relationship quietly wraps up its third year.

Since 2008, the USDA Forest Service has worked with MLB to help make America's pastime safer, and the results have been impressive.

"Since Major League Baseball's partnership with the USDA Forest Service began in 2008, we have witnessed a dramatic decrease in the number of broken bats thanks to the extensive efforts of the scientists from the Forest Products Laboratory, especially Dave Kretschmann," said Dan Halem, MLB's Senior Vice President of Labor Relations.

In fact, thanks to Kretschmann's research, there has been an eye-opening 50% reduction in multiple-piece failure (MPF) rates in baseball bats in the past three seasons.

Kretschmann, a research engineer at the FPL has seen video of every shattered bat. He's tested and analyzed hundreds of bats and recorded the who, when, and how of every breakage in 2009, 2010, and through the early 2011 season. Through his recommendations and the cooperative work of TECO, an independent certification and testing agency for wood products overseeing changes from the factory to the dugout; baseball players, owners, and fans have reaped the rewards of increased safety through practical science.

"Most of my initial recommendations addressed 'slope of grain' issues," says Kretschmann. Slope of grain refers to the straightness of the wood grain along the length of a bat. Straighter grain lengthwise is associated with less likelihood for breakage.

"One change made to address this issue, something that players and fans can easily see," says Kretschmann, "is a small ink dot placed on the face-grain of bat handles. This helps identify grain characteristics at just a glance."

Although broken bats have always been part of the game, MPF is something relatively new. With recent changes in bat geometry, wood species used to manufacture bats, and inconsistencies in the grain of the wood itself, up until 2008 there had been an increase not only in cracked or broken bats, but also in bats dangerously shattering into multiple pieces on contact.

FPL's work with Major League Baseball garnered national media attention from hundreds of outlets this summer. Follow these links to see video segments and radio spots on this research:

Associated Press: http://www.youtube.com/associatedpress#p/u/11/R_pVZJD_tvM

National Public Radio: http://onlyagame.wbur.org/2011/07/09/mlb-bats

Fox News: http://www.fpl.fs.fed.us/news/news_inthe/news-video-07112011.php

TECO

Major League Baseball


Major League Baseball

One particular modern bat design feature, a thick barrel tapering quickly to a much thinner handle, is also associated with increased multiple-piece failure. All MLB bats need to weigh about the same, so a bat using a larger volume of wood needs to use lower density wood, which is also weaker. Over-drying during the production process, says Kretschmann, can create weaknesses and affect a bat's strength integrity.

Thanks to these findings, the 2010 season saw limits to bat geometry dimensions, wood density restrictions, and wood drying recommendations. Shattered bat incidents continued to decrease under these new limits, and the trend has continued into the 2011 season.

"We are pleased to be able to work with Major League Baseball to help make the game safer for fans, players, and everyone else at the game," said USDA Forest Service Chief Tom Tidwell. "Safety is important, at work and play, and I'm proud that our collective 'grain trust' could score a win by coming up with recommendations that have reduced the number of broken bats by half over recent years."

And there's still more work to do.

TECO

"We will continue to work closely with the Forest Products Laboratory and the bat manufacturers to further decrease the number of broken bats in order to ensure the safety of all on-field personnel and our fans," Halem said.

Safety is a strong part of Forest Service ethos. As such, it makes good sense for Forest Service researchers to contribute to the safety of the players and fans of Major League Baseball. It is one strong American institution contributing to the wellbeing of another because, truly, safety is no accident.

End of an Era: FPL's "Million Pound Machine" Dismantled

By Rebecca Wallace, Public Affairs Specialist

The construction of FPL's Centennial Research Facility brings new capabilities for scientists but spells the end for a historic piece of equipment that has been in use for more than 90 years. The "million pound machine," a 40-foot-tall universal test machine, was purchased in 1920 and set up in the parking lot of the original FPL building on the University of Wisconsin–Madison campus. When FPL moved to its current location in the 1930s, the machine was built into the main building. It has been used over the years to evaluate timber construction properties and test poles, piles, large beams, and unique structures such as glulam arches and wood cylinders. Large poles often extended out of the building during testing. The strong floor and strong wall systems in the CRF have now taken over the duties of the million pound machine, which has been dismantled and recycled.


Steve Schmieding, USDA FS-FPL

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Lords of the Ring Profiler

Tim Scott, USDA FS-FPL

Tim Scott, USDA FS-FPL

The Ring Profiler could help forest managers make decisions about restoration operations.

So Scott and two FPL colleagues, David Vahey and JunYong Zhu, devised a method, called the Ring Profiler, that reliably determines the anatomical properties of trees simply by looking at the samples in a different light. Literally.

A common method for examining wood cells involves slicing sections with a razor blade and sanding them repeatedly to get the smoothest possible surface before viewing the sample under a microscope, typically illuminating the sample from above. Unfortunately, the sanding process can result in debris filling the lumen of the cells and obscuring the view. Other methods produce clearer images but can be costly and time consuming.

The Ring Profiler is novel because it illuminates the wood sample from the sides. Lighting from the sides allows the wood cells to act like fiber optic conductors; light is internally reflected within the cell walls, producing a bright, high-contrast image of the cellular anatomy when viewed from above.

"Side illumination is the key to this invention," says Scott. "The clear, high-contrast images obtained by the Ring Profiler can be used in conjunction with image analysis software to calculate the shape and width of the cells, the width of the cell walls, and the proportional area of the sample occupied by cell mass. Subsequently, if the density of the cell wall is known or can be estimated, a calculation of local wood density can also be made."

Developing the ability to accurately calculate mass distribution sparked a realization for Scott that went far beyond his original research on ethanol production. In regard to global climate change, for example, there is considerable interest in knowing the mass of trees in order to calculate the rate at which trees sequester carbon or function as carbon sinks.

"The ability to account for the amount of mass a tree accumulates over time is important on many levels," says Scott. "From managing forest health to measuring carbon sequestration, accurate information is vital."

Current inventories of forest biomass are based on a survey of density estimated by measuring the circumference of trees. However, as Scott and his team observed, such physical measurements may not be accurate in suppressed-growth forests.

The Ring Profiler provides a reliable way to account for mass accumulation in trees over time in order to calculate levels of carbon sequestration. Scott is now working on automating the process, with the ultimate goal of developing a field instrument. Such a tool could be used by forest managers to assess the health of the forests and aid in restoration efforts.

Scott and his team have patented the Ring Profiler and are interested in finding an industrial cooperator to collaborate on further development of the product.

Continued from page 3 – ## Rural Community Endeavors to Eliminate Termite Problem

Damage and subsequent repair costs due to termite infestation nationwide is estimated to be about $11 billion annually. According to Kalk, termite treatment for the average homeowner costs $1,000 to $2,000 per property for initial treatment. Necessary ongoing treatments cost an additional $300 to $500 per year and can go on indefinitely. Expenses vary depending on the size of the treated structure. Repair costs to address prior damage can be thousands more.

For this project, Green and Arango acquired bait stations through FPL, which were initially placed only on city property. Eventually, all Endeavor homeowners were eligible to participate. Those who elected to receive treatment were covered by an arrangement through the village administration, which paid a total of $3,493 annually between 2006 and 2009 for treatment and monitoring services throughout the village.

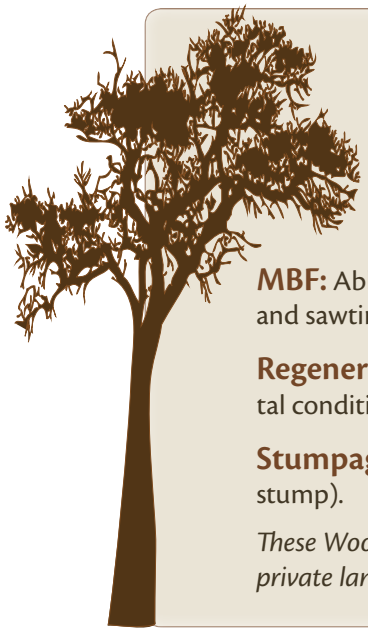
The town's location of 43.7°N latitude, 100 miles north of where termites might typically be found, affords a unique combination of climatic, geologic, and hydrologic conditions for these destructive insects to thrive. Impending changes in global climate patterns, however, may eventually allow for natural migration of colonies further north, making eradication research at the community level all the more important. Traditional chemical-intensive management methods were avoided because of the potential for contamination of the town's shallow water supply and adjoining river basin.

Tivoli Gough, USDA FS-FPL

Community education efforts throughout the project involved newsletter supplements describing what termite activity looks like and how to distinguish termites from ants. Continuing bait station observation and reporting by Kalk in 2010 and 2011 have been voluntary and will continue indefinitely. Though this project has been ongoing for five years, the underground nature of most termite activity makes it difficult to say that the problem is completely "solved."

Just like the people of Endeavor, termites are known to be resolute. Or, as Arango says, these persistent pests "are much more clever than we initially thought!" Thanks to the collaborative efforts of local citizens, private business, state agencies, and federal researchers, the termite may well have met its match.

Wood Wise—*Terms from the World of Wood*



Bole: The main trunk of a tree.

Crown: The branches and foliage at the top of a tree.

Cord: A stack of round or split wood consisting of 128 cubic feet of wood, bark, and air space. A standard cord measures 4 feet by 4 feet by 8 feet. A face cord or short cord is 4 feet by 8 feet by any length of wood less than 4 feet.

MBF: Abbreviation denoting 1,000 board feet. MBF is a typical unit of trade for dimension lumber and sawtimber stumpage. (It takes 11 MBF of wood to build an average 1,900-square-foot house.)

Regeneration Cut: A cutting strategy in which old trees are removed while favorable environmental conditions are maintained for the establishment of a new stand of seedlings.

Stumpage: The value or volume of a tree or group of trees as they stand uncut in the woods (on the stump).

These Wood Wise words taken from North Carolina State University Extension's glossary of terms for private landowners: http://www.ces.ncsu.edu/forestry/pdf/WON/won26.pdf

USDA Newsline

Published quarterly by
USDA Forest Service
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53726-2398
www.fpl.fs.fed.us

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