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Forest Products Laboratory's

Newsline

SUMMER 2013

Rate of Shattered Baseball Bats Remains Low Thanks to Partnership

By James Spartz, Public Affairs Specialist

As the 2013 Major League Baseball (MLB) season slides into the All-Star break, U.S. Forest Service Chief Tom Tidwell discussed some MLB-funded research at the Forest Products Laboratory (FPL) that has resulted in significantly fewer shattered baseball bats.

"Since 2008, the U.S. Forest Service has worked with Major League Baseball (MLB) to help make America's pastime safer," said Chief Tidwell. "I'm proud that our collective 'wood grain trust' has made recommendations resulting in a significant drop in shattered bats, making the game safer for players as well as for fans."

By testing and analyzing thousands of shattered Major League bats, FPL researchers have implemented changes in bat manufacturing that have led to significantly fewer shattered bats, especially maple bats. Even though maple bats are now more popular than ever among players, the rate of shattered maple bats is less than half what it was five years ago.

"These results would not have been possible without the outstanding work of the Forest Products Laboratory and the tireless efforts of its project coordinator, David Kretschmann," says Daniel Halem, MLB's Senior Vice President of Labor Relations.

In 2008, the joint Safety and Health Advisory Committee of Major League Baseball and the MLB Players Association began working to address the frequency of

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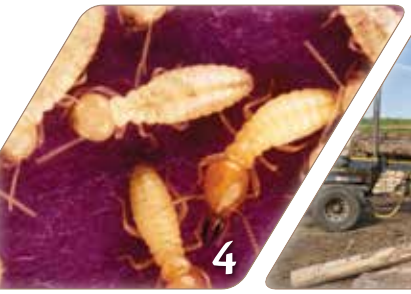
Courtesy of Major League Baseball

The average number of shattered bats per Major League game (multiple-piece failures) has dropped significantly since 2008 thanks in large part to FPL research.

Courtesy of TECO

FPL wood experts examined thousands of shattered bats used by Major League Baseball players.

In this issue



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NewsLine Team

Douglas Clawson
Jim Anderson
Tivoli Gough
Bill Ireland
Rajinder Lal
Steve Schmieding
James T. Spartz
Rebecca Wallace
Madelon Wise

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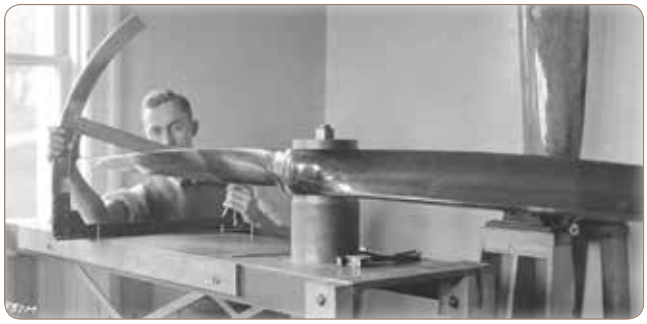
Wood You Believe: *National Defense Edition*

FPL packaging research laboratory during WWII.

During WWI and WWII, military operations required safe and efficient shipping of materials throughout the world. Packaging research at FPL greatly assisted in this effort. Engineers were able to design more efficient containers, reducing weight and volume while providing adequate product protection.

FPL's research on wood propellers, aircraft design, wood manufacturing processes, and drying substantially contributed to the proper use of wood in aircraft.



FPL research on propeller blades that resist warp, twist, and unbalancing with changes in humidity.

Launching of an unmanned aerial reconnaissance vehicle.

Nearly 90 years after the first research on wood propellers, FPL investigated the effects of dry heat on wood propellers for the Shadow 200 unmanned aerial reconnaissance vehicle used by U.S. forces in the Middle East.

Photos from "Forest Products Laboratory, 1910–2010, Celebrating a Century of Accomplishments." www.fpl.fs.fed.us/centennial/index.shtml

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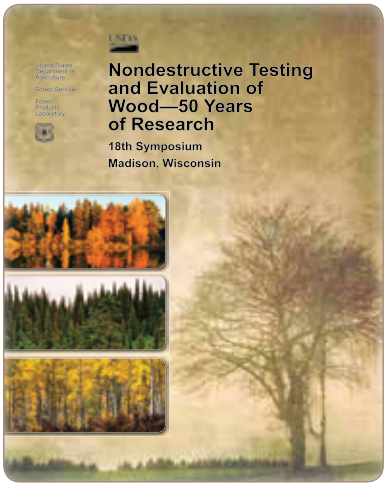
Upcoming Events



18th International Nondestructive Testing and Evaluation of Wood Symposium

September 24–27, 2013, Madison, Wis.

The 18th International Nondestructive Testing and Evaluation of Wood Symposium is a forum for those involved in nondestructive testing and evaluation of wood, and wood-based materials and products. It will bring together the international nondestructive testing and evaluation research community, users of various nondestructive testing technologies, equipment development and manufacturing professionals, representatives from various government agencies, and other groups to share research findings and new nondestructive testing products and technologies.

Registration is open and will be accepted through September 19, 2013. More than 150 presentations are already registered with 23 countries currently being represented, so register now!

For more conference information, visit www.forestprod.org/symposium2013/

2013 International Conference on Timber Bridges

September 30–October 2, 2013, Las Vegas, Nev.

The USDA Forest Products Laboratory aims to foster new international collaborations at the second International Conference on Timber Bridges. Join us and share your unique perspective on timber bridges with an international community of practitioners, researchers, government agencies, and bridge owners focused on timber bridges including highway, railroad, and pedestrian structures.

The main objective of this conference is to showcase and discuss state-of-the-art timber bridge technology. The mission of the National Center for Wood Transportation Structures (NCWTS) is to bring together academia, government, and industry to efficiently complete research, demonstration, and education that result in durable, cost-effective wood transportation structures to improve the transportation infrastructure of America and the world.

The NCWTS is a center at the Institute for Transportation at Iowa State University and is maintained in partnership with the Forest Products Laboratory, the Federal Highway Administration, and the National Park Service.

For more conference information, visit www.woodworks.org/education-event/ictb-201/

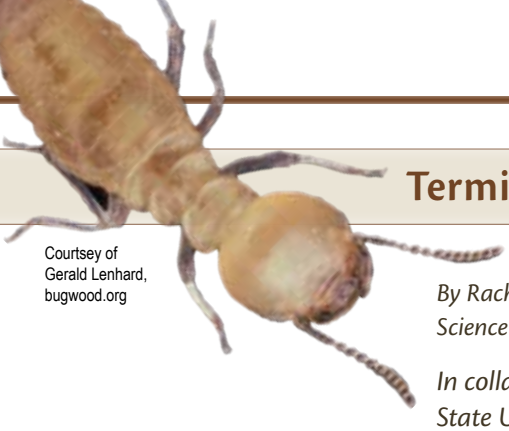
International Conference on
Wood Adhesives

International Conference on Wood Adhesives

October 9–11, 2013, Ontario, Canada

The International Conference on Wood Adhesives is the premier forum for scientific and technical exchange on the topic of wood adhesives. Our goal is to bring together all parties with a special interest in wood adhesives: whether you are an adhesive supplier or user of the downstream product, from industry, academia, government, or NGO, this conference provides an opportunity to interact with leaders in the field from around the world and hear about the latest developments. Session topics include energy concerns and opportunities for bonded forest products, structure and properties of bonded wood products, impact of regulations and consumer preference on wood products, new wood-based bonded products, bio-based and novel adhesive systems, resin chemistry, bonding to unconventional substrates, analytical and testing methodology, developments in fundamental understanding of wood bonding, modeling, composites, engineered wood products, and other applications.

For more conference information, visit www.forestprod.org/woodadhesives/index.html



Courtesy of Gerald Lenhard, bugwood.org

Termites in Wisconsin

By Rachel Arango, Biological Science PATH, Student Trainee

In collaboration with San Diego State University and University of Wisconsin, FPL termite experts have provided an update on previous work with termites in Wisconsin. Here, Rachel Arango explains how this work adds to greater understanding of northern termite biology, colony formation, and the possible impacts of climate change.

Although subterranean termites are more common in the southern United States, they have also been found in colder climates such as Wisconsin. New research suggests that a changing climate may allow termite colonies to spread even further in the warmer north by formation of winged reproductives.

Little attention was paid to northern termite activity until Dr. Glenn Esenther's historic work in Sheboygan, Wis. His 1969 paper, "Termites in Wisconsin," highlighted areas of termite activity in the state and gave some insight regarding termite biology. Despite this work, research on termite reproduction, caste formation, and distribution is still needed to facilitate control strategies.

Rebecca Wallace, USDA FS-FPL

Termites housed at Forest Products Laboratory.

Whitney Cranshaw, Bugwood.org

Termite infestation under a log.

This study updates Esenther's early work, further pinpointing areas of termite activity in the state. Only one species of termite is established in Wisconsin, *Reticulitermes flavipes*, the eastern subterranean termite. Results indicate that termite populations still appear to be limited to the southern half of the state, supporting the idea that Wisconsin lies on the northern boundary of termite territory. One long-standing hypothesis about termites in this northern range is that they tend not to form the winged reproductive forms (alates) as often as their southern counterparts. Instead, numerous secondary reproductives are thought to be responsible for colony expansion.

For this work, we were seeking clues about how new termite colonies form. We used a genetic technique that has been useful in other population genetic studies to determine genetic variation within and among Wisconsin termites. Analysis of the genetic data showed significant differences among the populations collected around the state. This supports the idea that human introduction, rather than introduction by winged termites, was likely the origin of termite colonies in the state.

The exact triggers for colony formation of winged reproductives are still unknown but this study afforded an interesting observation of numerous alates in the field

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after a particularly mild winter. This suggests that temperature plays a role in termite wing development. It is possible that changing climate trends could allow for formation of these winged termites, rapidly expanding their distribution throughout the state.

Visit the FPL Flickr page to see the technical poster about this project from the recent American Wood Protection Association conference: www.flickr.com/photos/fswood-lab/9186986308/

Rebecca Wallace, USDA FS-FPL

Tales from the Test Floor

By Rebecca Wallace, Public Affairs Specialist

Structural insulated panels (SIPs) are the latest material being put to the test in FPL's Engineering Mechanics and Remote Sensing Laboratory. SIPs are high-performance building panels used in floors, walls, and roofs for residential and light commercial buildings.

Engineering technician Dwight McDonald installs sensors to collect data during the test. The test will evaluate mechanical properties of the SIPs.

As the Instron machine applies force, the SIP flexes under the load until reaching its breaking point, literally.

Researchers will look at how and where the SIPs failed as part of the evaluation process. Understanding the mechanical properties of SIPs and other high-performance building materials supports their efficiency and use in construction by improving design standards and building codes.

Steve Schmieding, USDA FS-FPL

Engineering technician Dwight McDonald installs sensors to collect data during testing to evaluate mechanical properties of SIPs.

Steve Schmieding, USDA FS-FPL

As the Instron machine applies force, the SIP flexes under the load until reaching its breaking point.

Steve Schmieding, USDA FS-FPL

Wood Wise—*Terms from the World of Wood*

Blistering: The formation of dome-shaped projections in paints or varnish films by local loss of adhesion to the underlying surface and lifting of the film, usually caused by applying paint to a surface containing excessive moisture. It may also be caused by excessive heat or by using paint with poor adhesive qualities.

Commercial trimming: Partial harvesting of commercial trees with the aim of accelerating the growth of remaining trees.

Coppice: A cut made right through the trunk of a tree for the purpose of regenerating new shoots from the stump. This may be done low or high on the trunk, for the purpose of producing a new, straighter bole, for inducing flowering to attract bees, or for providing forage for animals. Coppicing is the usual way of regenerating oak and aspen clear-cuts.

Epicormic sprout: A small shoot, smaller than a branch, caused by sunlight directly hitting the trunk. Often caused by releasing a tree from competing neighbors, epicormic sprouting can cause imperfections in the tree's wood. For this reason, shade-tolerant trees are often cultivated around veneer trees to shade their trunks.

MBFT: One thousand board feet of one-inch thick wood. The most common measure of a quantity of wood to be used for lumber or veneer.

Sustained yield: The amount of timber that can be continuously extracted in perpetuity without affecting the quality and inventory of a forest.

Totholz: Dead wood that attracts insects and mosses important to biodiversity and wildlife. German forestry practices suggest leaving between 5 and 10 percent of your trees to decay in your woodland.

Source: Common Sense Forestry by Hans Morsbach (2002)

FPL's Economics and Statistics Research Group

By James T. Spartz, Public Affairs Specialist

Led by project leader and forest economist Ken Skog, the team's mission is to "provide economic analysis and projections that indicate the impacts of changing wood products use" and applying "modern statistical methods to enhance the integrity and efficiency of FPL research."

A handful of current research projects exemplify the breadth of this important line of work:

- Applying statistical methods to enhance the quality of FPL's wood utilization and economics research
- Improving statistical modeling of wood, fiber, and composite properties, processing, and performance
- Monitoring and modeling markets, production, consumption, and trade trends and technology changes in the U.S. forest products industry

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- Providing accessible, consistent information on timber, wood products, and paper product industries for forestry and forest industry strategic planning
- Providing knowledge on the economic viability of new technologies for converting wood and fiber into new or improved paper and wood products or biofuels
- Evaluating the forest sector's role in sustainable management of natural systems
- Evaluating the environmental effects of wood-based product production and use and evaluating the carbon mitigation benefits of wood products production in combination with benefits of forest management

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Rate of Shattered Baseball Bats Remains Low

bats breaking into multiple pieces. FPL research engineer Kretschmann and a team of wood experts looked at every broken Major League bat from July to September during the 2008 season. They found that inconsistency of wood quality, primarily the manufacturing detail "slope of grain," for all species of wood used in Major League bat manufacture was the main cause of broken bats. Also, low-density maple bats were found to not only crack but shatter into multiple pieces more often than ash bats or higher density maple bats. Called multiple-piece failure, shattered bats can pose a danger on the field and even in the stands.

Slope of grain refers to the straightness of the wood grain along the length of a bat. Straighter grain lengthwise means less likelihood for breakage.

About 60,000 baseball bats are sold to Major League players every season. The majority of those bats, 64 and 33 percent, respectively, are maple or ash. The overall rate of maple bats sold to Major League players fell by nearly 10 percent between 2008 and 2010, a time when the popularity of ash bats rose by about the same amount.

"Since 2008, the U.S. Forest Service has worked with Major League Baseball (MLB) to help make America's pastime safer." -Chief Tom Tidwell

Couresy of TECO

FPL researchers have implemented changes in bat manufacturing that have led to significantly fewer shattered bats, especially maple bats.

Orders for maple began to rise during the 2011 season and are now at an even higher percentage of sales than in 2008.

With the help of TECO, a third-party wood inspection service, the manufacturing changes the Kretschmann-led team established have proven remarkably successful over time. Limits to bat geometry dimensions, wood density restrictions, and wood drying recommendations have all contributed to the dramatic decrease in multiple-piece failures, even as maple's popularity is on the upswing.

A Look at Wood Use in Nonresidential Construction

By Rebecca Wallace, Public Affairs Specialist

Low-rise nonresidential buildings are an important market for lumber, engineered wood products, and structural and nonstructural wood panels in the United States.

In a cooperative study between the Forest Products Laboratory (FPL) and major wood industry associations, researchers evaluated the types and quantities of solid wood used in buildings, such as factories, churches, and schools, with six or fewer stories above ground level.

FPL Research Forester Dave McKeever was involved in the international study. "We aimed to determine the amount of wood products currently being used and identify areas where wood can be used in place of nonrenewable building materials," says McKeever.

According to the published report, in 2011, the value of all low-rise nonresidential buildings constructed totaled $208 billion. The construction of nearly 10,500 new buildings and major additions, and alterations and renovations to numerous existing buildings, consumed a remarkable amount of material:

627 million board feet of lumber
27 million linear feet of wood I-joists
67 million board feet of glulam timber

Tivoli Gough, USDA FS-FPL

Wood products can sometimes be used in commercial buildings in place of nonrenewable materials.

Steve Schmieding, USDA FS-FPL

FPL's Pilot Plant, built in 1967, prominently showcases the use of wood glulam beams.

6 million cubic feet of structural composite lumber
1 million square feet of engineered rim boards
712 million square feet of structural panels
19 million square feet of nonstructural panels

Although these numbers look impressive, McKeever says the most surprising thing he learned from this study was how much the recession of the late 2000s was still having a severe impact on nonresidential construction, the value of which was 35 percent below the high reached in 2008.

As a research forester, McKeever monitors and assesses the various end uses of wood products. He has also studied wood use in residential construction, and explains that the nonresidential market is a bit trickier to work with.

"Wood components used in typical home construction are fairly similar and therefore easier to measure," says McKeever. "It is difficult to predict the impact of nonresidential construction on wood use because the types of buildings

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are very diverse in how they are constructed, and the places where wood can feasibly be used change drastically between building types."

This diversity also offers opportunities for using wood in new ways, however, and McKeever's report serves as a tool for helping wood products manufacturers determine where they can promote the use of wood to architects and designers in ways not commonly known.

An executive summary of the report is available at www.fpl.fs.fed.us/products/publications/specific_pub.php?posting_id=64022&header_id=p

The complete report is available at www.fpl.fs.fed.us/products/publications/specific_pub.php?posting_id=64156&header_id=p

Tivoli Gough, USDA FS-FPL

Nonresidential buildings are an important market for wood products.

Engineered Wood Products Benefit from Better Adhesives

By Rebecca Wallace, Public Affairs Specialist

Wood construction materials like plywood or laminated veneer lumber rely on adhesives for part of their structural integrity. When used in outdoor applications, however, humidity can affect their performance even when the materials are mostly protected from the elements.

FPL researcher Joseph Jakes is taking a closer look at the relationship between moisture, adhesives, and wood, particularly as it relates to historic covered bridges. The roof structures keep the heavy timber trusses dry enough that they have lasted 100 to 200 years. But when historic bridges are repaired using today's engineered wood products, the swelling and shrinking of wood because of humidity changes can cause wood–adhesive bondline failures that result in further costly repairs.

Jakes is working to develop new, sophisticated techniques to better understand the interactions between wood and adhesives at the cellular level. These techniques can be used to formulate improved adhesives, resulting in more cost-effective methods for preserving historic covered bridges.

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James Wacker, USDA FS-FPL

Improved understanding of wood adhesives will help preserve historic covered bridges.

James Wacker, USDA FS-FPL

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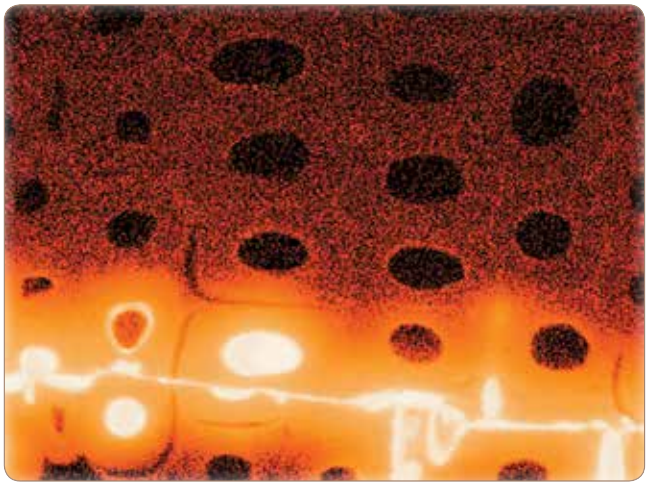
The results of this project reach beyond the benefits of historic bridge applications. The development of more durable engineered wood products promotes the forest products industry as a whole by increasing the use of wood in outdoor applications. This study will also add to greater fundamental understanding of how wood cell walls swell with moisture.

This project is being conducted in cooperation with the Argonne National Laboratory and the Oak Ridge National Laboratory.

USDA FS-FPL



Xray fluoresence mapping of adhesives in cells and infiltration into cell walls.

Biological Properties of Wood, a New Chapter

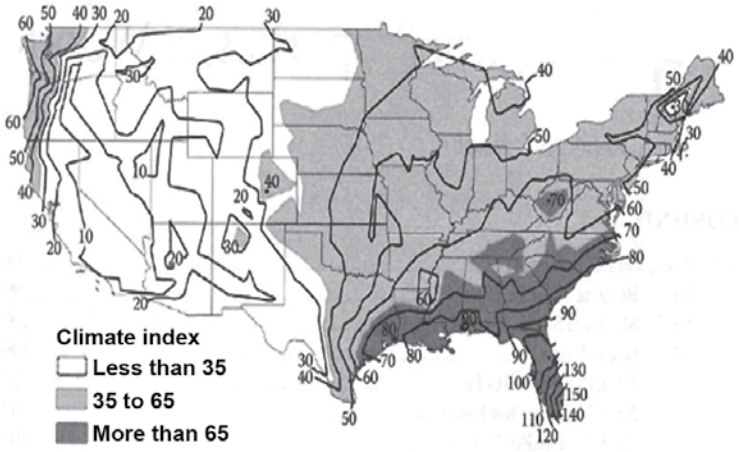
Steve Schmieding, USDA FS-FPL

Rebecca Ibach, FPL Research Chemist.

Rebecca Ibach, research chemist at FPL, has written a chapter for the new edition of the Handbook of Wood Chemistry and Wood Composites (2nd ed., 2013) titled Biological Properties of Wood (www.fpl.fs.fed.us/documnts/pdf2013/fpl_2013_ibach001.pdf).

Biological damage to wood and wood products (e.g., logs, lumber, or other products) occurs when it is not stored, handled, or designed properly. Biological organisms such as bacteria, mold, stain, decay fungi, insects, and marine borers depend heavily on temperature and moisture conditions to grow.

Among the many interesting bits of information in this chapter, one figure (Fig. 5.1) shows the climate index for decay hazard in the U.S. The index ranges from a low of 0-10 to a high of 150. The higher the number means a greater decay hazard. The southeastern and northwest coasts, for example, have the greatest potential for decay. Florida ranges from about 90 in the panhandle to a high of 150 around Fort Lauderdale. In contrast, the much drier American southwest has the lowest decay potential. An index level of 10 covers much of the



Climate index for decay potential for wood in service. Higher numbers (darker areas) have greater decay hazard.

Intermountain West including most of southeastern California, Nevada, and a thin stretch of central Oregon.

The Handbook chapter focuses on the biological organisms, their mechanism of degradation, and prevention measures. If degradation cannot be controlled by design or exposure conditions, Ibach suggests, then protection with preservatives is warranted.

Senator Tammy Baldwin Tours FPL

U. S. Senator Tammy Baldwin visited the Forest Products Laboratory on Friday, August 9, to meet with FPL leadership and learn more about how research at the Lab benefits the American public.

Story photos by Steve Schmieding, USDA FS-FPL

FPL Director Michael Rains welcomes Senator Baldwin in the Centennial Research Facility lobby and provides an overview of FPL research.

In the Engineering Mechanics and Remote Sensing Laboratory the group visits the strong floor and discusses how researchers use this unique space to gain a better understanding of the physical properties of wood and wood products. (Left to right, Assistant Director Mike Ritter, Director Michael Rains, Senator Tammy Baldwin)

Assistant Director Michael Ritter and Sen. Baldwin take a look inside the Lab's one-of-a-kind weathering chamber and discuss wood durability research.

In the composites research area, materials engineer Ron Sabo (left) and Assistant Director Ted Wegner (right) explain how composites can use low-value or waste material to create high-quality wood-based products.

FPL chemist Alan Rudie explains the wonders of wood-based nanotechnology to Senator Baldwin in the Nanocellulose Pilot Plant.

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