Volume 13 • Issue 4

Forest Products Laboratory's

Newsline

2014

Hosting a Holiday Giant: U.S. Capitol Christmas Tree Lights up Lab

By Rebecca Wallace, Public Affairs Specialist

The U.S. Capitol Christmas tree made a stop at the Forest Products Laboratory in early November on its way from Minnesota's Chippewa National Forest to its final destination on the West Lawn of the U.S. Capitol in Washington, D.C.

Visitors were treated to a glimpse of the 88-year-old, 88-foot-long white spruce and signed the banners enclosing the tree. In conjunction with the tree visit, FPL held an open house providing the public the opportunity to take a look inside our world-class research facility and talk with researchers about their work.

"It was an honor to be chosen to play host to such an iconic event," said Michael T. Rains, Director of the Northern Research Station and Forest Products Laboratory. "And it was a real bonus to host the public and show them some of the important research we are conducting at the lab."

This is the 50th anniversary of a "People's Tree" adorning the Capitol lawn. By making more than 30 stops while en route to Washington, D.C., the tree provides an opportunity for local communities to celebrate the healthy forests that connect us all and the spirit of the season. The theme for this year's tree is "bringing a piece of the forest to the people."

– Continued on page 10 –

Steve Schmieding, Forest Products Laboratory

Steve Schmieding, Forest Products Laboratory

Above: FPL volunteers stand proudly in front of the U.S. Capitol Christmas Tree.
Below: The U.S. Capitol Christmas Tree lit up for viewing during FPL's Open House event.

In this issue

Visit our website
www.fpl.fs.fed.us

NewsLine Team

FOREST PRODUCTS LABORATORY DIRECTOR
Michael T. Rains

OFFICE OF COMMUNICATIONS DIRECTOR
Douglas Clawson

ASSOCIATE EDITOR
Rebecca Wallace

ART DIRECTOR
Tivoli Gough

WRITERS/EDITORS
Jim Anderson
Madelon Wise

PHOTOGRAPHER
Steve Schmieding

WEB EDITOR
Rajinder Lal

DISTRIBUTION
Bill Ireland

Published quarterly by USDA Forest Service Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53726–2398. Articles may be reprinted provided credit is given to the Forest Products Laboratory and NewsLine. To receive this newsletter electronically or to be removed from our mailing list, call Forest Products Laboratory at (608) 231–9200.

Wood You Believe

A major goal of the USDA Forest Service (USFS) is to enhance the wise use of our natural resources, particularly those associated with forests. The USFS works to develop forests, manage ecosystems, and wisely use forest resources in a sustainable manner to meet the needs of our nation.

The Forest Products Laboratory's (FPL) role in meeting this goal is to enhance the wise use of wood produced by forests and help ensure the forest's sustainability.

FPL research has increased our understanding of how wood grows, improved harvesting practices, determined wood's constituents and properties, and developed new products and processes to utilize species that were once considered waste materials. FPL's research extends the wood supply by utilizing more species and smaller trees, providing uses for invasive wood species, and extending the life of wood products such as railroad ties, piles, and housing components through preservative treatments.

The public has greatly benefited from adequate, low-cost wood products that enhance their daily lives while leaving millions of acres of forests to provide a wide range of additional benefits.

www.shutterstock.com

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

Follow us on Twitter! @fsWoodLab

Upcoming Events

69th Forest Products Society International Convention

June 10–12, 2015, Atlanta, Georgia

The annual International Convention is the premier event for professionals in the forest products industry. The convention brings together hundreds of scientists, design professionals, managers, decision makers, and others from academia, government, nonprofit, and private industry sectors to discuss the state of forest products research and learn about innovations in the field.

Wood remains one of our most important renewable construction materials–a natural resource that contributes to the social, economic, and environmental sustainability of the planet. The convention is a showcase for ideas: research, development, philosophy, technology. The boundaries between industry sectors are gone. Cross-pollination is the goal.

The theme of the 69th International Convention is "Unlocking the Potential of Forest Products" and will feature sessions targeting wood properties in construction, wood and the environment, education and marketing for the forest products industry, and advances in technology.

For more conference information, visit http://www.forestprod.org/IC/index.php.

19th International Nondestructive Testing and Evaluation of Wood Symposium

September 22–25, 2015, Rio de Janeiro, Brazil

The 19th International Nondestructive Testing and Evaluation of Wood Symposium is a forum for those involved in nondestructive testing and evaluation of wood, 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.

For more conference information, visit http://abendieventos.org.br/wood_symposium/.

North American Wood Window and Door Symposium

September 23–25, 2015, Forest Products Laboratory, Madison, Wisconsin, USA

A premier symposium focused on the effective use and optimal performance of wood and wood-based materials in wood window and door manufacturing. The purpose of this conference is to ensure that wood remains a viable option for windows and doors and to educate attendees of the benefits of wooden fenestration, as well as to provide instruction that will ensure optimal performance of these products. The target audience will consist of manufacturers, architects, contractors, designers, researchers, and policy makers who influence selection of materials for residential and commercial construction.

For more conference information, visit http://www.forestprod.org/wooddoorsymposium/#!/.

Visit Lab Notes!

Have you checked out *Lab Notes*, the FPL's online news feed? Visit www.fpl.fs.fed.us/labnotes for unique, interesting, and quick-hitting stories about FPL research, scientists, and the greater forest products industry.

With Lab Notes, you can easily follow hyperlinks and get to know our researchers, their work, and how it all fits within a larger forestry-sector context.

Firefighting Costs Burn Up Dollars for Fire Prevention

By Rebecca Wallace, Public Affairs Specialist

As the USDA Forest Service spends more money each year on fighting wildfires, less and less is available for the programs and projects that can help prevent fires and mitigate fire damage.

Agriculture Secretary Tom Vilsack announced a report in August showing that as the cost of fighting forest fires has rapidly increased over the last 20 years, the budgets for other forest programs, including those that can help prevent and mitigate fire damage, have substantially shrunk. The Forest Service's firefighting appropriation has rapidly risen as a proportion of the Forest Service's overall budget, increasing from 16 percent in 1995 to 42 percent today, forcing cuts in other budget areas.

"Climate change, drought, fuel buildup and insects and disease are increasing the severity of catastrophic wildfire in America's forests," Vilsack said. "In order to protect the public, the portion of the Forest Service budget dedicated to combating fire has drastically increased from what it was 20 years ago. This has led to substantial cuts in other areas of the Forest Service budget, including efforts to keep forests healthy, reduce fire risk, and strengthen local economies."

Those efforts are a large part of the research program here at the Forest Products Laboratory. Finding valuable uses for the small-diameter and beetle-killed trees that are overcrowding America's forests creates incentive for businesses, often in rural communities, to take on thinning and restoration work. Such projects can improve forest health while boosting rural economies and providing valuable materials, from green building products to nanocellulose.

http://www.shutterstock.com

> *"Bipartisan proposals to fund catastrophic fire like other natural disasters could help ensure that efforts to make forests more healthy and resilient and support local tourism economies aren't impacted as significantly as they have been in recent years."*
>
> *~ Secretary of Agriculture Tom Vilsack*

Vilsack noted that on top of the budget reductions outlined in the new report, the Forest Service's non-fire program budgets are affected by "fire borrowing." Funds spent on fire suppression have exceeded the allocated amount in all but four years since 2000. In these cases, the shortfall is covered through transferring, or "borrowing" additional funds from Forest Service programs that have already been cut over the last 20 years. Secretary Vilsack renewed his request to Congress to allow an existing disaster fund to provide resources to fight catastrophic fires in years when Forest Service and Department of Interior fire costs exceed the amount Congress has budgeted, rather than forcing borrowing from non-fire programs.

"Bipartisan proposals to fund catastrophic fire like other natural disasters could help ensure that efforts to make forests more healthy and resilient and support local tourism economies aren't impacted as significantly as they have been in recent years," Vilsack said. "These proposals don't increase the deficit, they just budget smarter by allowing existing natural disaster funding to be used in cases of catastrophic wildfire."

The report shows the extent to which many Forest Service program budgets have been cut *even before*

– Continued on next page –

– Continued from previous page –

borrowing occurs to accommodate for the rapid rise in firefighting costs in the past 20 years. For example,

- **Funding for the Vegetation and Watershed Management Program**—a cornerstone for forest, rangeland, soil and water restoration, enhancement activities, and a key factor in post-fire restoration—has been cut by 22 percent since 2001. This has reduced the Forest Service's ability to prevent and limit the spread of invasive species, which can weaken forest health and make forests more susceptible to fire.
- **Maintenance and capital improvements** on approximately 21,600 recreation sites and 23,100 research and other administrative buildings has been reduced by two-thirds since 2001.
- **Support for recreation, heritage, and wilderness activities** that connect the public with our natural lands and support tourism and thousands of jobs (visitors to national forests contributed more than $13 billion to America's economy each year) has been cut by 13 percent.
- **Wildlife and fisheries habitat management** has been reduced by 17 percent, limiting recovery efforts for threatened and endangered species.
- **Research funding** has declined by over $36 million in the ten year period ending in 2013.

While fire staffing has increased 110 percent since 1998, staffing for those dedicated to managing National Forest Service lands has decreased 35 percent over the same period.

Vilsack said the average number of fires on Federal lands has more than doubled since 1980 and the total area burned annually has tripled. He said that climate change, population growth near forests, and brush and fuel buildup have drastically increased wildfire severity and the cost of fighting them.

Vilsack's request to change the way catastrophic fire costs are funded is included in the Obama Administration's proposed budget and is supported by a bipartisan group of lawmakers. The change means that in years when the cost of fighting wildfires exceeds the firefighting budget provided to the Forest Service by Congress, additional resources would be provided from an existing fund already in place to help provide emergency funding for natural disasters, rather than forcing the Forest Service to take money from other programs designed to protect forest health.

Early Cardboard Box Testing at FPL

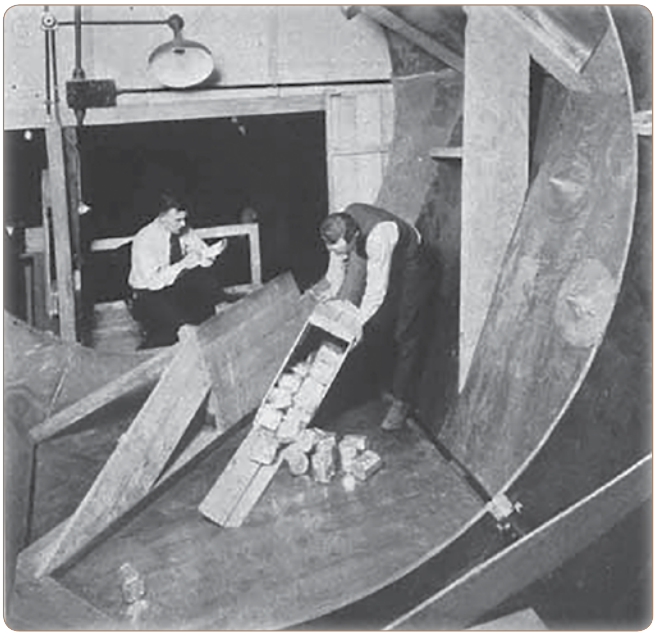
By Madelon Wise, Technical Publications Editor

The historic publication, The Forest Products Laboratory--A Decennial Record 1910-1920, tells how FPL used to test cardboard boxes in the old days. This big drum gave consistent results that indicated the value of any type of construction for the shipment of goods and developed various standard types of box constructions that were adopted by the associations of manufacturers and uses of boxes. It also investigated and tested the relative value of many woods for box making and divided them into four groups on this basis, and the woods in each group were used interchangeably. The book states that "This work represents the greatest single step forward in box design and proper selection of box species which has so far been taken."

Cardboard box testing has come a long way in the last 100 years, and we can appreciate this unique old method of research.

Visit https://archive.org/details/forestproductsla00fore to view the publication.

USDA-FS Forest Products Laboratory



Box testing in the big tumbling drum, a laboratory device for quickly determining box or crate weaknesses.

Landmark Report Charts Path to Commercialization of Cellulosic Nanomaterials: Potential to Improve Forest Health, Create Products, New Demand for Timber, and Jobs

The USDA Forest Service has released a report that details the pathway to commercializing affordable, renewable, and biodegradable cellulose nanomaterials from trees. Cellulosic nanomaterials are tiny, naturally occurring structural building blocks and hold great promise for many new and improved commercial products. Commercializing these materials also has the potential to create hundreds of thousands of American jobs while helping to restore our nation's forests.

"This report is yet another important step toward commercializing a material that can aid in restoring our nations' forests, provide jobs, and improve products that make the lives of Americans better every day," said USDA Forest Service Chief Tom Tidwell. "The Forest Service plans to generate greater public and market awareness of the benefits and uses for these naturally-occurring nanomaterials."

The report, titled " Cellulose Nanomaterials—A Path towards Commercialization," is a result of a workshop held earlier this year that brought together a wide range of experts from industry, academia, and government to ensure that commercialization efforts are driven by market and user materials needs.

Cellulose nanomaterials have the potential to add value to an array of new and improved products across a range of industries, including electronics, construction, food, energy, health care, automotive, aerospace, and defense, according to Ted Wegner, Assistant Director at the USDA Forest Service Forest Products Laboratory in Madison, Wis.

"Finding high-value, high-volume uses for low-value materials is the key to successful forest restoration,"
~ FPL & NRS Director Michael T. Rains

"These environmentally friendly materials are extremely attractive because they have a unique combination of high strength, high stiffness, and light weight at what looks to be affordable prices," Wegner explained. "Creating market pull for cellulose nanomaterials is critical to its commercialization."

The success of this commercialization effort is important to the USDA Forest Service for another key reason: creating forests that are more resilient to disturbances through restorative actions. Removing excess biomass from overgrown forests and making it into higher value products like nanocellulose, is a win for the environment and for the economy.

"Finding high-value, high-volume uses for low-value materials is the key to successful forest restoration," said Michael T. Rains, Director of the Northern Research Station and Forest Products Laboratory. "With about 400 million acres of America's forests in need of some type of restorative action, finding markets for wood-based nanocellulose could have a huge impact on the economic viability of that work."

– Continued on next page –

Steve Schmieding, Forest Products Laboratory

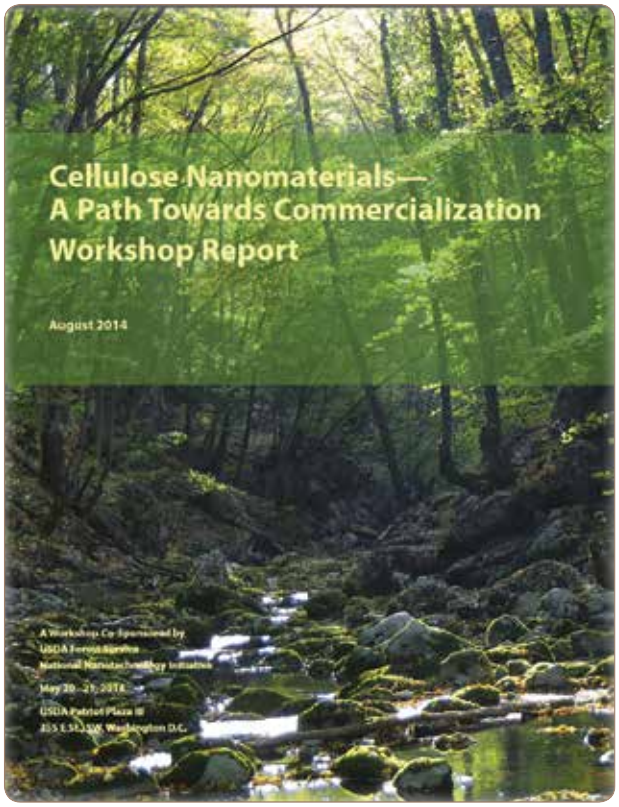
Supervisory Research Chemist Alan Rudie (left) and Chemical Engineer Richard Reiner (right) produce cellulose nanomaterial in FPL's Nanocellulose Pilot Plant.

– Continued from previous page –

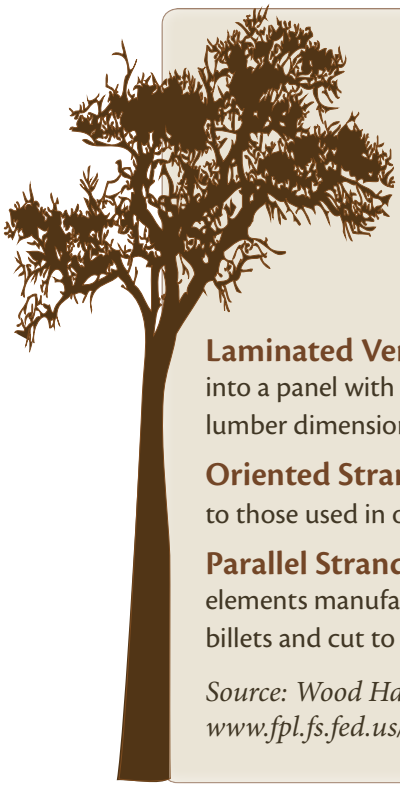
The USDA Forest Service, in collaboration with the U.S. National Nanotechnology Initiative, organized the workshop. Participants included over 130 stakeholders from large volume industrial users, specialty users, Federal Government agencies, academia, non-government organizations, cellulose nanomaterials manufacturers and industry consultants. The workshop generated market-driven input in three areas: opportunities for commercialization, barriers to commercialization, and research and development Roles and Priorities. Issues identified by participants included the need for more data on materials properties, performance, and environmental, health, and safety implications and the need for a more aggressive U.S. response to opportunities for advancing and developing cellulose nanomaterial.

"The workshop was a great opportunity to get research ideas directly from the people who want to use the material," says World Nieh, the USDA Forest Service's national program lead for forest products. "Getting the market perspective and finding out what barriers they have encountered is invaluable guidance for moving research in a direction that will bring cellulose nanomaterials into the marketplace for commercial use."

USDA Forest Service



Wood Wise—*Terms from the World of Wood*



Kiln: A chamber having controlled air-flow, temperature, and relative humidity for drying lumber. The temperature is increased as drying progresses, and the relative humidity is decreased.

Structural Composite Lumber (SCL): Wood elements glued together to form products that are similar in size to solid-sawn lumber.

Laminated Strand Lumber (LSL): Similar to oriented strand lumber with somewhat longer strands.

Laminated Veneer Lumber (LVL): Structural composite lumber manufactured from veneers laminated into a panel with the grain of all veneer running parallel to each other. The resulting panel is ripped to common lumber dimensions.

Oriented Strand Lumber (OSL): Structural composite lumber made from wood strand elements similar to those used in oriented strand board. The strands are oriented primarily along the length of the member.

Parallel Strand Lumber (PSL): Structural composite lumber made from high aspect ratio wood strand elements manufactured from veneer oriented primarily along the length of the member. It is manufactured in billets and cut to lumber dimensions.

Source: Wood Handbook—Wood as an Engineering Material, General Technical Report FPL–GTR–190, www.fpl.fs.fed.us/woodhandbook

Tivoli Gough, Forest Products Laboratory

The Promise of Wood-Based Nanotechnology at the USDA Forest Service Forest Products Laboratory

850 million acres of forests cover the U.S.

400 million acres in the U.S. need restoration by removing excess forest biomass

220 million acres in the U.S. classified as high risk of wildland urban interface (WUI) fire

Over 50,000 wildfires annually.

No market outlets for small trees and brush that add fuel to forest fires = catastrophic wildfire.

Finding new, high-value, market-based outlets for excess forest biomass is vital to forest restoration.

WUI land includes 46 million single-family homes, several hundred thousand businesses, and a population of 120 million people. This demonstrates the magnitude and complexity of the growing WUI fire protection problem.

*This is where **wood-based nanotechnology** makes the connection.*

Nanotechnology is defined as understanding and controlling matter at dimensions of approximately 1 to 100 nanometers.

Marble 10,000,000 nm

Human hair 100,000 nm

Bacteria 1,000 nm

Cellulose nanomaterial 3–5 nm

DNA 2.5 nm

Single-walled carbon nanotube 1 nm

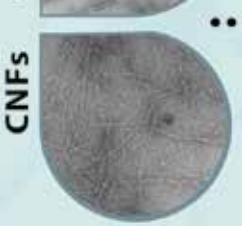
Wood is made up of nanometer-size building blocks that are incredibly strong and lightweight compared to solid wood. These building blocks do not require the use of large diameter trees, cost less than other nanomaterials to produce, and have much higher value than other forest products.

FPL's nanocellulose pilot plant is the first of its kind in the U.S., producing

CNCs

Nanoscale cellulose fibers offer unique advantages that

renewable, forest-based nanomaterials to supply researchers and early adopters of cellulosic nanomaterials with working quantities. The plant produces batches of cellulose nanofibrils (CNFs) and cellulose nanocrystals (CNCs).



enable remarkable mechanical and chemical properties (including an elastic modulus greater than that of Kevlar®).

America's forests contribute over **$240 billion** to our Gross Domestic Product and employ more than 1.1 million people.

Potential product applications

for wood-based cellulose nanomaterials are extensive: coatings; lightweight, high-strength panels for construction; flexible electronic displays; aerospace and automobile parts; films; photovoltaics; polymer composites reinforcement; medical applications; sensors; and many other industrial tools and consumer products.

EXAMPLE

Automotive applications

Lightweight parts to improve fuel efficiency and ***green,*** sustainably sourced materials to reduce the environmental footprint.

Wood-derived nanomaterials can ***generate new, high-value products*** that can create new revenue streams for forest-based product manufacturers and ***new jobs for American workers.***

FPL is devoted to the efficient use of our Nation's wood resources, helping keep our ***forests healthy.***

Using structural, chemical, and mechanical evaluation techniques by interdisciplinary teams of chemists, materials scientists, engineers, and botanists, the ***Forest Products Laboratory*** continues to expand its fundamental research in wood nanotechnology to promote healthy forests and forest-based economies through the efficient, sustainable use of wood.

Visuals: Forest Products Laboratory and www.shutterstock.com

Continued from page 1 – **Hosting a Holiday Giant**

Scenes from the U.S. Capitol Christmas Tree Visit and FPL Open House

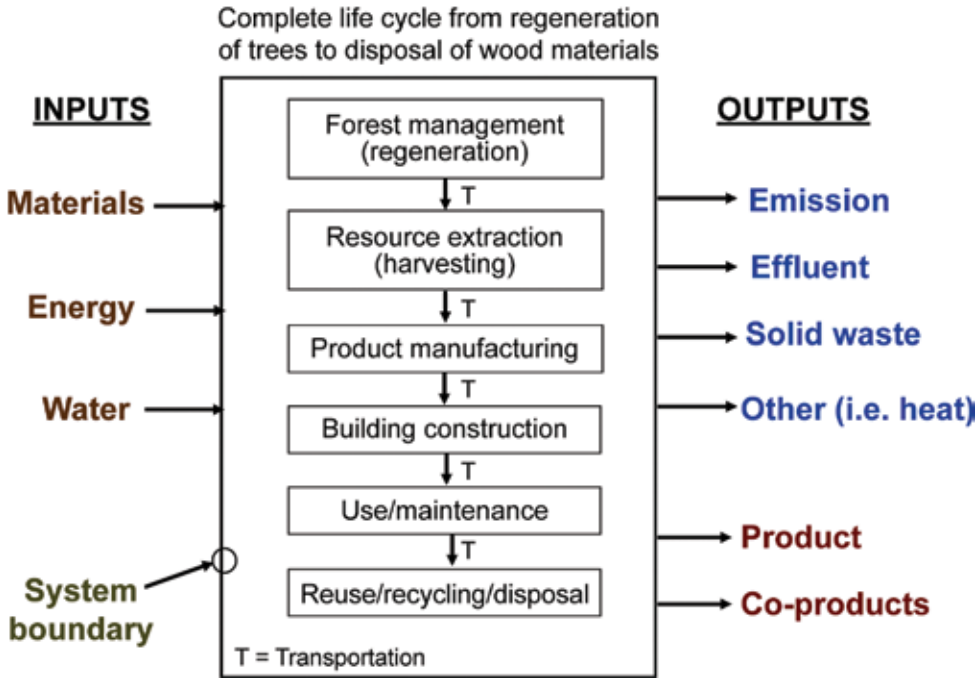
Photos by Steve Schmieding, Forest Products Laboratory

Rebecca Wallace, Forest Products Laboratory

Updating of U.S. Wood Product Life-Cycle Assessment Data for Environmental Product Declarations

By Madelon Wise, Technical Publications Editor

A recent and significant FPL publication has recently been published, *Updating of U.S. Wood Product Life-Cycle Assessment Data for Environmental Product Declarations*, by Richard Bergman.



Complete life cycle from regeneration of trees to disposal of wood materials.

Demand for credible and transparent product eco-labels based on life-cycle assessment (LCA) data is increasing, especially involving international trade. Over the past several years, stakeholders in the U.S. wood products industry have developed many such "eco-labels" under the ISO standard of LCA-based environmental product declarations (EPDs). The standard requires data to be less than 10 years old. Under the umbrella of the Consortium for Research on Renewable Industrial Materials (CORRIM), the process of updating the data for many structural wood products' life-cycle inventories (LCIs) has begun. Some of these wood product LCIs include softwood lumber, oriented strandboard, plywood, laminated veneer lumber, I-joists, and glulam.

CORRIM wood product LCA studies on wood products have been instrumental in informing stakeholders about the environmental benefits of using wood materials for building. Ongoing LCA research will enable the wood products industry to better understand environmental impacts associated with manufacturing their products, to plan for product and process improvements, and to gain entry into competing markets. Environmental concerns continue to increase, especially for the building industry, and wood products have positive environmental benefits that are demonstrated by EPDs and other marketing efforts.

Key Points

- Green building certification systems have become more prominent in the building industry.
- Continuing LCA and EPD development will help wood products manufacturers to improve existing products and create new products with lower environmental impacts.
- This work will help wood to compete well with other building products.

Research cooperators include the USDA Forest Service Forest Products Laboratory, Madison, Wisconsin; Consortium for Research on Renewable Industrial Materials, Seattle, Washington; WoodLife Environmental Consultants, LLC, Corvallis, Oregon; and University of Washington, Seattle, Washington.

Visit http://www.fpl.fs.fed.us/documnts/pdf2014/fpl_2014_bergman006.pdf to view the complete publication.

Guardrail Post Possibilities: A New Use for Forest Thinnings?

By Rebecca Wallace, Public Affairs Specialist

Small-diameter trees can be used for a variety of products, including lumber, structural round wood, wood composites, wood fiber products, compost, mulch, energy, and fuels.

Developing even more uses for small-diameter trees would increase their product potential, encouraging thinning projects that remove trees from overcrowded forests, thereby improving forest health and decreasing the risk of catastrophic wildfires.

In response to this need, Forest Products Laboratory researchers and their partners at the Midwest Roadside Safety Facility at the University of Nebraska-Lincoln are studying using small-diameter wood for highway guardrail posts.

Currently in phase two, the study has already determined appropriate sizes of southern yellow pine, Douglas-fir, and ponderosa pine round posts for use in the 31-inch-tall Midwest Guardrail System. Now researchers are looking to continue to expand opportunities for using round ponderosa pine in guardrail systems as a substitute for the rectangular southern yellow pine posts commonly used.

The Midwest Roadside Safety Facility will conduct low-speed, dynamic component tests on nine round ponderosa pine posts and three rectangular southern yellow pine posts set in a compacted, crushed limestone soil material. Each test will be performed at a speed of 15-20 miles per hour using a rigid nose, steel-framed reusable test vehicle.

Results of this research program are expected to provide test results that allow round ponderosa pine posts to be substituted into existing U.S. highway guardrail systems.

Further information is available in this Research in Progress report: http://www.fpl.fs.fed.us/documnts/rips/fplrip-4714-027-UofNB-kretschmann.pdf.

FPL-RIP-4714-027

A test vehicle impacts a guardrail posts at 15–20 miles per hour.

FPL-RIP-4714-027

Example of dynamically tested ponderosa pine post.

Patents? From Dead Trees?

By Madelon Wise, Technical Publications Editor

You may be surprised at how many technologies from FPL research get patented. What is the value of that? Patents are an effective mode of technology transfer, as they make technologies more appealing to the marketplace due to the exclusivity they offer. Technology transfer leads to increased productivity, increased industrial innovation, enhanced U.S. industrial competitiveness, job creation, and improved and lower cost public services.

Patent Advisor Janet Stockhausen and her team ensure that this technology transfer happens each year. Below are some patents that came from FPL this year.

Curious about what else from FPL has been patented? All Forest Service patents available for licensing can be found here: http://www.fs.fed.us/research/patents/technologies.php.

www.shutterstock.com

The Forest Products Laboratory Patent team works to ensure technology transfer happens each year.

FPL Patents and Licenses

USDA-FS Forest Products Laboratory

Naphthalenic Compounds as Termite Bait Toxicants

Maria G. Rojas, Joan A. Morales-Ramos, Frederick Green, and Thomas A. Kuster

Patent No. RE44,543, Issued 10/22/13

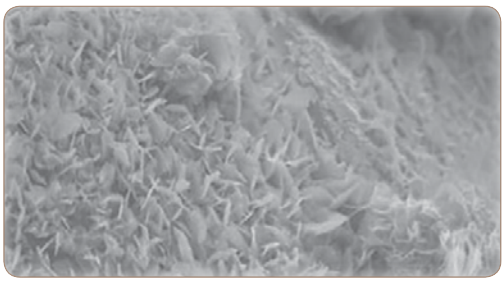
www.shutterstock.com

Cellulose Nanocrystal Additives and Improved Cementious Systems

Jeffrey P. Youngblood, Yizheng Cao, Robert J. Moon, William J. Weiss, and Pablo D. Zavattieri

Licensed by Purdue Research Foundation

USDA-FS Forest Products Laboratory



Methods of Synthesizing Graphene from a Lignin Source

Jilei Zhang, Zhiyong Cai, and Sung Phil Mun

Licensed by Mississippi State University

Back to Basics: Wood for Warmth

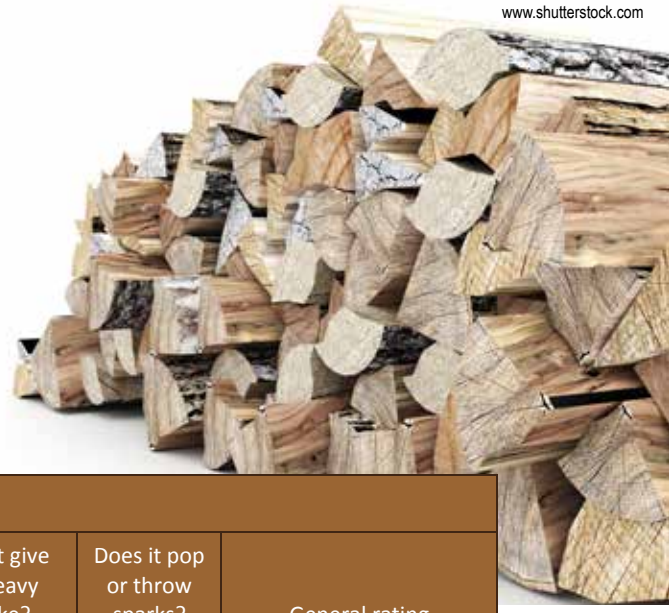
By Rebecca Wallace, Public Affairs Specialist

www.shutterstock.com

For all of FPL's technological advances in wood science over the past century, the simple act of wood providing warmth and ambiance in fireplaces and wood stoves is still important.

According to the USDA publication "Firewood for Your Fireplace," choosing the best wood for your fire depends on several factors. You should consider what species are readily available to you, any personal preference you have as to aroma, and what type of fire you want to build.

Softwood species are easy to ignite and burn with a hot flame. However, they also burn rapidly and require frequent replenishing to stay lit. Softwood species are recommended if you're looking to warm up with a short fire that will burn out quickly.



www.shutterstock.com

For a longer lasting fire, hardwood species are a good choice. These woods burn less vigorously with a shorter flame and produce long-lasting, steady glowing coals.

The ideal fire, then, would be made with a mixture of softwood logs for easy ignition and hardwood logs for longevity. By adding wood from fruit trees (such as apple and cherry) or nut trees (such as hickory, beech, or pecan), your fire will also emit a pleasant aroma.

The chart below outlines the characteristics of several species and may help you decide which wood to use the next time you're looking to keep warm by the fire.

Types of Wood to Burn in a Fireplace

Species	Relative amount of heat per cord	Is it easy to burn?	Is it easy to split?	Does it give off heavy smoke?	Does it pop or throw sparks?	General rating
Ash, red oak, white oak, beech, birch, hickory, hard maple pecan, dogwood	High	Yes	Yes	No	No	Excellent
Soft maple, cherry, walnut	Medium	Yes	Yes	No	No	Good
Elm, sycamore, gum	Medium	Medium	No	Medium	No	Fair
Aspen, basswood, cottonwood	Low	Yes	Yes	Medium	No	Fair, but good for kindling
Chestnut, yellow poplar	Low	Yes	Yes	Medium	Yes	Poor
Southern yellow pine, Douglas fir	High	Yes	Yes	Yes	No	Good, but smoky
Cypress, redwood	Medium	Medium	Yes	Medium	No	Fair
White cedar, western red cedar, eastern red cedar	Medium	Yes	Yes	Medium	Yes	Good, great for kindling
Eastern white pine, western white pine, sugar pine, ponderosa pine, true firs	Low	Medium	Yes	Medium	No	Fair, but good for kindling
Tamarack, larch	Medium	Yes	Yes	Medium	Yes	Fair
Spruce	Low	Yes	Yes	Medium	Yes	Poor

USDA Newsline

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

FIRST CLASS PRSRT
U.S. POSTAGE PAID
MADISON, WI
PERMIT NO. 168

RETURN SERVICE
REQUESTED

In this issue

Newsline