



Forest Products Laboratory's

Newsline

2012
SPRING

The Big Break Strength Testing of Glulam Beams

By Rebecca Wallace, Public Affairs Specialist

The largest wood beams ever tested are being studied at the Forest Products Laboratory (FPL).

Made of Douglas-fir, the glued laminated (glulam) beams each measured 72 feet long and weighed in at 6,000 pounds.

Using FPL's strong floor system coupled with hydraulic rams, engineers broke 12 glulam beams to determine how much load they could withstand. The beams were fitted with sensors that recorded the effects of the applied load.

Each test took about 8 minutes to conduct, and the beams bowed as much as 13 inches in the middle before finally snapping under the pressure. The beams withstood a range of loads between 69,000 and 95,800 pounds.

Thanks to the new Centennial Research Facility, FPL is one of the few locations worldwide that has the capacity to test such large wood specimens. As FPL engineer Doug Rammer explains, that capability is key to determining their strength.

"To get a realistic measurement of how much load these large beams can withstand, it's important to test them at their actual size," Rammer says. "Larger beams fail at a lower stress when compared to smaller replicas, so full-scale testing is necessary to obtain accurate data."

Glued laminated timbers are a manufactured wood product composed of layers of sawn lumber glued together. Glulam beams are typically used in commercial construction to span large open areas, such as in churches or sporting arenas. They make for both an aesthetically pleasing and structurally sound option.

— Continued on page 7 —



Steve Schmieiding, USDA FS-FPL

Above: FPL Engineer Doug Rammer tours St. Mary's Middle School Students (Janesville, Wisconsin) around the giant, life-size science project. Below: A glued-laminated timber after failure.



Rebecca Wallace, USDA FS-FPL



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Upcoming Events

Forest Products: Solutions for a Global Green Economy

June 3-5, 2012, Washington, D.C.

Forest products are renewable and sustainable when they are manufactured with environmentally responsible practices. In 2010, citizens of the world consumed an estimated 1.26 billion cubic meters of wood and wood-based products. In the United States of America, the forest products industry represents approximately 6% of the U.S. manufacturing base and ranks among the top 10 in manufacturing in 48 states. With the scale of the forest products industry, renewable and sustainable products derived from forests will provide excellent solutions to a global green economy.

The 2012 Forest Products Society International Conference in Washington, D.C., U.S.A., will provide registrants with an opportunity to network and engage with R&D scientists and issues experts. Speakers at the conference will present research findings and analysis on hot-topic issues that will advance forest products research, create value for landowners, generate new revenue for business owners, and provide insights to a global green economy. For more conference information, visit www.forestprod.org/ic/about.php.

2012 Society of American Foresters National Convention

October 24-28, 2012, Spokane, Washington

This year's scientific and technical program brings pieces of forest management into focus. Sessions will focus on ecological resilience, the role of forest management in sustaining forests, and the role of communities and collaborations in resilient forests.

We'll learn from our peers during poster sessions and honor them during our national award program. An evening alumni reception will break the ice on Thursday and allow people to reconnect during the remainder of the meeting. For more conference information, visit www.safnet.org/natcon12/index.cfm.

"People's Gardens" Flourishing at FPL

FPL is home to two very different, but uniquely beneficial, gardens established as a part of the United States Department of Agriculture's People's Garden Initiative. A permaculture garden showcases sustainable landscape practices and features a series of swales and berms, planted with complementary vegetation, whose purpose is to catch and retain runoff from buildings and paved surfaces. Also, a traditional vegetable garden is tended and the produce is donated to help local people in need. Three years after their installation, the gardens are well established and flourishing. Watch for a feature story on FPL's involvement in the People's Garden Initiative in the next issue of NewsLine.



Tivoli Gough, USDA FS-FPL

New Wood Product Launched with Help from FPL

By Rebecca Wallace, Public Affairs Specialist

With its more than 100 years of research on record, the FPL is where people often look for answers when new questions about wood products arise. So FPL researchers were up to the challenge when Eastman Chemical Company approached them during the development of a new modified wood product.

In 2009, Eastman was developing a decking product by modifying Southern Pine through a chemical process called acetylation. Now marketed as Perennial Wood, the product has all the advantages of wood without its sensitivity to water. Because the product is not traditional treated wood or a wood-plastic composite, however, developers were unsure about what types of adhesive would be most effective when needed.

Researchers at FPL have been studying how to bond wood products for decades. The expertise and equipment at the Lab, in addition to a history of successful public/private partnerships, made collaborating with Eastman a natural fit.

“Eastman was hoping to find an adhesive that was already on the market that would work well with their new product,” explains Chris Hunt, a research chemist at FPL. “So we worked with various adhesive suppliers, tested an array of formulas, and were able to make a recommendation for the most effective adhesive.”

Moving Forward

Getting a solid answer to their question helped Eastman move their product into the marketplace.

“Research and testing conducted by FPL helped Eastman meet its goal of launching the complete Perennial Wood decking system at the same time,” said Ellen Turner, technical service and application development engineer for Perennial Wood. “Because modified wood is relatively new, we needed to test how various glues and adhesives would take to the wood. That’s where FPL was instrumental. Its research team identified the best alternative for bonding 2 by 6s together to create strong railing posts, ensuring our products deliver the quality homeowners expect.”

According to Hunt, this partnership is a great example of government research benefiting the American public. “We were able to use our knowledge and facilities to assist a company that uses domestic materials and labor to create better products for the American public. FPL is here for

Eastman



Eastman



Eastman



Eastman



the public, and partnerships like this showcase how our research works for you.”

Eastman Chemical Company, founded in Tennessee in 1920, is now a global producer of chemicals, fibers, and plastics that employs more than 10,000 people. Perennial Wood decking was officially launched in February 2012.

Bat Safety 101

As fans and players alike swing into baseball season, research from the FPL continues to play a role in the safety of the game. This year, FPL's partnership with Major League Baseball and TECO (Sun Prairie, Wisconsin), an independent certification and testing agency for wood products, resulted in development of educational posters for players. These posters are displayed in every Minor League team locker room and aim to help players get a grip on new regulations.

TECO, Sun Prairie, Wisconsin



Karen Nelson, USDA FS-FPL



BAT SCIENCE



What Can Reduce Flying Broken Bats?

High Density + Straight Grain = Hard, Durable Bat



LOWER DENSITY BATS
have

- ▶ Big barrels
- ▶ Big weight drops
- ▶ No cup

which makes them

- ▶ Softer
- ▶ Weaker

New 2012 Regulations for Low Density Maple (LDM)

WHAT TYPE OF MAPLE BAT CAN YOU USE?

If you...

- ▶ Have never signed a Major League (ML) contract:
 - You **CANNOT** use an **LDM** or **LDM-X** labeled bat
- ▶ Signed your first ML contract during 2011 or 2012:
 - You **CAN** use an **LDM-X** labeled bat
 - You **CANNOT** use an **LDM** labeled bat
- ▶ Signed your first ML contract before 2011:
 - You **CAN** use any approved maple bat

Ash and yellow birch are not regulated for density.



HIGHER DENSITY BATS
have

- ▶ Smaller barrels
- ▶ Smaller weight drops
- ▶ Full cups

which makes them

- ▶ Harder
- ▶ Stronger
- ▶ Perform better

STRAIGHT GRAIN = STRONGER BAT

- ▶ For maple and yellow birch, we use "The Dot" on the handle to measure grain angle.

Is your bat supplier approved by MLB for this season?

➔

Your Equipment Manager has the approved supplier list!



For more info and ideas, see BatInfo.Tecotested.com
Spring 2012

Researcher Named TAPPI Fellow

By Rebecca Wallace, Public Affairs Specialist

Steve Schmitting, USDA FS-FPL



Nancy Ross Sutherland

TAPPI, the leading association for the worldwide pulp, paper, packaging, and converting industries, has announced the selection of FPL's Nancy Ross Sutherland as a TAPPI Fellow. "Fellow" is an honorary title bestowed upon a small percentage of TAPPI's membership and is given to individuals who have made extraordinary technical and service contributions to the industry and/or the association. Ross Sutherland has worked for the Forest Service since joining FPL in 1989 and is currently head of the Paper Test Laboratory.

For more information, visit www.tappi.org

Pulp NonFiction: Fungal Analysis Reveals Clues for Targeted Biomass Deconstruction

Without fungi and microbes to break down dead trees and leaf litter in nature, the forest floor might look like a scene from TV's "Hoarders." Dan Cullen, research microbiologist at the FPL, is part of an international team of scientists studying the genomic make-up of two fungus species that are especially talented when it comes to clean-up.

Phanaerochaete chrysosporium and its close relative *Ceriporiopsis subvermispora* can selectively break down the cell wall components cellulose and lignin—the number one and two most abundant biopolymers on Earth. Both fungus species are found all over the world and are of interest to bioenergy researchers because they possess enzymes that can break down plant biomass and could therefore be useful for accelerating biofuels production.

In a study published online in the *Proceedings of the National Academy of Sciences*, the team presented a comparative genomic analysis of the two white-rot fungi, whose genomes were generated and annotated at the Department of Energy (DOE) Joint Genome Institute (JGI). The study revealed substantial differences among the sets of genes involved in lignocellulose degradation, providing further insight into the mechanics of how white rots do their dirty work.

"The fact that we have such a large group of people involved in this project is a clear demonstration that there's certainly interest in enzyme discovery," said Cullen, study senior author and long-time DOE JGI collaborator.

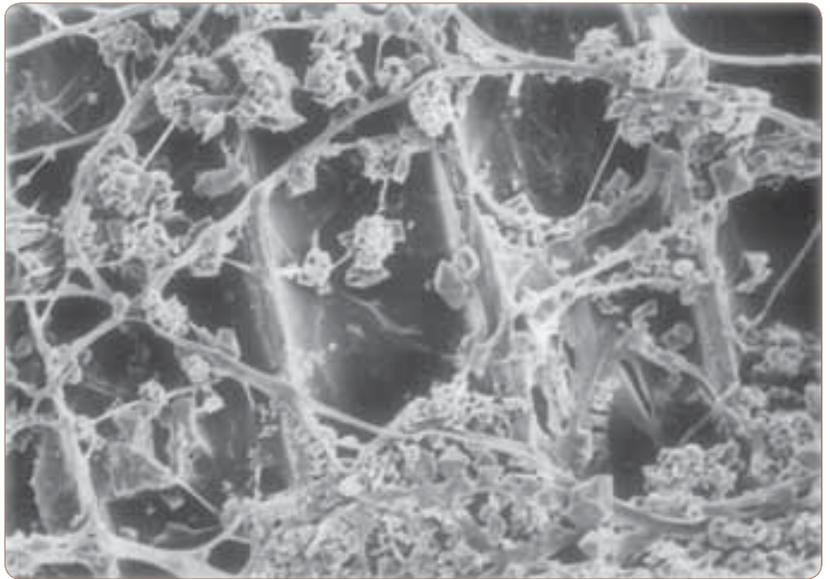
Cullen and his colleagues compared the fungal genomes to learn more about the basis of *C. subvermispora's* ability to selectively break down lignin. Understanding this process is of longstanding interest to the pulp and paper industry. According to the American Forest & Paper Association, approximately \$175 billion worth of forest products such as pulp and paper are produced annually, and account for 5% of the Nation's GDP.

Kent Kirk, a former FPL researcher who is considered a leading figure in the study of lignin degradation by fungi, provided

perspective on how the current research could impact the pulp and paper industry. "This grew out of fundamental research by the University of Minnesota and FPL where they applied the concept of 'biopulping,' the partial decay of wood by lignin-degrading fungi to decrease the energy required for mechanical pulping. *Ceriporiopsis subvermispora* quickly became the 'biopulper' of choice."

Kirk described how wood chips treated with the fungus for two weeks required 30% less energy for pulping than

R. Blanchette, University of Minnesota



Above: Scanning electron micrograph of *Ceriporiopsis subvermispora* mycelium on wood. Below: Fungi break down dead trees and leaf litter on the forest floor.

Karen A. Rawlins, University of Georgia, Bugwood.org



– Continued on page 11 –

Longstanding Partnership Continues to Benefit Consumers

Research at the FPL aims to improve forest health while boosting the economy and improving quality of life for the public. Developing products that are commercially viable helps meet that goal, but getting new technologies into the marketplace can be challenging. Often, creating partnerships with private companies helps to move newly developed products out of the laboratory and into the hands of the people who can benefit from them.

Noble Environmental Technologies (NET, San Diego, Calif.), a leading sustainable materials developer and manufacturer, has had a long and successful partnership with FPL. Recently, NET announced its exclusive license to commercialize technology based on two patents that were filed jointly with FPL.

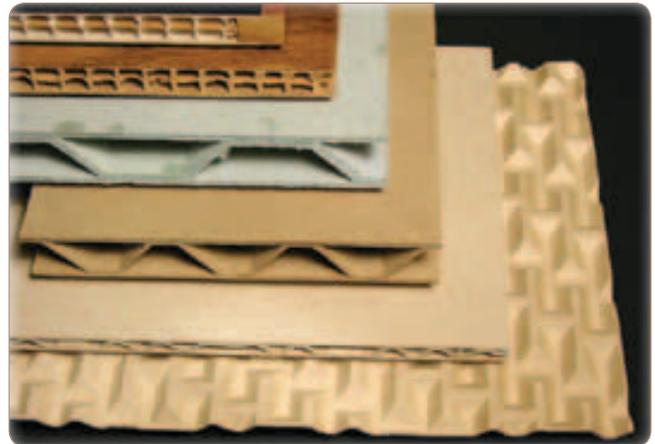
NET and FPL previously partnered under a cooperative agreement that resulted in the development of three-dimensional engineered molded fiber (3dEMF). NET named the new manufacturing technology and resulting products “ECOR® Advanced Environmental Composites.”

“This license agreement is another milestone in our longstanding collaboration with the FPL, where environmentally superior fiber-based structural technologies have been a focus for decades,” says NET Founder and CEO and ECOR® inventor Robert Noble. “Many industries and markets worldwide will now have access to a large variety of design-versatile, nontoxic, 100% recycled content, 100% biobased products for an almost infinite variety of market and product needs.”

Collaboration Key to Success

John Hunt, Research General Engineer at FPL (pictured at right), has worked closely with NET and is pleased with the outcome. “The collaboration between the FPL and NET is a perfect example of how government and industry can work together to meet society’s needs,” says Hunt. “By combining our unique capabilities, we were able to turn research results into tangible products—products that bring improved options to consumers and promote the sustainable use of resources, all while creating jobs and contributing to the economy.”

ECOR products provide solutions to designers and architects searching for materials which are versatile and can provide imaginative design opportunities. Extraordinary characteristics, including environmental sustainability, distinctive shaping, compound curves, and significant strength-to-weight ratios make ECOR unique. The product can be used in countless applications ranging from furniture, interior architecture and decor, signage and displays,



Steve Schmieding, USDA FS-FPL



Steve Schmieding, USDA FS-FPL



Steve Schmieding, USDA FS-FPL

to automotive, aviation, marine, rail, industrial and manufacturing, military/logistics, and consumer products.

Dr. James Torti, NET’s President remarks, “Fiber resources and underutilized raw material sources are ubiquitous worldwide. NET’s work with FPL provides the platform for utilizing the widest array of raw materials to provide significant economic and environmentally sustainable opportunities within farm, forest, and urban redevelopment locations. We are proud to be moving together to the next level of commercialization of these great technologies.”



Continued from page 1 – The Big Break

FPL researchers are working in cooperation with the University of British Columbia on these tests. The results will influence building code requirements for the use of glulams in the United States and Canada.

If you've ever wondered what 80,000 pounds of load looks or sounds like when applied to a 72-foot-long, 3-ton wood beam, now's your chance. Bam!

Visit our webpage to view a short video to get a sense of both the size of these glulam beams and the engineering acumen on display at the FPL. (Hint: keep the volume up around the :53 second mark.)

www.fpl.fs.fed.us/products/presentations/visuals.php

Steve Schmieding, USDA FS-FPL



Above: The glulam beams arrive on a flatbed truck and are unloaded by 10-ton cranes.

Below: Close-up of 72-foot-long, 3-ton wood beams.

Steve Schmieding, USDA FS-FPL



Wood Wise—Terms from the World of Wood: Adhesive Edition



Adhesive: A substance capable of holding materials together by surface attachment. It is a general term and includes cements, mucilage, and paste, as well as glue.

Cold-Setting Adhesive: An adhesive that sets at temperatures below 20 °C (68 °F).

Hot-Setting Adhesive: An adhesive that requires a temperature at or above 100 °C (212 °F) for it to set.

Room-Temperature-Curing Adhesive: An adhesive that sets in the temperature range of 20 to 30 °C (68 to 86 °F), in accordance with the limits for Standard Room Temperature specified in the Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing (ASTM D 618).

For more on adhesives used with wood check out our 2010 Wood Handbook—Wood as an Engineering Material (Forest Products Laboratory, General Technical Report FPL–GTR–190), www.fpl.fs.fed.us/products/publications/specific_pub.php?posting_id=18102&header_id=p.

Researcher Honored with Early Career Scientist Award

By Rebecca Wallace, Public Affairs Specialist

Steve Schmieding, USDA FS-FPL



Joseph Jakes

FPL researcher Joseph Jakes has been selected to receive the 2011 Forest Service Research and Development Deputy Chief's Early Career Scientist Award.

This award recognizes scientists who are at the beginning of their research careers and have demonstrated, through personal accomplishments, outstanding capability and exceptional promise for significant future achievement.

Jakes is a research materials engineer in FPL's Performance Enhanced Biopolymers research unit. His research focuses on the use of nanoindentation to determine the structure–property relations of wood and wood-based materials at the sub-micrometer level. Jakes was selected for this award based on his research productivity, the impact of his work, and his efforts in science delivery.

As a recipient of the early career scientist award, Jakes is automatically nominated for the 2012 Presidential Early Career Awards for Scientists and Engineers competition, the highest honor bestowed by the U.S. Government on science and engineering professionals in the early stages of their independent research careers. These awards, established by President Clinton in 1996, are coordinated by the Office of Science and Technology Policy within the Executive Office of the President. Winning scientists and engineers receive a research grant for up to 5 years to further their study in support of critical government missions.

Wood You Believe?



FPL, 1909–1910



FPL, 1910–1932



FPL, 1932–current

- A house in Madison, Wisconsin, was the first location for the Forest Products Laboratory. From 1909–1910, it was temporary quarters until completion of the new lab on the University of Wisconsin (UW) campus.
- From 1910–1932 FPL was located on the UW campus. The original building still stands as the Materials Science and Engineering building.
- In 1932, FPL moved to its current location on Gifford Pinchot Drive in Madison, Wisconsin. It has since expanded to include a full-scale pilot plant, research demonstration house, and the 87,000-square-foot Centennial Research Facility.

Source: *Forest Products Laboratory 1910–2010, Celebrating a Century of Accomplishments*

www.uwpress.wisc.edu/books/4975.htm

Science Serving Society Forest Service Research & Development 2011 Highlights

The FPL is only one facet of the research and development arm of the U.S. Forest Service. Research has been part of the Forest Service mission since the agency's inception in 1905. Today, some 500-plus Forest Service researchers work in a range of biological, physical, and social science fields to promote sustainable management of the Nation's diverse forests and rangelands. Their research includes programs in all 50 States, U.S. territories, and commonwealths. The work has a steady focus on informing policy and land-management decisions, whether it addresses invasive insects, degraded river ecosystems, or sustainable ways to harvest forest products. Researchers work independently and with a range of partners, including other agencies, academia, nonprofit groups, and industry. The information and technology produced through basic and applied science programs is available to the public for its benefit and use.

Some FPL-specific highlights include the following:

- **America's Historic Covered Timber Bridges**—FPL has taken the lead in conducting research efforts aimed at preserving and/or restoring historic covered bridges. Several collaborative studies have been initiated to improve engineering evaluation methods, increase the durability of the bridge components, and develop new historic structure documentation techniques.
- **Colony Collapse of Eastern Subterranean Termites**—Termite colonies in laboratory and field tests were rapidly eliminated using a trap, treat, and release method with commercial termite toxicants and a patented termite bait developed at the FPL.
- **Integrating the Production of Nanocellulose and Biofuels**—FPL researchers have demonstrated a method of integrating the production of cellulose nanofibers and biofuels. Such a strategy is expected to improve the economics and reduce the financial risks associated with producing nanocellulose and biofuels from forest-based materials.
- **Soy-Based Adhesives for Wood Products**—Soy-based adhesives developed at FPL have been commercialized and allow wood manufacturers to replace adhesives based on fossil fuels. These biomass-based adhesives meet increasingly strict emissions standards for air quality.

For more FPL accomplishments, visit www.fpl.fs.fed.us/research/highlights/science_making_a_difference.php?highlight_year=2011

Download the Research & Development 2011 Highlights at www.fpl.fs.fed.us/products/publications/specific_pub.php?posting_id=19078&header_id=p

Tivoli Gough, USDA FS-FPL



The Wood Handbook's International Appeal

By James T. Spartz, Public Affairs Specialist

The *Wood Handbook* is consistently the most popular publication of the Forest Products Laboratory (FPL). In April 2010, the Centennial Edition of the *Wood Handbook* (FPL-GTR-190) was released to mark FPL's 100th anniversary as the Nation's premier forest products research laboratory. Since then, weekly downloads of all or part of the *Wood Handbook* from the FPL website have averaged about 2,290.

Though an American audience dominates, with 117,291 of the 203,842 total downloads as of early March 2012, international demand is also strong. Downloads to other countries have made up 42% of the total, or 86,551 downloads worldwide.

"FPL has produced the Wood Handbook for many years. It is viewed, by folks around the world, as a the primary source of technical information on wood, and how to use wood and wood products effectively in a range of applications."

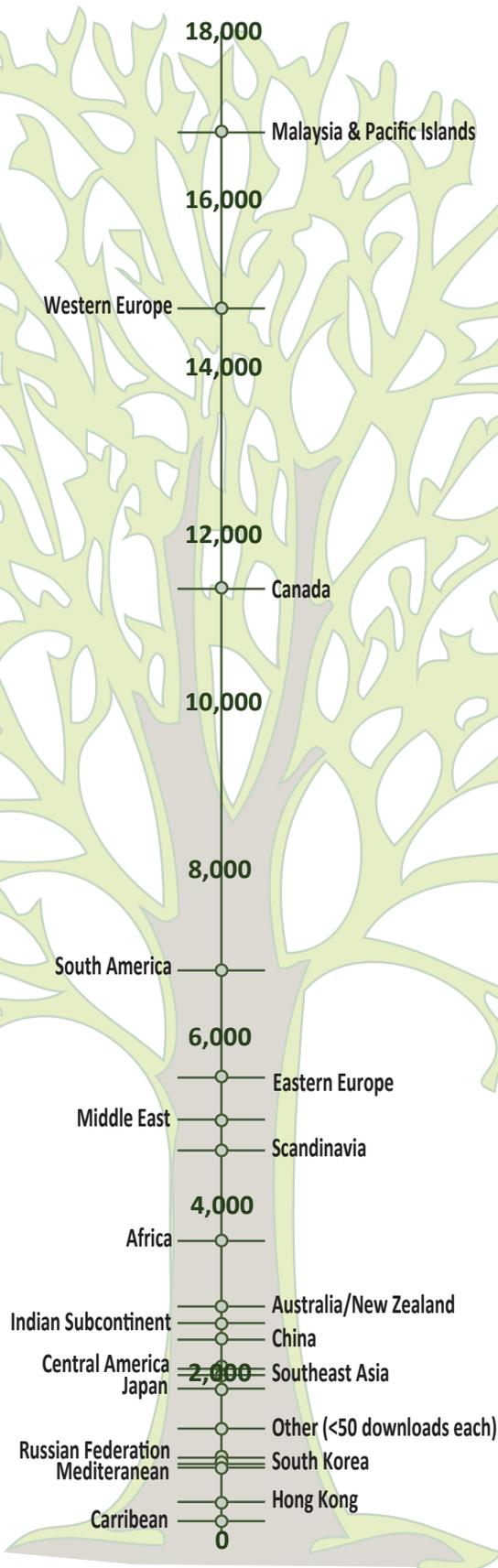
Bob Ross, Supervisory Research General Engineer

The graph to the left demonstrates the international popularity of the *Wood Handbook*. Grouped by country or region, the wide range of demand becomes evident. People from about 180 nations worldwide have downloaded all or part of this instructive manual.

Downloads from Western Europe (14,696) and Canada (11,357), along with Malaysia and the Pacific Islands region (16,788) have been most common. Other nations of note not specifically shown here, however, include Brazil's 4,104 downloads (contributing to South America's total of 6,813) as well as Iran (1,882) and Turkey (1,363) contributing to the Middle East total of 5,009. Also, within the continent of Africa's total 3,569 downloads, 1,266 came from South Africa alone.

The *Wood Handbook's* international appeal demonstrates the need for unbiased information about wood and its many uses across countries and cultures. See a *Wood Handbook* historic photo highlight on Page 11.

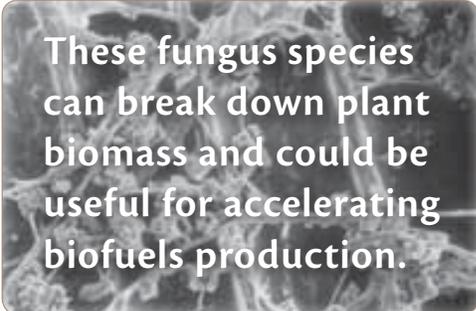
International downloads of the *Wood Handbook* (FPL-GTR-190) from June 20, 2010, to March 04, 2012.



Continued from page 5 – Pulp NonFiction

untreated chips and how outdoor trials were repeatedly successful at the 50-ton scale. “The technology has not yet been commercially adopted, but as energy costs continue to rise, it should be increasingly attractive for implementation,” Kirk said.

Analyzing the diversity of wood-decaying fungi and cataloging enzymes involved in lignocellulose degradation is one of the goals of the DOE JGI Fungal Genomics Program led by Igor Grigoriev. “We are in the process of



These fungus species can break down plant biomass and could be useful for accelerating biofuels production.

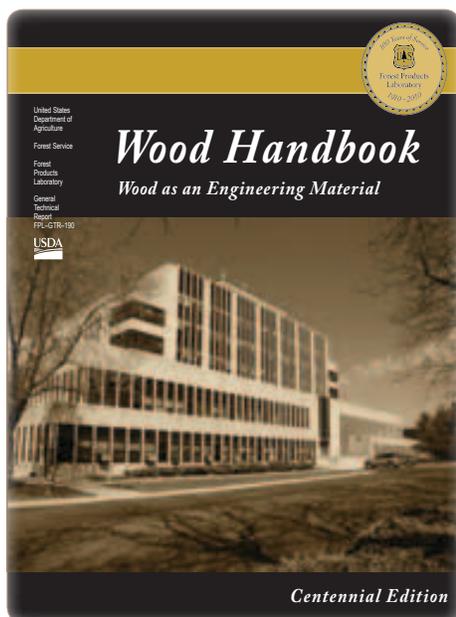
conducting functional comparative genomics of more than 20 such fungi sequenced or currently being sequenced at the DOE JGI,” he said. “This should provide us a better understanding of the diverse and complex mechanisms of lignocellulose degradation in fungi, the influence of these mechanisms on carbon cycling in the forest ecosystem, and ultimately lead to improvements in biopulping.”

Cullen sums up the collaborative work of the DOE JGI team and their interest in these fungi, “In this particular case, one would come away thinking more about the role of white-rot fungi in the carbon cycle. Lignin is a recalcitrant compound in forest ecosystem biomass and very few fungi have the capability to degrade lignin. Even fewer fungi have the ability to selectively remove lignin at such an efficient rate. *C. subvermispora* is one exception in its ability to do just that.”

For more information, visit www.jgi.doe.gov/News/news_12_03_22.html

Wood Handbook—Historic Photo Highlight

Research at the Forest Products Laboratory is always evolving. FPL’s Wood Handbook has evolved over the years too!



Check out our most recent version online: 2010 *Wood Handbook—Wood as an Engineering Material* (Forest Products Laboratory, General Technical Report FPL–GTR–190, www.fpl.fs.fed.us/products/publications/specific_publication.php?posting_id=18102&header_id=p). Read more about the Wood Handbook’s international appeal on Page 10.



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