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## A Cheaper Way to Clean Water

### Water Filters Made From Wood Fiber

Filtering contaminants from water is challenging and expensive. Global spending on filtration (including dust collectors, air filtration, liquid cartridges, membranes, and liquid macro-filtration) is estimated to increase from \$17 billion in 1998 to \$75 billion by 2020. But researchers at the USDA Forest Service, Forest Products Laboratory (FPL), have developed a new kind of water filter made from a variety of wood fibers such as juniper that is showing great promise in cleaning water contaminants in a more effective and less expensive way. These

filters are cleaning heavy metals from former mine sites; phosphorus, nutrients, and pesticides from agricultural activities; and oil from highway and parking lot runoff. According to Roger Rowell, FPL research project leader, the Lab is demonstrating these filters in two key areas. "We have filters set up in the Wayne National Forest in Ohio and around the New York City watershed area," says Rowell. "The problem in the Wayne is acid mine discharge.

There are a large number of abandoned mines in the area that would be very expensive to clean up. In the New York City watersheds, the problem is phosphates from dairy farms in the Catskill Mountain area."

Rowell says that so far the filters are proving to be about 90% effective in removing particles and sediment, 80% effective in collecting heavy metals on the Wayne, and about 80% effective in removing phosphates. "We expect our research to increase those numbers," says Rowell. Because agricultural run-off and acid mine discharge are common problems (*see sidebar on "cleaning former mine sites"*) he thinks there is a huge potential market for these filters.

### An Interesting Twist

An interesting connection is developing between these two sites. Researchers discovered the filters discarded from the Wayne mine site can then be re-used at the New York City

*(continued on page 3)*



*Water filter system showing the wood fiber mats inside.*



## Transforming a Troublesome Tree

The once troublesome red maple has earned a new reputation in the world of wood. Researchers recently donated 30 red maple trusses to Habitat for Humanity in Duluth, Minnesota, where volunteers used the trusses to construct a transitional home for battered women. This new use for red maple looks to be beneficial in many ways, from healthy forests to healthy economies.



*Workers at Kymala Truss in Duluth, MN, assemble a Red Maple truss.*

Red maple sounds nice, but to those who know forestry, the name spells trouble. This species has invaded the forests of Wisconsin, Michigan, and the New England states, preventing the regeneration of historic forests. “To restore the balance of trees, plants, and animals to these forests, invasive species such as red maple must be removed, and traditional trees must be replanted,” says Research Engineer Bob Ross.

The remedy isn’t simple. Red maple is a low-value, underused species, whose

wood is worth less than the cost to remove it. The wood harvested from red maple has customarily been made into low-value products such as pallets. Selling pallets cannot cover the cost of reforestation, so the trees remain in the forests.

When researchers at the Forest Products Laboratory hear the words red maple, they think of something different: opportunity. “We have developed a high-value product from this low-value wood, making removal of these invasive trees profitable and worthwhile,” Ross says.

The Forest Products Laboratory, in collaboration with the Natural Resources Research Institute at the University of Minnesota–Duluth and the Michigan Technological University, tested many characteristics of red maple, including its strength, durability, and load-bearing capacity. Results indicated that red maple is suitable for more uses than building pallets. Traditionally, structural components

*(continued on page 8)*

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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, write Public Affairs Director Gordon Blum at the address above or at [gblum@fs.fed.us](mailto:gblum@fs.fed.us) or call Forest Products Laboratory at 608–231–9200.



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## Water Filters *(continued from page 1)*

site to capture excess phosphates and other nutrients in agricultural runoff water. The highly acidic particles from the mine runoff water captured in the filter are very effective at removing these types of pollutants.

## Helping Rural Communities

The wood fiber filter system is made from readily available material and can be manufactured and maintained locally. Also, according to FPL researcher Jim Han, it makes more sense, environmentally and economically, to go to the local source of the pollution (point source) and clean from there. And an inexpensive filtering system might allow local communities to clean their water. "If local people handle the filtering, the money stays in the community," Han says. It's also more difficult to clean water after it has collected into ponds and lakes.

## Wood Fiber From Low-Grade Material

Another exciting element to this filtering system is that low-grade wood material (bark, small-diameter trees, and agricultural waste) can be used for the fiber. This can help improve forest health because this undesirable material usually

needs to be cleared out of the forest, and having a product it can be used for provides economic incentive for this otherwise costly work. This also contributes to the fiber being readily available and inexpensive.

## The Juniper Situation

Because of a unique chemical property, juniper fiber is very effective for use in water filters. Juniper is a low-value species whose growth has run rampant in the southwestern United States, making it a serious fire hazard. Just as with other undesirable material, providing an economic incentive makes the process of removing juniper more affordable. If filters made with juniper fiber prove to be successful, this could be a large market for juniper. Another advantage to using juniper fiber is that the bark is actually a desired part of the fiber for processing. The bark contains even more of the valuable extractives than the wood. For other species, the bark must be removed first, which adds to the cost of fiber production. And sometimes the reason for one fiber being preferred to another is simple—"The filters made from juniper smell better after 2 weeks of filtering than filters made from other wood," says Han.

## Cleaning up Former Mine Sites Is Important to Everyone

When FPL researcher Roger Rowell was visiting the former mine site in the Wayne National Forest where he and others are experimenting with cleaning acid mine discharge, he discovered something peculiar. "School children were actually coloring rivers and streams orange in their artwork," Rowell noticed. The contamination from former mines in the area not only has affected the local environment but is also affecting what the next generation considers normal. This is probably not the only place where this is happening. In 1993, the Mineral Policy Center estimated that there were more than 500,000 abandoned hard rock mine sites in the nation. Of these, they estimated that 131,000 sites, or 24%, had some sort of physical or environmental hazard. In 1996, the USDA Forest Service estimated that there were approximately 38,500 abandoned or inactive hard rock mine sites on or affecting National Forest lands. Of these, they estimate that 6,000 were causing environmental or human health problems. In 1999, the Environmental Protection Agency (EPA) estimated that 3,400 public drinking water systems were located in watersheds contained in National Forests and about 60 million people lived in the communities served by that drinking water.



## Ag Secretary Visits FPL on Earth Day

Agriculture Secretary Ann Veneman and U.S. Representative Tammy Baldwin celebrated Earth Day by promoting “conservation where you live” activities at FPL’s Research Demonstration House.

FPL and the Natural Resources Conservation Service (NRCS) are working together at the house to exhibit conservation-minded home building techniques and environmentally friendly home landscaping techniques.

The home showcases proper building practices, the latest in energy efficient appliances, and “green building” technologies advocated by leading building experts. The house will also be a center for continuing research on moisture intrusion and related problems such as mold.

The yard around the demonstration home is also a demonstration project—one that shows homeowners how to landscape their yards in an environmentally friendly way. These techniques are part of the Backyard Conservation project, a national effort led by NRCS.

“This demonstration project illustrates the innovative and environmentally friendly uses of agriculture and forestry projects,” said Veneman. “Through projects like these, we can bring conservation techniques into the homes and backyards of America.”

For more on this project, check out the FPL website at [www.fpl.fs.fed.us](http://www.fpl.fs.fed.us)

### Photos:

1. Forest Service mascot Woody Owl shares snack time with third grade students from a local elementary school.
2. Our Earth Day message was seen on banners and T-shirts throughout the day.
3. FPL Assistant Director Mike Ritter demonstrates how sound waves can be used to evaluate wood for USDA Secretary Ann Veneman and Forest Service Associate Chief Sally Collins.
4. FPL Director Chris Risbrudt and Engineering Technician Tim Nelson demonstrate a strength test for Associate Chief Sally Collins.

5. Researchers help the students make homemade paper bookmarks.
6. Secretary Veneman talks with the students after they recite an Earth Day poem.
7. U.S. Representative Tammy Baldwin plants a Silky Dogwood to commemorate Earth Day.
8. The FPL and NRCS Earth Day team pose for a picture with Secretary Veneman and NRCS Chief Pearlie Reed.
9. FPL Botanist Alex Wiedenhoef shares the secrets of Wood ID with third grade students.
10. FPL Director Chris Risbrudt shows Associate Chief Sally Collins a variety of fasteners used in small diameter wood construction.
11. NFFE Union President John Obst meets with Secretary Veneman.
12. U.S. Representative Tammy Baldwin holds a question and answer session with the students.

Photos by Steve Schmieding.



NRCS Natural Resources Conservation Service





## Questions?

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## Ask FPL

Spring is here and thoughts are straying to backyard barbecues and relaxing on the deck. Here are some common questions whose answers can help make your summer spaces more enjoyable:

*My deck looks dirty and dull. What can I do to give the wood a more appealing look?*

Refinishing a weathered deck is a good way to restore its beauty; however, proper cleaning is an essential first step, without which, early failure of refinishes is likely.

To clean your deck, a commercial cleaner with sodium percarbonate as the active ingredient is recommended. Or, you may want to try a 3:1 solution of water and household bleach mixed with a little powdered laundry detergent. (Do not use liquid laundry detergent, as it may form noxious vapors when mixed with the bleach.)

Once you choose a cleaner, start with a gentle mixture and spread the solution out on the deck with a broom or sponge mop. Avoid aggressive scrubbing so you don't damage the surface layer of the deck. Let the solution sit for about 15 minutes, keeping the deck wet. Then, rinse the deck using a garden hose for at least 10 minutes. Let your deck dry for 2 to 3 days in the sun before you refinish it.

There are three common types of finishes to choose from:

- **Water-repellant preservatives (WRP):** These finishes have a mildewcide added to the formula, which enhances their performance. They only take a short time to apply but also last only 1 to 2 years.
- **Tinted water-repellant preservatives:** These finishes color the wood slightly, but you can still see the grain. The added pigment extends the life of the finish about 2 years, but it also takes longer to apply.
- **Semitransparent stains:** These finishes have a much higher concentration of pigments and last 4 to 6 years. However, they also take the longest to apply.

Consider factors such as service life and ease of application when choosing a finish for your deck. If you're unsure of whether to use a WRP or a stain, apply a WRP first. You can always switch to a semi-transparent stain when the deck needs to be refinished.

*How can I keep my outdoor furniture looking its best?*

The best way to protect your outdoor wood furniture is to cover it with a roof. A roof can protect it from weathering and even decay as long as there is no other source of moisture, such as direct contact with the ground.

However, if the furniture is located on an uncovered deck or patio, it will require a durable finish that doesn't wear off on clothes. A good choice for this purpose is paint. Enamel paint provides a hard surface that wears well. A light sanding of the wood may increase adhesion of topcoats, and thinning the paint for the first coat will increase penetration.

*I recently built a new picnic table and I'm ready to finish it. What can I do to make the finish last longer?*

The following tips should help prolong the life of the finish:

- Subject the wood to 1 or 2 wetting/drying cycles before you apply the finish; wet the wood with a hose and let it dry completely each time.
- Sand the wood before applying the finish.
- Apply paint to wood soon after sanding.
- If possible, paint in a covered area, such as a garage, to protect the wood from the sun. Even one week of sunlight can weather unfinished wood and shorten the life of the finish.

For more information on these topics visit our website at [www.fpl.fs.fed.us](http://www.fpl.fs.fed.us) and click on Painting and Finishing Factsheets listed under FAQs. Or, you can call or email us to request a Finish Packet.



## New and Notable

### **Sawmill closures, openings, and net capacity changes in the softwood lumber sector, 1996–2003**

Spelter, Henry

FPL–RP–603

([www.fpl.fs.fed.us/documnts/fplrp/fplrp603.pdf](http://www.fpl.fs.fed.us/documnts/fplrp/fplrp603.pdf))

From a starting universe of approximately 1,300 Canadian and American sawmills, 149 were permanently closed between 1996 and 2003. This figure does not include small portable or part-time operations. These mills represented 17.6 million m<sup>3</sup> of capacity, nearly 12% of the 1995 industry total. On the other hand, 25 new mills brought on-line have offset 4.9 million m<sup>3</sup> of lost production potential. Further, upgrades to existing sawmills have added 31 million m<sup>3</sup> of capacity. The region most severely impacted by closures was the U.S. West, which accounted for over half of all the capacity lost. Other regions fared better, with the U.S. South and eastern Canada losing the least, the U.S. North and British Columbia taking somewhat higher losses. Overall, however, each major producing region gained capacity when all changes are accounted for.

### **Wood Handbook—Wood as an engineering material**

Forest Products Laboratory

FPL–GTR–113

([www.fpl.fs.fed.us/documnts/fplgtr/fplgtr113/fplgtr113.htm](http://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr113/fplgtr113.htm))

Most recently published in 1999, the *Wood Handbook* continues to provide important information on the efficient use of our nation's timber resource. Because a major use of wood in the United States is in construction, particularly housing construction, good practice in this endeavor can have a profound impact on the resource. This handbook is intended as an aid to more efficient use of wood as a construction material. It provides engineers, architects, and others with a source of information on the physical and mechanical properties of wood and how these properties are affected by variations in the wood itself. Continuing research and evaluation techniques hold promise for wider and more efficient utilization of wood and for more advanced industrial, structural, and decorative uses. The *Wood Handbook* was first issued in 1935, and slightly revised in 1939, as an unnumbered publication. Further revisions in 1955, 1974, and 1987 were published by the U.S. Department of Agriculture as Agriculture Handbook No. 72. This current work is a complete revision of the 1987 edition. This revision was necessary to reflect more recent research accomplishments and technological changes.

### **Wood You Believe . . .**

- that a typical healthy tree uses 1.47 pounds of carbon dioxide and gives off 1.07 pounds of oxygen to grow a pound of wood? (Source: [www.firewood.ca](http://www.firewood.ca))
- that during the American Revolution soldiers ripped pages from books to use as wadding for their rifles because paper was so hard to find? (Source: [www.hardwoodinfo.com](http://www.hardwoodinfo.com))
- that carpenter ants don't actually eat wood? They lack the enzyme necessary to digest wood, but they chew through it just to use it as a shelter.

### **Here's a Stumper...**

If you put a nail in a tree 3 feet from the ground when you were 10 years old, how high would the nail be when you were 40?

**Answer:** It would be at the same height! Trees grow from the tips of their branches and roots, adding layers as they mature. The trunk does not elongate as the tree grows; it just gets thicker.



## NewsLine

Published Quarterly by

USDA Forest Service  
Forest Products Laboratory  
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Chris Risbrudt  
Director

### TAPPI Fellow Named

John H. Klungness, an FPL Research Chemical Engineer, has been named a Fellow of the Technical Association of the Pulp and Paper Industry.



TAPPI is the leading technical association for the global pulp, paper, and converting industry. Fellowship—an honorary title bestowed upon less than 1% of TAPPI's membership—is given to individuals who have made extraordinary technical or service contributions to the industry or the association.

Klungness has published more than 80 technical papers and presented many of them at technical conferences. He was awarded the highest and most prestigious honor bestowed by the USDA—the Honor Award for Excellence—for his work as team leader in developing enzyme-enhanced deinking of toners.

### Red Maple *(from page 2)*

of construction, such as trusses and I-joists, have been made of softwoods such as spruce, pine, and fir, but red maple can now be added to that list.

Researchers constructed and tested 24-foot trusses and standard-sized I-joists made from red maple. Tests showed that hard maple trusses are 29% stronger and 10% stiffer than the softwood equivalent. Researchers also developed a method of drying the wood that reduced kiln-drying time by 75%, making hardwood use more cost-effective than softwood use.

By using red maple for structural applications such as these, the value of underutilized hardwoods could increase by 100%. And with over 100 million board feet of red maple in need of removal this could be

the key to improving the economics of forest restoration.

Industry partners are pleased with the success of this project. Kylmala Truss of Duluth, Minnesota, and Superior Wood Systems of Superior, Wisconsin, have already manufactured hardwood lumber trusses and I-joists. And as the Habitat for Humanity project shows, the benefits are now reaching even further than forestry and the industries supported by it. "This project gave the Forest Products Laboratory and its partners a chance to showcase the new materials while supporting a worthy cause," Ross says. "It was a great opportunity to demonstrate the new-found value of red maple."

For more, visit our website at [www.fpl.fs.fed.us](http://www.fpl.fs.fed.us)