Forest&Wood Products Australia
Knowledge for a sustainable Australia

R&D works.

R&D WORKS - MAY 2014

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Welcome to our May edition of the R&D Works newsletter.

Our stories this month include research into genetically engineered trees that produce paper and biofuel using fewer chemicals and less energy; developing reduced formaldehyde emissions adhesives for medium density fibreboard from natural sources such as tree bark; using aerodynamic modelling to improve the fuel efficiency of tractor-trailer combinations used in the forest industry; and an independent Cost-Benefit Analysis of three randomly selected FWPA funded projects that have been found to be economically very positive to the timber and wood products industry.

I hope you enjoy reading about these research projects and the potential benefits they can bring to our industry.

Ric Sinclair
Managing Director

MAIN NEWS

Economic Analysis of Selected FWPA Projects 2014

As part of the FWPA's ongoing review of its project investments, an economic analysis of three projects was undertaken to assess their economic return to industry. The analysis, conducted annually by an independent economist, was asked to assess the randomly selected FWPA-funded research projects against three investment criteria, being Net Present Value (NPV), Benefit Cost Ratio (BCR) and the Modified Internal Rate of Return (MIRR) (i.e. a measure of the financial attractiveness of investing in a research project). Benefits and costs were projected 30 years after each project was completed, using a five percent discount rate.

The three research projects considered were: PNA011-0708 Contemporary sound and fire rated timber framed construction practices for low rise building; PN06.1039 Industry standard recycled timber – visually graded recycled decorative products; and PNC220-1011 Utility of molecular breeding in forestry.

All three projects had positive net present values which indicates positive economic impact, and had positive MIRRs ranging from 12% to 19%. The Benefit Cost Ratio (i.e. the dollar benefit to industry for every dollar invested in the research) for the projects ranged from $7.17 to $14.54 to $44. These results compare well with the average benefits of Research and Development Corporations of $10.51.

Link Resource

FOREST GROWING

Nutrient-rich forests absorb more carbon

The ability of forests to sequester carbon from the atmosphere depends on nutrients available in the forest soils, shows new research from an international team of researchers.

The study showed that forests growing in fertile soils with ample nutrients are able to sequester about 30% of the carbon that they take up during photosynthesis. In contrast, forests growing in nutrient-poor soils may retain only 6% of that carbon. The rest is returned to the atmosphere as respiration.

"This paper produces the first evidence that to really understand the carbon cycle, you have to look into issues of nutrient cycling within the soil," said Michael Obersteiner from the International Institute for Applied Systems Analysis, who worked on the study as part of a new international research project sponsored by the European Research Council.

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Image credit: Nicholas Tonelli

Designing trees that make it easier to produce paper

Researchers have genetically engineered trees that will be easier to break down to produce paper and biofuel, a breakthrough that will mean using fewer chemicals, less energy and creating fewer environmental pollutants.

"One of the largest impediments for the pulp and paper industry, as well as the emerging biofuel industry, is a polymer found in wood known as lignin," says Shawn Mansfield, a professor of Wood Science at the University of British Columbia.

Lignin makes up a substantial portion of the cell wall of most plants and is a processing impediment for pulp, paper and biofuel. Currently the lignin must be removed, a process that requires significant chemicals and energy and causes undesirable waste.

Researchers used genetic engineering to modify the lignin to make it easier to break down without adversely affecting the tree's strength.

"We're designing trees to be processed with less energy and fewer chemicals, and ultimately recovering more wood carbohydrate than is currently possible," says Mansfield.

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Climate change in Tasmanian forests monitored

Amid the towering gums and timeless myrtles of Tasmania's southern forests, scientists are deploying cutting-edge technology to unravel the mysteries of an ancient ecosystem and of future climate change.

A World Heritage Area wet eucalypt forest in the Huon Valley has been set aside for a globally significant and extraordinary carbon-monitoring project. An 80 metre steel tower has been erected to monitor and detect real time fluctuations in the amount of carbon, water and energy between the land and the atmosphere.

Combined with soil samples, measuring trees and collecting bugs, scientists' hope the data will reveal how and when forests store and release carbon.

Tim Wardlaw, a principal scientist with Forestry Tasmania, said data from the site, which is one of 10 around the nation, is beginning to shed light on how Australian forests react to extreme weather. "Different parts of Australia will have different vulnerabilities (to extreme weather), and we still don't understand what they are," Dr Wardlaw said.

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Massive climate change mapping and modeling project

What might a snapshot of the earth look like in 2050? How much land will be occupied by forest? How much will produce food? And how much area will be used to supply biofuels for alternative energy? How hot will it be, globally and in particular spots? How will decisions about forests and tree cover affect land use and human communities around the globe?

These are the big questions being asked at the University of Virginia, where faculty and experts from a wide swath of disciplines and countries are embarking on a major climate change-mapping project.

Researchers are using a new, robust global-scale computer models that analyse some of the world's largest forests to help determine the best options to balance the Earth's allocation of forest, food and biofuel land parcels in a context of global climate change.

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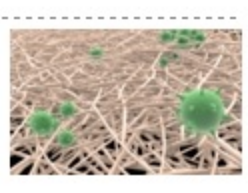
Image credit: University of Virginia

NEW PRODUCT INNOVATIONS

Nanopaper filter offers natural way to remove viruses



Researchers at the Division of Nanotechnology and Functional Materials, Uppsala University have developed a paper filter which can remove virus particles with the efficiency matching that of the best industrial virus filters. The paper filter consists of 100% high purity cellulose nanofibers, directly derived from nature.

The discovery is a result of a decade long research on the properties of high surface area nanocellulose materials, which eventually enabled the scientists to tailor the pore size distribution of their paper precisely in the range desirable for virus filtration.

"Viral contamination of biotechnological products is a serious challenge for production of therapeutic proteins and vaccines. Because of the small size, virus removal is a non-trivial task, and, therefore, inexpensive and robust virus removal filters are highly demanded" says Albert Mihranyan, Associate Professor at the Division of Nanotechnology and Functional Materials, Uppsala University, who heads the study.

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Image credit: Björn Syse

Sponges made from wood waste may soak up oil spills

As the Deepwater Horizon incident showed us, oil spills can be huge environmental disasters. That said, there are also considerable challenges in dealing with the waste products generated by the forestry and agriculture industries.

Now, scientists from Switzerland's Empa research group have come up with a method of addressing the one problem with the other – they've developed sponges made from cellulose waste that can soak up 50 times their own weight in oil.

The sponges are made from a chemically-modified version of what's called nanofibrillated cellulose (NFC), also known as nanocellulose.

In lab tests, the sponges effectively removed substances such as engine oil, silicone oil, ethanol, acetone and chloroform from water samples, within a matter of seconds. Additionally, the oil-saturated sponges remain floating for easy retrieval, and they're biodegradable.

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Image credit: Gizmag

High-tech process turns cellulose into energy storage devices

Based on a discovery by scientists at Oregon State University (OSU), it appears that trees may soon play a major role in making high-tech energy storage devices. OSU chemists have found that cellulose can be heated in a furnace, in the presence of ammonia, and turned into the building blocks for supercapacitors.

These supercapacitors are extraordinary, high-power energy devices with a wide range of industrial applications, in everything from electronics to automobiles and aviation. But widespread use of them has been held back primarily by cost and the difficulty of producing high-quality carbon electrodes.

The new approach can produce nitrogen-doped, nanoporous carbon membranes – the electrodes of a supercapacitor – at low cost, quickly, in an environmentally benign process. The only byproduct is methane, which could be used immediately as a fuel or for other purposes.

"The ease, speed and potential of this process is really exciting," said Xiulei (David) Ji, an assistant professor of chemistry in the OSU College of Science. "We're going to take cheap wood and turn it into a valuable high-tech product," he said.

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Image credit: US Department of Agriculture

WOOD HARVESTING, TRANSPORT AND LOGISTICS

Reducing forestry truck fuel consumption using aerodynamic modelling

FPInnovations' research shows reducing forestry truck fuel consumption is possible with aerodynamic modelling.

With funding from Natural Resources Canada, FPInnovations was able to initiate research and develop several concepts for reducing the aerodynamic drag, thereby improving fuel efficiency, of tractor-trailer combinations used in the forest industry.

The concepts were analysed using computational fluid dynamics (CFD) and the most promising were tested in Laval University's scaled-wind tunnel.

The concept that showed the most potential to reduce drag and fuel consumption was identified to be folding down the stakes of an unloaded log truck. This has the potential to reduce aerodynamic drag by 28% and a fuel savings of 14.6%. Over the course of an entire year, this could translate to a fuel savings of up to $3,400, with a greenhouse gas emissions reduction of up to eight tonnes (per trailer).

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Image credit: Forestry Expo

New biomass from hardwood plantations in South-East Queensland

Small community-based biomass energy systems sourcing feedstocks from local small-scale forests are common in the northern hemisphere, but are few in Australia.

Fine-grained analyses of feedstock availability are an important precursor to increased investment in these systems in Australia. This University of the Sunshine Coast study presents estimates of the potential biomass for energy supply from hardwood plantations within the Sunshine Coast Council region of southeast Queensland.

The region's 1,120 ha of private farm forestry, corporate-owned and joint venture hardwood plantations are predominantly small-scale Gympie Messmate (*Eucalyptus cloeziana*) monocultures. It is forecasted that future thinning (at age 12 years) and clearfell harvests (age 25 years) could provide minimum woody biomass yields of 30 and 108 GMt/ha respectively. Closer to 200 GMt/ha may be available from clearfell harvests of poorly-managed farm forestry plantations.

The forecast annually available biomass supply is highly variable and mostly of small quantities. Biomass energy plants seeking a sustainable supply of feedstock must therefore access additional locally-available waste biomass.

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WOOD PROCESSING AND MANUFACTURING

Environmental impact of bioadhesives encouraging

For several years New Zealand manufacturers of medium density fibreboard (MDF) have been working to reduce formaldehyde emissions of products in response to regulatory pressure from overseas markets. Health concerns in the United States and Europe around these emissions have resulted in higher demand for "green" panel products.

Responding to this challenge and to ensure markets remain open for New Zealand wood composite products, Warren Grigsby from Scion is developing adhesives from natural sources such as tree bark.

The scientists used a Life Cycle Analysis (LCA) to calculate the environmental impact of producing either conventional adhesives or adhesives from biological sources. The bioadhesives had a 22% lower environmental impact over their entire lifecycle than conventional adhesives derived from petrochemicals.

The main reason for lower environmental footprint was because they were created largely from New Zealand forest products. In contrast, conventional adhesives are created from petrochemicals that are transported from distant Middle East oilfields.

These findings can create marketing opportunities and possibly price premiums for new MDF products incorporating bioadhesives.

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Image credit: Scion

OTHER INFORMATION

Social impacts of forest policy changes in Western Australia

An FWPA funded postgraduate study at the Australian National University conducted an ex post facto assessment of social impacts experienced by members of the forest industry in Western Australia following the introduction of three forest policy changes between 1999 and 2004.

Results indicate that the process by which forest policy decisions were made, the nature of the resulting policy changes, and the actions people took in response, together contributed to three key negative social impacts: uncertainty, a perception of injustice, and financial stress.

These impacts in turn led to diminished perceptions of industry security, thus discouraging business owners from investing in the industry, rather than encouraging investment, which was a key goal of the forest policy changes. The results highlight the importance of recognising, avoiding and mitigating negative social impacts associated with policy changes, as these impacts can hinder the realisation of policy goals.

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