

Welcome to our R&D Works newsletter for March.

This month our stories include a new kind of paper made from wood fibres that could be used for next-generation solar cells, a FWPA-funded long-term analysis of pine plantation productivity to increase future capacity and new research showing removing fuel from the bush by mechanical removal, combined with prescribed burning, could dramatically reduce the devastation caused by bushfires.

I hope you enjoy reading about all the stimulating research projects in this month's newsletter.

Ric Sinclair

Managing Director

FWPA

MAIN NEWS

Structural engineering software should include timber properties.

Structural engineers rely upon structural analysis software, which predicts the behaviour of structures and building components, in the design of non-residential or commercial buildings. The widely used structural analysis software is dominated by concrete and steel information. For the timber industry to compete in the non-residential or commercial building sector, suitable software has to be readily available that includes timber information.

This review pointed to a wide range of timber engineering and design software programs being available, but they have not been taken up by general structural engineers. In general this is because the overall level of awareness of the software amongst structural engineers is very low.

The review recommends that FWPA help to publicise and promote existing timber specific structural design and analysis software to structural engineers through FWPA's Wood Solutions program. The review also recommends that after a period of time, structural engineers should be resurveyed on their software preferences to measure any change in usage.

FWPA Project: PRA215-1011

[See here](#)

Long-term pine study to increase productivity

For the continued productivity and profitability of pine plantations through future rotations it is vital that growers have a true understanding of the balance of the production of timber, carbon take up, water use and other values occurring in their plantations. This long term study measured these criteria in pine (*Pinus radiata*) plantation sites from the 1980s and 1970s to the present.

Forest plots analysed during the first rotation were re-measured in subsequent rotations. Where significant quantities of phosphatic fertilizer had been applied in the second rotation, productivity in the second rotation was more than 30% higher than in the first, and had a residual effect on productivity into the third rotation. The research also found that the mature pine plantations accumulated 2.14 tonnes of carbon per hectare per year between ages 42 and 55 years, most of this in the vegetation. The subsequent rotation accumulated carbon at a rate of 5.5 tonnes of carbon per hectare per year in the first 12 years of growth.

Measurements of water use found that as forests develop they use water, then as trees mature, runoff increases. The researchers suggest that to minimise the patterns of decreased and increased runoff, the pattern of harvesting (thinning and clearcut) and re-establishment should be planned so only a proportion of any larger catchment is affected in any year.

FWPA Project: PNC216-1011

[See here](#)

FOREST GROWING

Biomass reduction lessens bushfire risk and costs

A newly commissioned study by Deloitte Access Economics has shown that removing fuel from the bush by mechanical removal, combined with prescribed burning of trees and understorey biomass, could dramatically reduce the devastation caused by bushfires. This would also save the community tens of millions of dollars each year.

The cost benefit analysis forms part of a scoping study commissioned by the Australian Forest Products Association to look into the benefits from increased fuel reduction in key fire prone areas.

The Deloitte study suggests that, for example, in New South Wales' Blue Mountains area removing fuel from as little as 5% of the area each year could halve the extent of bushfire. The community would have saved as much as \$34 million per year in insurance claims, property loss and fire-fighting costs.

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Detecting exotic hybrids between plantation and native eucalypts

Eucalyptus globulus is grown extensively in plantations outside its native range in Australia. Some concerns have been raised that the species may pose a genetic risk to native eucalypt species through hybridisation and introgression. Methods for identifying hybrids are needed to enable assessment and management of this genetic risk.

The University of Tasmania has assessed the efficiency of a Bayesian approach for identifying hybrids between the plantation species *E. globulus* and *E. nitens* and four at-risk native eucalypts. This study was funded by FWPA.

The marker set and Bayesian modelling approach implemented had accurately identified simulated and pedigreed first generation hybrids. The combined evaluation undertaken here has provided validation of natural advanced generation hybrids between *E. globulus* and *E. cypellocarpa* and *E. globulus* and *E. viminalis*. It also provided confirmation of exotic hybridisation between *E. globulus* plantations and native *E. camaldulensis*.

The database is now available for deployment in the detection of exotic hybrids from plantations in Australia, and in the future could be built upon to include other species and used for comparison with other hybrid systems.

FWPA Project: PGD183-0910

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Image Credit: [FIEA](#)

NEW PRODUCT INNOVATIONS

Tree branch filters water

A small piece of freshly cut sapwood can filter out more than 99% of the bacteria *E. coli* from water, according to the latest research from the Massachusetts Institute of Technology.

Scientists were interested in studying low-cost and easy-to-make options for filtering dirty water, a major cause of human mortality in the developing world. The sapwood of pine trees contains xylem, a porous tissue that moves sap from a tree's roots to its top through a system of vessels and pores. To investigate sapwood's water-filtering potential, researchers collected white pine branches, stripped the outer bark, and cut them into small inch-long sections. They then mounted each in plastic tubing, sealed and secured, and filtered water through that either contained small particles or *E. coli* bacteria.

The authors found that sapwood filtered out particles greater than 70 nanometers wide. The results demonstrate the potential of plant xylem to address the need for pathogen-free drinking water in developing countries and resource-limited settings.

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Image Credit: [FLOS One](#)

Future solar cells may be made of wood

A new kind of paper that is made of wood fibres yet is 96% transparent could be a revolutionary material for next-generation solar cells.

Coming from plants, the paper is inexpensive and more environmentally friendly than the plastic substrates often used in solar cells. However, its most important advantage is that it overcomes the trade-off between optical transparency and optical haze that burdens most materials.

A team of researchers from the University of Maryland, the South China University of Technology, and the University of Nebraska-Lincoln, have published a paper on the new material in a recent issue of *Nano Letters*.

To test the paper for solar cell applications, researchers coated the wood fibre paper onto the surface of a silicon slab. Experiments showed that the light-harvesting device can collect light with a 10% increase in efficiency. Due to the simplicity of this laminating process, solar cells that have already been installed and are in use could benefit similarly from the additional paper layer.

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Image Credit: [FIEA](#)

TIMBER CONSTRUCTION AND DESIGN

Sprinklers key for building safety

A recent Canadian study has shown that the type of building construction material used did not affect the increased likelihood of a fire spreading, injuries and death — as long as the buildings were equipped with sprinklers.

The "Fire Outcomes in Residential Fires by General Construction Type" report analysed almost 12,000 fires and compared the injury, death and spread of fire for a range of building types. The structures included combustible construction, protected combustible construction, heavy timber construction, non-combustible construction and protected non-combustible. Close to two-thirds of all fires examined were in protected combustible structures.

Across almost 12,000 fires there were no recorded deaths in timber structures with sprinklers. This reinforced the safety aspect of timber structures when compared to other construction materials.

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The environmental impact of wooden cladding

A Belgian report has outlined the environmental impact of different types of cladding, with the focus on the impact of wooden cladding treated with fire retardants. This study demonstrates the relevant importance of a treatment of wooden cladding with fire retardants.

In testing, the fire retardant was responsible for about one fifth of the total environmental impact. The change in quantity of fire retardants over a range of plus or minus 20% causes a change in overall environmental impact of plus or minus 4%.

Even though fire retardant treatment implies an increase of the environmental impacts, this preliminary analysis does show that, when compared to other cladding solutions, the necessity of fire retardant treatment doesn't inhibit the use of wooden cladding on large scale.

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Image Credit: [Mark Hogan](#)

WOOD HARVESTING, TRANSPORT AND LOGISTICS

Chipping productivity in Western Australia

Roadside chipping is a common harvesting station in Australian plantations, which utilises a mobile chipper stationed at the field edge to produce high-quality pulp chips for export.

This University of the Sunshine Coast study looked at the efficiency, chip quality and harvesting residues of a chipping operation with flail and chipper in Western Australia. The harvesting system studied included a feller-buncher, two grapple skidders, a flail-debarker and a disc chipper.

Tree size had significant impact on the feller-buncher productivity, where the larger tree volume resulted in higher feller-buncher efficiency. Skidding distance was also a significant variable in affecting skidding productivity.

This paper offers valuable information about the impact of different factors on feller-buncher and skidder productivity.

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Image Credit: [Wikipedia](#)

OTHER INFORMATION

Smell of forest pine can limit climate change

New research suggests a strong link between the powerful smell of pine trees and climate change.

Scientists say they've found a mechanism by which these scented vapours turn into aerosols above boreal forests. These particles promote cooling by reflecting sunlight back into space and helping clouds to form. One of the biggest holes in scientific knowledge about climate change relates to the scale of the impact of atmospheric aerosols on temperatures.

A team of researchers from Finland, Germany and USA say they have solved the chemical mystery by which the rich odours become reflective, cooling particles. They've discovered ultra-low volatility organic vapours in the air that irreversibly condense onto any surface or particle that they meet.

Having a clear understanding of the way in which forest smells become aerosols will improve the accuracy with which they can predict the ability of these particles to limit rising temperatures.

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Image Credit: [Mikael Ehn, University of Helsinki](#)

Melbourne's urban forest strategy

Recent studies have shown that Melbourne will experience severe climate change over the next 20 years, including an increase in average temperatures, less rainfall and more frequent heatwaves and flooding. The city's urban heat island effect is also expected to intensify.

The City of Melbourne's Urban Forest Strategy's main goal is to create a resilient, healthy and diverse urban forest to combat this climate change and ensure a sustainable future for the city.

At present, Melbourne's tree population is estimated at around 70,000 council-owned trees spread throughout parks, gardens, green spaces and tree-lined streets. These trees help contribute to the city's status as one of the world's most liveable cities. According to the report however, 27% of the current tree population could disappear over the next 10 years and 44% in the next 20 years.

The new plan is ambitious and includes the following actions: increasing canopy cover from 22% to 40% by 2040, increasing forest diversity and improving existing vegetation health, soil moisture and biodiversity.

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