

Welcome to this month's edition of the FWPA R&D newsletter.

I hope you enjoying reading these research stories, which range from a new veneer drying method from Finland, to an advanced lightweight material made from lignin removed from wood during paper pulp production and an evaluation of volume losses when using different feller buncher heads.

Such research helps us make the most of our forest resources and develop new products that will find a ready place in the marketplace.

Ric Sinclair
Managing Director, FWPA

FOREST GROWING

Comparison of terrestrial and airborne LIDAR

Airborne LIDAR (ALS) has been widely used for measuring canopy structure, but much of the woody components of the canopy are not directly visible with this system. Terrestrial LIDAR (TLS) data may help fill this gap by helping to understand the relationship between above and below canopy architecture.

This study, backing up recent remote sensing studies in Australia, looks at the potential for combining TLS and ALS, thereby focusing on forest inventory and wood quality-related characteristics (such as number and dimension of branches).

Results show that both TLS and ALS were able to describe stand height using the top 10% of LIDAR returns at a high level of precision; however, TLS measurements were negatively biased. The distribution of foliage measured by ALS and TLS was strongly related to basal area and stand density. Tree-level attributes were also more accurately described by TLS compared with ALS for crown depth.

[Click here for source](#)

Image credit: www.freeussiestock.com

Improving forest biomass accuracy through remote sensing

Individual trees have been shown to exhibit strong relationships between DBH, height and volume. Often such studies are cited as justification for forest volume or standing biomass estimation through remote sensing. With resolution of common satellite remote sensing systems generally too low to resolve individuals, and a need for larger coverage, these systems rely on descriptive heights, which account for tree collections in forests.

In this study, a forest growth model (SERA) analyses forest canopy height relationships with forest wood volume. Maximum height, mean, H100, and Lorey's height are examined for variability under plant number density, resource and species.

SERA predicts mean height to provide the most consistent relationship with volume of the height classifications studied and overall across forest variations. This prediction agrees with empirical data collected from conifer and angiosperm forests with plant densities ranging between 102–106 plants/hectare and heights 6–49m. These findings may be used to advance forest biomass estimation accuracy through remote sensing.

[Click here for source](#)

A clearer picture of tropical carbon

Researchers have created a new high-resolution map of carbon storage in tropical forests that could play an important role in effective forest management.

Shades of russet, yellow and deep green between the tropics of Cancer and Capricorn circle the globe, providing the clearest picture yet of the world's above-ground tropical biomass – essentially, plants and trees. The data are mapped at a resolution four times greater than previous measurements in a 2011 study.

Researchers, led by Alessandro Baccini at the nonprofit Woods Hole Research Center, gathered two years of LIDAR data to develop the image. More than 300 field visits across Latin America, Africa and Asia were used to confirm and calibrate the LIDAR data on carbon stocks before the final measurements were projected onto an interactive map. Both the map and the data are available online, fulfilling the goal of allowing any institution, researcher, policy maker or student to use the information.

[Click here for source](#)

Aspects of forest carbon management in Australia

In Australia, a pervasive response to increasing atmospheric greenhouse gases and the exchange of these gases between the atmosphere and forests has been to focus on storing carbon in forested landscapes. However, the amount of carbon stored and able to be stored in the landscape is commonly over-estimated and over-emphasised. This occurs, in part, due to a focus on the continent's most carbon-rich forests when discussing landscape carbon storage or carbon carrying capacity, and by failing to account for wildfires that will prevent all forests from becoming old and carbon-rich.

Improving atmospheric outcomes will only be achieved if variation in landscape carbon stocks is accurately described and the full role of forests in greenhouse gas mitigation including the role of wood products is explored and reflected in policy.

[Click here for source](#)

MARKETS

Forest bioenergy: recent analysis raises doubts

A large, global move to produce more energy from forest biomass may be possible and already is beginning in some places, but scientists say in a new analysis that such large-scale bioenergy production from forest biomass is unsustainable and will increase greenhouse gas emissions.

"Early suggestions that such a forest biofuel industry would be greenhouse neutral, or even reduce greenhouse emissions, are based on erroneous assumptions," a group of international researchers said in an invited analysis in *Global Change Biology/Bioenergy*, a professional journal.

A major increase in this industry, they concluded, would also result in shorter tree rotations, younger forests, depleted soil nutrients, increased risk of erosion, loss of forest biodiversity and function, higher costs for bioenergy than are now being anticipated, and increased use of fertilisers – also a source of greenhouse emissions.

[Click here for source](#)

NEW PRODUCT INNOVATIONS

Advanced lightweight material from forestry

Promising research findings with carbon fibre from lignin are presented in a new doctoral thesis by Ida Norberg. Her thesis shows that lignin, a substance that is found in wood but is removed during kraft pulp production, has great potential for use as a raw material for manufacturing carbon fibre.

Carbon fibre is strong and light, with many applications. Today, demand is mainly limited by the high cost of production, with the petroleum-based raw material and fibre spinning accounting for around 50% of the cost. Thanks to LignoBoost technology, the pulp mill can extract extremely pure lignin which could be used for carbon fibre, thus increasing access to a raw material for carbon fibre.

A major breakthrough came when the team succeeded in spinning fibres from softwood lignin. This had previously been thought impossible, but is of particular interest to the forest industry in the northern hemisphere, such as the Nordic region and North America.

[Click here for source](#)

Photo credit: Ida Norberg, new Doctor of Technology at Innventia

WOOD HARVESTING, TRANSPORT AND LOGISTICS

Feller buncher heads evaluated

The CRC for Forestry has produced research examining volume losses when using different feller buncher heads. Compiled by Martin Strandgard (University of Melbourne) and Rick Mitchell (CRC for Forestry), the research compared shear, hotsaw (continuous disc saw) and chainsaw felling heads operating in *Eucalyptus nitens* and *globulus pulwood* plantations. The research compared the heads in terms of estimated volume and value lost in stumps and saw kerf during harvesting. Other aspects such as productivity, site impacts and fire risk were also considered.

The results showed that using shear heads can recover more volume and value per hectare than the other feller buncher heads due to lower stump heights and a lack of saw kerf. Chainsaw heads were also better suited to larger trees and stands producing sawlogs.

For more information, please contact Mark Brown from CRC for Forestry at mbrown2@usc.edu.au.

[Click here for source](#)

WOOD PROCESSING AND MANUFACTURING

Nanotech reduces leaching in pressure-treated lumber

Pressure-treated lumber has been shown to leach much less preservatives when treated using a newly-developed technology. Now, however, researchers have found a way of using nanotechnology to keep the preservatives in the wood.

The scientists, from Michigan Technological University, encapsulated tiny droplets of the fungicide tebuconazole within spherical nanoparticles. The spheres were chemically modified to work with the fungicide, and were made from either gelatin or chitosan.

The nanoparticle-encapsulated fungicide was then applied to wood samples, using regular pressure treating techniques. Tests showed that the wood was just as insect and rot resistant as wood treated with conventional fungicide, yet 90% less leaching occurred. Further testing is now being performed in the warm, wet conditions of Hawaii.

[Click here for source](#)

Sapwood's impact on the market utilisation of plantation hardwoods

The hardwood processing industry in Australia is changing – from predominantly milling larger native forest logs to milling a combination of smaller plantation and regrowth native forest logs.

For this transition to be successful, more needs to be known about the properties of young, fast grown hardwood, particularly as recovery losses by removing sapwood become increasingly significant as log diameter decreases.

This research project assessed the physical properties and appearance of both the sapwood and heartwood of nine species from plantation and young regrowth regimes, and compared results with previously collected data on native forests.

The results showed the mechanical properties of the sapwood generally performed well relative to the heartwood product from the same site and therefore could be assumed acceptable in the structural market.

For appearance grade products a marketable product can be achieved using a dark stain to mask the sapwood-heartwood contrast. A simple calculation using recovery and product value assumptions with the average log statistics valued sapwood retention between \$33 and \$113 per m³ of log processed – depending on species, nature of primary breakdown and market. However, for appearance grade products – demanding little sapwood-heartwood contrast (i.e. timber flooring) the additional costs of staining make using sapwood economically unviable.

Keeping the sapwood allows millers to produce greater volumes of wider products (e.g. 100mm versus 75mm wide boards) that are typically easier to sell and have higher market values.

FWPA project ref. PNB039-0708

[Click here for source](#)

New veneer drying method from Finland

A new type of contact drying method for timber veneers has been developed at Aalto University in Finland. A paper presents experimental results from tests with the new drying method.

The drying system consists of a hot upper plate, a cold bottom plate, a vacuum inside the drying chamber and a mechanical press. Compared to conventional convective drying, the new method decreased the total drying time significantly, by approximately 50%.

The preliminary tests show that the quality of the veneer was not compromised in the drying process. The new method could be used in the plywood and LVL manufacturing process, as well as in special drying applications.

[Click here for source](#)

Managing the effects of European House Borer in Western Australia

In January 2004 the introduced pest European House Borer (EHB) – *Hylotrupes bajulus* – was found in Perth's eastern suburbs. The EHB larvae consume seasoned, untreated pine wood such as dead pine trees, pine furniture as well as structural pine timber. FWPA funded a two-year research project investigating the pest in Australia and how it may be managed.

This project tested colonies of EHB beetles to determine if they can initiate and sustain infestations in pine framing in roof spaces despite Perth's high summer temperatures. Test cages containing lengths of untreated commercial kiln dried pine were installed in the roofs and living spaces of six test houses built close to a known infested plantation. Survival rates for both EHB adults and larvae were monitored.

The research clearly shows that temperature does not prevent infestation by EHB, and that they can infest pine framing under current Australian construction practices. The pine timber production, building and pest control industries need to consider EHB risks. It is recommended that manufacturers of structural and other pinewood consider producing treated pine products to H3 standard (AS1604) for all pine timber sold in WA to control infestations.

FWPA project ref. PNA023-0809

[Click here for source](#)

OTHER INFORMATION

Limitless power from 'forests' of the future

Researchers, based at the University of California in San Diego, have used the idea of forests to create a nanowire tree which can generate hydrogen gas from water. Nanotrees, which are microscopic trees made from equally microscopic wires, are so small that 10,000 could fit on the cross-section of a human hair.

The nanotrees use sunlight to split water molecules into hydrogen atoms, which are then used in fuel cells to produce energy. The tips of these nanotree branches are extremely tiny so, compared to a simple wire, the branches of their tree structure provide many more points at which electrical charges, derived from sunlight, can be transferred to water molecules with very high efficiency.

This research not only has the potential to improve solar power generation, but also directly power fuel cells for energy storage.

[Click here for source](#)

An audit of forest biosecurity arrangements and preparedness in Australia

Serious pest or disease outbreaks can cost Australian agricultural industries many millions of dollars; for example, government agencies estimate that even a small foot and mouth disease outbreak would cost the agricultural industry around \$7.1 billion, while a large 12 month outbreak would cost \$16 billion.

Although such events are relatively rare, the Australian plantation industry could be equally vulnerable to a similar scale disease outbreak. Unfortunately, current forest biosecurity procedures are poorly defined. To remedy the situation this research project audited and analysed Australia's current response procedures to biosecurity threats in the commercial sector, and recommended solutions for identified weaknesses.

Initially the researchers detailed the current systems and environments for responding to a plant pest emergency. A cross section of forest biosecurity stakeholders – from government to industry to environment groups – then participated in a workshop facilitated by the Australian Centre of Excellence for Risk Analysis. This approach promoted understanding of the different perspectives and supported a collective recommendation for strategies to improve forest biosecurity to be implemented over the next two to five years.

Two non-research actions were prioritised: a national body is needed for forest health and biosecurity (such as an expanded Research Working Group 7) with revised membership and terms of reference to be represented in the national arena by a dedicated officer; and there is an urgent need to demonstrate to the plantation timber industry that there are real benefits for industry financial investment in biosecurity and real costs for not participating.

In addition the report identified research priorities such as research to support cost benefit analyses; investigating the effects of changed environmental conditions on forest biosecurity; and pathway analysis for functional pest guilds.

FWPA project ref. PNC159-0910

[Click here for source](#)

