

Welcome to our March 2013 edition of the FWPA R&D Works newsletter.

This month's stories feature research using LIDAR to predict wood quality in *Pinus radiata*, a new bio-composite material that uses renewable natural fibre and a landmark study showing appropriately managed production forest landscapes have a similar biodiversity to that of largely undisturbed landscapes.

Such stories demonstrate the varied nature and importance of wood and timber research projects; I hope you enjoy reading about them.

Ric Sinclair
Managing Director, FWPA

FOREST GROWING

Study finds production forest landscapes retain biodiversity

A landmark study has found that appropriately managed production forest landscapes have a similar biodiversity to that of largely undisturbed landscapes.

The research, commissioned by Forest and Wood Products Australia and carried out by Forestry Tasmania and the University of Tasmania, has shown that tall eucalypt forests do not necessarily need to be in large reserves to provide suitable habitat for their associated animals and plants. Rather, it is possible to effectively integrate the conservation of these species with wood production.

Researcher Dr Tim Wardlaw said the study had provided the scientific evidence to show that timber harvesting is compatible with the maintenance of biodiversity values – particularly when it is integrated with, rather than separate from, areas containing mature forests.

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Image credit: FWPA



Increasing forest returns by applying biosolids

A long-term research trial was established in 1997 to investigate the effects of biosolids applications on a 750-ha of *Pinus radiata* forest plantation on Rabbit Island in New Zealand.

An analysis of the likely economic impact of biosolids application shows that biosolids application has been beneficial. Stem volume of the high treatment was 36% greater than the control treatment and stem volume of the standard treatment was 27% greater than the control treatment at age 18 years of age.

Biosolids treatments have effectively transformed a low productivity forest site to a medium productivity site. This increased productivity has been accompanied by some negative influences on wood quality attributes, with reduced wood stiffness, wood density, and larger branches. However, an economic analysis shows that the increased stem volume and greater average log diameter in the biosolids treatments outweighs these negative effects.

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Image Credit: FEA



Forests as rainmakers: new CIFOR study boosts support

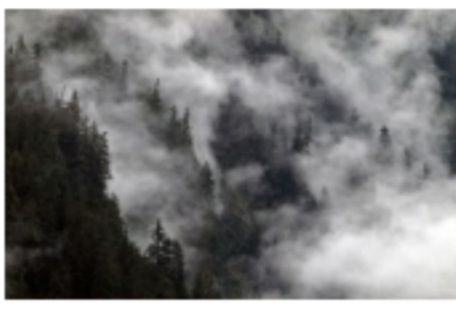
A new study boosts support for the physics behind a controversial theory that forests play a significant role in determining rainfall, creating atmospheric winds that pump moisture across continents.

The model could revolutionise the way we understand local climates, and their vulnerability, with many major implications. It suggests, for instance, that by strategically replanting forests we could attract rainfall into desert and arid regions like the African Sahel, where drought has for years ravaged crops and induced famine. Likewise, significant forest loss could transform lush tropical regions into arid landscapes.

'This theory provides us with yet another reason to protect and conserve forest cover', said Douglas Sheil, co-author of the paper published in Atmospheric Chemistry and Physics and a Senior Associate with the Center for International Forestry Research (CIFOR).

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Image credit: CIFOR



Using LIDAR to predict wood quality

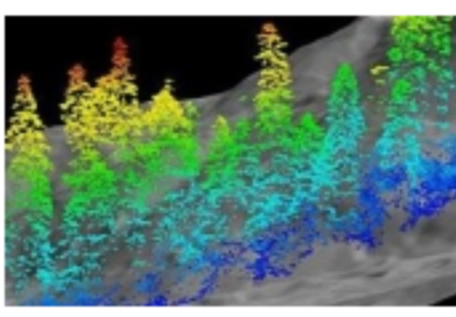
Light Detection and Ranging (LIDAR) is an established technology that has been shown to provide accurate information on individual-tree and stand-level forest structure. Although LIDAR has been widely used to describe stand structural dimensions, the utility of this technology to predict spatial variation in wood quality traits is largely unexplored.

This study used LIDAR metrics to predict spatial variation in total stem volume (TSV) and outerwood stress-wave velocity (V) in an even-aged mature forest (25 yrs) of moderate size. Outerwood stress-wave velocity is a good predictor of modulus of elasticity, which is a key performance criterion for structural timber.

The best statistical models that included only LIDAR data explained 60% and 37% of the variation in TSV and V, respectively. At the forest level LIDAR metrics were found to be useful for predicting both V and TSV.

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Image Credit: FEA



Landmark carbon assessment developed for Australia

The Australian landscape soaked up one third of the carbon emitted by fossil fuels in Australia over the past twenty years, according to a new CSIRO study released last week. The study, which marks a significant milestone in Australian atmospheric science, also found that Australia exported 2.5 times more carbon in fossil fuels in 2009-2010 than was emitted from fossil fuels burned within Australia.

These results emerge from the three-year study, the Australian Terrestrial Carbon Budget, published this month in the journal Biogeochemistry.

In the study, scientists quantified how much land carbon is lost or gained through plant and soil 'breathing' in response to variable climate and rising carbon dioxide. Effects of fires, erosion and deforestation were also considered. All these processes, together with fossil fuel emissions, are critical to domestic carbon management and international reporting protocols.

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Image credit: CSIRO



CSIRO maps out forest stability

Technology developed by CSIRO is providing an unprecedented level of information about the stability of Australia's forests and greenhouse balance.

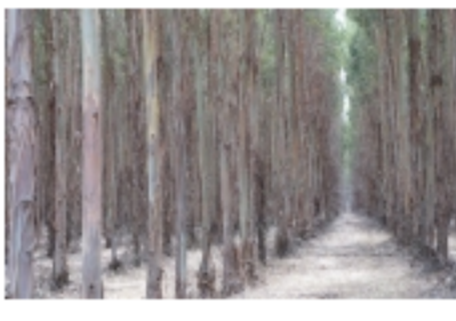
The National Forest Trend (NFT) is a time-series summary that produces maps of in-forest vegetation changes over time taken at very high resolution. Forest changes can be the result of a variety of natural and management actions including forest thinning, harvesting, disease or weeds.

Jeremy Wallace, from CSIRO's division of Mathematics Informatics & Statistics in WA, said that while the concept of using two or more images to show trends is not new, the fine scale of the imagery (25m) and its application over such a large area are important new developments.

Wallace said the NFT technology provided fundamental information about whether forests are stable or responding to climate or management programs and has applications in conservation, forest management and carbon accounting.

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Image Credit: FEA



Operational deployment of LIDAR in Australian softwood plantations

Airborne LIDAR (Light Detection And Ranging) remote sensing can deliver significant practical and economic advantages for pine plantation managers. To reduce costs and share expertise, the six largest Australian pine plantation management organisations formed a collaborative via a series of industry workshops to determine if the deployment of LIDAR can be coordinated.

This Forest and Wood Products Australia (FWPA) report compares the use of LIDAR in each organisation and suggests operational development and deployment strategies for the near future (i.e. the next 2-3 years). Discussion points include using LIDAR to assist early age inventory of unthinned stands; the possibility of using LIDAR for later age, post first thinning pre-harvest inventory; and how best to continually review LIDAR system parameters.

A subsequent research proposal for a full scale operational project has since received FWPA funding and commenced in late 2012. The project which will run for approximately 18 months is entitled "Operational deployment of LIDAR derived information into softwood resource systems" (PINC305-1213).

Project Ref: PRC281-1112

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Image credit: FWPA



NEW PRODUCT INNOVATIONS

New composite material aims to replace chipboard

Finnish forest products group UPM wants its bio-composite material ForMi to replace chipboard as the main raw material used in Finnish kitchen fitting frames. Kitchen fitting manufacturer Puustelli Group Oy has developed, in cooperation with UPM, kitchen fitting frame components that increase the utilisation of renewable natural fibre and reduce the manufacturing carbon footprint by 35-45%.

'This is an important first step for UPM ForMi in the furniture industry. Naturally, we hope that the construction industry will follow Puustelli's example and adopt the environmentally friendly material more extensively, not just in Finland but globally,' says Stefan Fors, director, bio-composites, UPM.

The bio-composite raw material is produced at UPM's facility in Lahti, and the cellulose used for it comes from certified forests. The die-cast Puustelli frames include ready-made holes for mounting drawers, hinges and other mechanisms. A composite frame is evidently more resistant to stress and moisture than chipboard.

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Image credit: UPM



TIMBER CONSTRUCTION AND DESIGN

Fire performance of post-tensioned timber beams

Post-tensioned timber frames have recently been undergoing heavy research and development at the University of Canterbury. The focus of Phillip Spellman's research was to investigate the fire performance of post-tensioned timber beams. This was completed through a series of full-scale furnace tests and the development of a fire resistance design method.

The results demonstrated the importance of considering shear during fire design. It was also important to consider shear, not only in the webs at the centroid where the shear flow is greatest, but also in the lower corners, which can become much thinner than the webs. It was found that the proposed calculation method, when used with a char rate of 0.72mm/min and an additional allowance of 7mm for temperature-affected timber beneath the char layer, provided good predictions of the failure times for the full-scale experiments.

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Image credit: Phillip Spellman



WOOD HARVESTING, TRANSPORT AND LOGISTICS

Practices for controlling erosion on skid trails

Sediment from forest areas with logging activities is one of the environmental concerns which loggers try to address. Skid trails can be a large source of erosion if not managed correctly.

Researchers from Virginia investigated five different erosion best management practices on skid trails to determine which was the most effective. These practices included: (1) Water bars; (2) water bars and grass seed; (3) water bars, grass seed and straw mulch; (4) water bars and piled hardwood slash; and (5) Water bars and piled pine slash.

Results showed that the water bar was the least effective method for preventing erosion, with the most effective being the straw mulch with grass and water bar. In Addition, where the skid trails were not bladed, only half as much erosion can be expected.

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Image Credit: FEA



Work schedule productivity on mechanised logging operations

Researchers have carried out long-term studies in Chile on over 30,000 logging machine day records. Forestal Mininco started collecting detailed information on the productivity of their contractor's ground-based harvesting machines across different work schedules. The logging systems used included feller-buncher, slider and dangle-head processor, and harvesters and forwarders. Maintenance of the machines is carried out by a different contractor during the night.

The results showed that production increased as the working hours increased. But the average hourly productivity dropped by 9-30% as the working day increased from 9 to 18 hours. Factors that caused the productivity drop included type of work schedule, type of operation, season, tree species and tree size.

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Image Credit: FEA



WOOD PROCESSING AND MANUFACTURING

Energy optimisation software reduces industrial power consumption

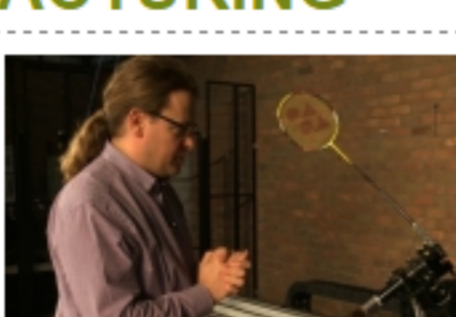
New energy efficiency analysis software, designed for factory automation, plans to help save money and protect the environment. The Energy Software Tools for Sustainable Machine Design (ESTOMAD) project was created to 'model, simulate and analyse energy flows and losses throughout the whole machine.'

ESTOMAD could be used to help engineers get the most of out of existing machines and will likely become an integral component in the design of new ones, because it can simulate them before they're built.

A trial was conducted by PICANOL, a company that produces industrial weaving machines. Its production line scored 10-15% lower power consumption with just a few modifications – a significant reduction that will benefit the company's bottom line. Also, researchers at the Flanders' Mechatronics Technology Center (FMTC) in Belgium did even better with their badminton-playing robot. They were able to reduce its energy consumption by 50% by targeting areas deemed wasteful by the software.

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Image credit: Gizeag



OTHER INFORMATION

Wireless technology to stop illegal logging in Amazon

The Gemalto-powered Invisible Traccc solution was deployed to detect unauthorised logging activities missed by traditional satellite surveillance and radio monitoring. Smaller than a deck of cards, the discreet device combines Gemalto's tiny Criterion BGS2 module with cutting-edge localisation algorithms and new radiation exchange data (RED) technology that extends the range of wireless communications in low signal areas.

The devices has been covertly installed in trees located in active harvesting zones and sends alarm notifications, with the exact location information, to officials as soon as trees pass within 32km of a cellular network.

This enables law enforcement and the Brazilian environmental protection agency IBAMA to respond in real time, trace the loggers to sawmills and prevent the sale and profit from illegally harvested lumber. With the rugged durability and sophisticated power management system of Gemalto's Criterion M2M solution, the device can operate reliably in the field for over a year without recharging batteries.

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Image credit: Gemalto

