

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

This month our stories range from research into recovering higher value products from fibre managed plantation eucalypts to tools that calculate the costs of forest roads and a program that is conserving 'unselected wild' genes in radiata pine for the future. Together with many other forest and wood R&D projects, such research is helping build a stronger, more economically robust industry.

Ric Sinclair
Managing Director, FWPA

FOREST GROWING

Recovering higher value veneer products from fibre managed plantation eucalypts



Variable world woodchip prices mean growers of pulp-grade hardwood logs must breed and grow trees that could find more valuable uses in the future—notably in rotary peeled veneers, plywood and LVL (laminated veneer lumber).

Identifying the genetic parameters and wood quality of 16-year old and 26-year old *Eucalyptus nitens* and 33-year old *E. globulus* from unpruned, unthinned plantations currently managed for fibre production made up part A of this project.

The results revealed a genetic correlation between pulpwood selection criteria and wood stiffness in *E. nitens*. Breeding programs that improved desired properties in pulpwood have also improved the veneer stiffness for veneered engineered wood products.

The 16-year *E. nitens* was not very useful for producing higher value veneer and ply because of low overall veneer recovery and a tendency to produce a relatively high proportion of low-grade (knotty) veneer, which is plentiful and cheap. The older *E. nitens* tended to deliver a higher recovery than the younger material and was higher in stiffness than the younger material. Although *E. nitens* veneers often failed to meet minimum visual grade standards, they could be used for structural products and for producing LVL.

The *E. globulus* produced veneer that was higher in stiffness to any of the *E. nitens*.

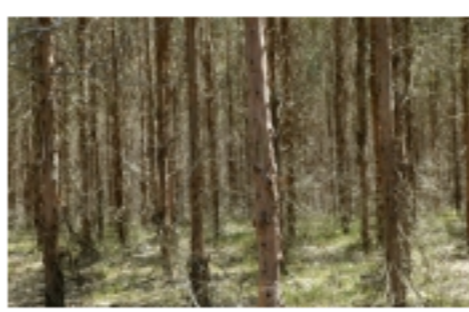
Researchers expect that further breeding and optimising peeling, drying, gluing and pressing processes will increase the use of younger *E. nitens* for higher value products. They also found that acoustic velocity measurements of logs enabled them to sort and select the best logs for value-added processing (i.e. some logs created better plywood panels).

Part B of the project investigated markets for products manufactured using rotary peeled veneer from native pulpwood and the potential to develop niche markets for these products. The results showed small-diameter or poor quality eucalypt logs can be successfully peeled and dried, and the veneer used to produce LVL. This LVL can be re-sawn to produce a range of high-quality appearance-grade products such as flooring, furniture and framing. The researchers expect the strength, durability and stability of the LVL products to equal or surpass equivalent solid wood products. They also suggest plantation grown hardwoods and softwoods could be used in certain lower-strength applications.

Project: PNB139-0809

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The regeneration niche: attributes and recruitment of eucalypts in dry forests



Lack of eucalypt recruitment is a key factor in the decline of forest and woodland remnants in low rainfall agricultural regions in Australia. Key to effective management of these forests is an understanding of the requirements and conditions that promote seed germination and seedling establishment (recruitment niche) and the persistence of lignotuberous sprouts (juvenile persistence niche).

Recruitment is limited by the availability of safe microsites that are suitable for the germination and establishment of seedlings. The objective of this study was to investigate the microsites of established eucalypt seedlings and lignotuberous sprouts in healthy dry forests burnt in the previous two to six years in the Tasmanian Midlands.

The results have important implications for the management of dry forest in order to facilitate eucalypt recruitment and persistence, suggesting the need for retention of coarse woody debris and the judicious use of fire.

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Native radiata pine germplasm: growth, form and wood quality, and risk traits



Conservation in radiata pine means ensuring that 'unselected wild' genes are not lost from the breeding population. These genes may have great importance for plantations in the future, enabling genetic adaptation to issues such as climate change, pests and diseases.

This important ongoing project is safeguarding genetic material from trees imported in 1978 and earlier collections from the regions where radiata pine originated in mainland California and islands of Guadalupe and Cedros, and planted in genetic conservation stands in different parts of Australasia.

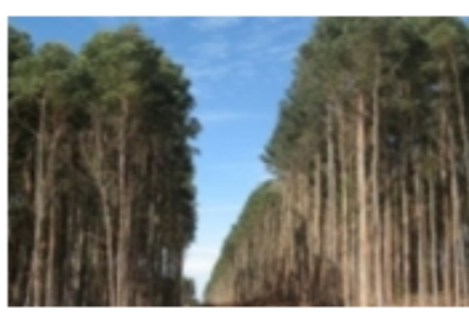
Researchers are cataloguing these conservation stands to provide forest managers with a long-term management plan and a record of all genetic resource plantings. Seeds are being stored strategically at low temperature for long-term conservation, while some genetic material is being used to re-establish conservation plantings at different sites in Australia and New Zealand to ensure long-term genetic security.

A comprehensive and large-scale genetic analysis of growth and wood quality traits revealed there is plenty of genetic variation in these populations. Superior trees are being archived for long-term gene conservation, as well as selected for use as parents in the national arboreta at Mount Gambier. Their genes can broaden the genetic base of the current breeding populations and help increase wood volume, stiffness and stem straightness.

Project: PNC135-0809

Contact FWPA for further information

Assessment of carbon stock changes in living biomass: a comparative study



Signatory countries to the United Nations Framework Convention on Climate Change (UNFCCC) and its supplementary Kyoto Protocol (KP) are obliged to report greenhouse gas emissions and removals. Traditionally, volume estimates are used as a forestry measure. Changes in living biomass may be assessed by first estimating the change in the volume of stem wood and then converting this volume to whole tree biomass using biomass expansion factors. However, this conversion often varies over time.

The objective of this study was to evaluate differences between biomass estimates obtained using biomass equations and biomass expansion factors, with particular focus on uncertainty analysis.

The highest accuracy was obtained for estimates based on biomass equations for different tree fractions, applied to data from the Swedish National Forest Inventory using a permanent sample design. Many countries have adopted such a design combined with the stock change method for reporting carbon stock changes under the UNFCCC/KP.

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Managing subtropical pines for improved wood production



Australia's subtropical plantations of slash pine (*Pinus elliottii*), Caribbean pine (*P. caribaea*), and their hybrids—the preferred tree species over the last decade—are important sources of high quality timber, but which of these species have the best wood properties that will help growers get the best financial returns?

This project analysed growth and wood property data across two subtropical plantation sites. Trees were managed under a number of different commercial thinning regimes and were assessed for the wood properties of density, stiffness and spiral grain.

Findings show slash pine has a higher density than Caribbean pine, and the hybrid has densities between the two parents. Slash pine also increases in density at a faster rate. Spiral grain comparisons showed slash pine had the least desirable grain angle values, while the hybrid angles were between their parents or similar to Caribbean pine. The hybrids tended to have wood stiffness values similar to slash pine. Acoustic velocity measurements show slash pine values are not changed much by stocking rate, whereas hybrid and Caribbean pine velocities reduce when grown at high stocking rates. This suggests they may be more affected by site conditions.

Project: PNC057-0809

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Design-based approach for mapping and estimation under forest management planning



Over the last decades, conservation and sustainable use of forest resources have become major issues of environmental and land policies. There is an increasing need of comprehensive and timely information to support their management at a variety of spatial scales.

Estimation and mapping of forest attributes are a fundamental support for forest management planning. This study describes a practical experimentation concerning the use of design-based k-Nearest Neighbours (k-NN) approach to estimate and map forest inventories.

Attributes from field surveys and Landsat image processing were coupled by k-NN to predict the attributes of interest for each pixel of the Landsat image. Achieved results demonstrate the effectiveness of the k-NN approach for statistical estimation that is compatible with the produced forest attribute raster maps.

Support for forest management should be framed according to a multi-faceted approach that integrates mapping and inventory as a means of providing comprehensive knowledge on the state and trends of forest resources.

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Estimating nutrient budgets for prescribed thinning in a regrowth eucalypt forest



This paper reports an approach for estimating thinning-induced changes in N and P budgets in jarrah (*Eucalyptus marginata*) forest in the Wungong catchment of Western Australia. Two thinning strategies, herbicide injection and selective removal, were tested and nutrient budgets were constructed for soil, litter and tree biomass. The effects of thinning were evaluated based on pre-thinning biomass allocation and on reductions in biomass after thinning.

Results indicate that both thinning strategies would increase nutrient cycling in the forest, while the implications of thinning-induced nutrient supply for the growth of remaining vegetation, understorey competition and ecosystem health need further examination.

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WOOD HARVESTING, TRANSPORT AND LOGISTICS

Keeping an eye on machine fuel consumption



Even though the continuing increases in fuel prices are raising operating costs for forestry equipment, the design, maintenance practices, and operating conditions of forestry machines, as well as how they are used, also influence fuel consumption. FPInnovations has just released the second edition of their report, 'In forestry operations: fuel economy counts', and provides a useful guide for reducing fuel costs.

Owners of forestry machines can reduce the impact of increased operating costs by purchasing new equipment that is proven to have low fuel consumption. With current forestry equipment, owners can still reduce fuel consumption through adequate maintenance and correct equipment operation.

According to various experts, fuel consumption differs among the different types of equipment. These differences can be explained by three main factors: the design of the machine accounts for 60% of the difference, with the engine technology and the operator's work methods both accounting for 20% each.

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Forest roads: tool for estimating road costs



Virginia Tech has produced a tool to calculate the costs of road construction, maintenance, and closure of forest roads and skid trails. The Microsoft Excel-based tool has the goal of assisting foresters estimate costs for forest road and skid trail construction, maintenance and closure. The tool makes use of five cost categories: stream crossings, road construction, improvement and maintenance of existing roads, bladed skid trail construction and skid trail closure.

The cost estimates are based on published road information, as well as information from quarries, excavation companies, and personal communication with forest road experts. This costing tool has been field tested and was found to provide an acceptably accurate estimate for foresters and contractors who want to quickly estimate their road construction and maintenance costs.

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WOOD PROCESSING AND MANUFACTURING

Active spindle system for a rotary planing machine



Rotary planing and molding machining operations have been widely used within the wood working industry for many years. This paper presents the experimental validation of an active control approach to improve the damping of a spindle system for wood machining. The active control was implemented using piezoelectric actuators in push-pull configuration with real-time control capabilities.

The adaptive control strategy based on the linear quadratic Gaussian is first modelled within MATLAB/Simulink, and then implemented on the real spindle system. Experimental tests were performed on the small-scale planer prototype to validate the simulation models. A cutting force observer which can be used to continuously monitor the cutting process is also implemented and its performance is presented.

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OTHER INFORMATION

D-Shape 3D printer can print full-sized houses



The growing popularity of 3D printers, such as the Printbot or MakerBot's Thing-o-Matic, testify to the fact that additive manufacturing is slowly entering the mainstream. The devices are now small enough to fit on a desk and they can make all sorts of stuff, such as toys, chess figures, or spare door knobs.

The D-Shape printer, however, is potentially capable of printing a two story building—complete with stairs, partition walls, columns, domes, and piping cavities—using only ordinary sand and an inorganic binder. The resulting material is said to be indistinguishable from marble, and exhibits the same physical properties, with durability highly superior to that of masonry and reinforced concrete.

The building process involves a nozzle moving along a preprogrammed path, extruding a liquid adhesive compound on a bed of sand with a solid catalyst mixed in. The desired structure is erected in a single work session, starting from the bottom up.

While printing a whole house is not quite there yet, the process does show potential in the future.

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Biomass availability study for district heating: a Canadian use case



Interest in biomass district heating has continued to increase due to biomass. While this feasibility report details the use of biomass in Canada's Lower Fraser Valley, it does provide a comprehensive use case for planners in Australia.

Biomass district energy systems require a secure, long-term supply of preferably dry woody fuel of a standardised size (e.g. chipped or palletised). Traditionally sawmill wood residue supplied this market. Due to local mill closures in Canada, this is now a declining source of wood fuel and urban demolition, land-clearing and construction wood residue are now becoming new and growing sources of wood fuel.

The report notes that the price advantage of biomass, relative to natural gas, yields an economic incentive to use biomass for energy. To develop public acceptance and support for biomass district energy projects, information and communication programs should be expanded to better explain the merits of biomass fuels. These information programs could also present the environmental consequences of not recovering this resource, such as increased GHG emissions and the impacts from long distance waste hauling or landfilling.

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