



# SPECIALTY WOOD PRODUCTS PROGRAMME UPDATE

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## Summary

One year into the Specialty Wood Products Partnership has seen a significant amount of work being undertaken and reported on. New products/processes have been evaluated, seed orchards established and various trials have been planted out. Novel techniques are being developed to speed up assessment and reduce the costs of wood quality and durability evaluations. A workshop was held to determine the industry's breeding priorities for Douglas-fir. The existing site species modelling work has been summarised and a workshop planned to structure this research area for the next 5 years.

## RESEARCH PROGRESS: Year 1

### PROCESSING OEL

Douglas-fir thinnings were used to produce OEL. The OEL (Optimised Engineered Lumber) technology produces structural products with known, uniform and reliable properties. It is a laminated and finger-jointed product. There is potential financial advantage derived from the fact that all the merchantable OEL production output is certified structural grade, this compares with the output from traditional sawmilling where not all production achieves certification as structural grade product. The results of the mechanical testing showed that the Douglas-fir OEL achieved the strength and stiffness properties of the New Zealand structural grade SG8.



### Thermally modified *E. nitens*

Samples of *E. nitens* were thermally modified to examine impacts on timber characteristics (photos of control and two temperature treatments below). Thermal modification involves heating wood to high temperatures (>180°C) in the absence of oxygen to alter the chemistry of the wood and consequently alter the wood properties. Compared to other wood modifications, thermal modification is a relatively low cost approach. It was found that the durability and stability were increased and the colour darkened (but faded on exposure to sunlight). Stiffness was unchanged but the strength was significantly reduced.



### Improved drying of *E. nitens*

*Eucalyptus nitens* has a very high incidence of drying degrade, primarily caused by water tension stress occurring early in drying. This degrade reduces the recovery of sawn timber from nitens logs and is a barrier to producing significant volumes of sawn timber. Some promising research has been



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done freezing wood, prior to drying, to reduce water tension. A trial was undertaken where four sets of twenty boards were briefly frozen (1 week or less), with the freezing temperature, freezing rate and time frozen varied between sets. None of the pre-freezing treatments had a noticeable effect on drying degrade or drying rate. There was no indication that pre-freezing had any effect on the wood stiffness during drying. However overall levels of degrade were significantly lower than expected, suggesting the incidence of drying degrade vary by forest resource. The next step is to looking at screening the resource and then checking the pre-freezing experiments with material that is known to check.

## Naturally durable eucalypt posts

Naturally durable eucalypt post and strainers have been installed in vineyards (photo of *E. bosistoana* below). It has been observed that less than 1% have failed despite the block being machine harvested and pruned. This compares to an expected failure rate of 3-5% with CCA treated pine posts. In the recent drought conditions, some vineyards had reported losses of 10 – 12%.



## GENETICS

### Douglas-fir

A Douglas-fir breeding workshop was held in Christchurch in June 2016 and it defined breeding objectives for producing high quality wood products and for increased wood production. Industry direction resulted in updated breeding targets for growth and form, wood quality and resistance to Swiss Needle Cast (SNC). The target for growth is a 35 year rotation length and yield of 600 m<sup>3</sup> TRV per ha including 20 m<sup>3</sup> per ha MAI. Form is an essential selection criteria and the target should be retained at the current level. Wood stiffness will be maintained at a minimum level of 8 GPa. SNC is the major limiting factor for growing Douglas-fir more widely in the Central North Island. Consequently, needle retention indicating resistance to SNC is critical and the long-term target was set to needle retention of 3 years. Industry also ranked the need for sterility very highly as the threat of wildings is currently limiting planting opportunities. Dr Glenn Howe (Oregon State University) visited Scion and SWP partners, as an international expert contributing to the Douglas-fir breeding workshop.







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## *E. Nitens*

Breeding in *E. nitens* will result in improved tree material for sawn timber properties (including wood density, growth strain, stiffness, shrinkage/collapse and internal checking). The wood property genetics study, resulted in two new seed-orchards that will produce improved germ-plasm specifically for solid wood products, and simultaneously maintaining high-quality production for pulp. Genomic selection to further boost genetic improvement of *E. nitens* breeding population was initiated, indicating improved accuracy of estimated breeding values in open-pollinated population.



## Naturally durable eucalypts

### 1. Heartwood

Heartwood is the durable part of the tree hence its quantity and quality are key to assess and improve. To achieve market acceptance the heartwood will need to perform at least as well as the current (imported) products. A light-weight, battery-powered increment corer was developed, which enables efficient sampling of young trees (photos top right). The heartwood diameter on the cores can be reliably measured by highlighting it with a stain.



As an indicator of heartwood quality a method is being trialled to predict extractive content on the cores by NIR (Near infrared spectroscopy). The 1<sup>st</sup> breeding populations of *E. bosistoana* have been assessed for heartwood properties.

Little information is available about heartwood formation in young trees. Observations have shown the presence of fully developed heartwood in 6 year-old in *E. bosistoana*. This is a critical driver for rotation length required to produce naturally durable timber.

### 2. Growth strain

A main factor restricting the use of plantation grown eucalypts for solid-wood processing is the frequent presence of large growth-stresses in these trees which cause splitting and distortion of the timber. The photo below shows the split in the stem of a young tree, the length of which is measured and used to rank that tree or family for splitting propensity.



No quick non-destructive technique of assessing growth-strain in stems is available. A concept for the non-destructive assessment of growth-strain in wood has



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been developed. If successful this would allow the identification of logs from existing eucalypts plantations which are suitable for higher value solid wood processing.

## Cypresses

Cypresses are highly valued by furniture makers and carvers. *Cupressus lusitanica* progeny trials were evaluated for growth and health (canker) indicating good selection possibilities to improve tree material. New selections will be included in seed orchards, delivering new seed to industry in 5-7 years. Long term evaluation of the performance of Cypress hybrids relative to pure *C. lusitanica* and *C. macrocarpa* continued. This project evaluates resistance of cypress hybrids to cypress canker.

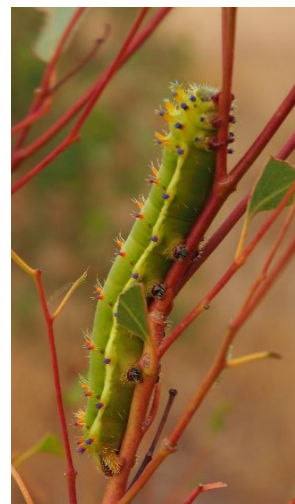


## OTHER

### Pest management

Around 30 insect species feed specifically on *Eucalyptus* in New Zealand. Several are known to cause significant damage. This could potentially restrict the growth of plantation eucalypts for solid wood processing. Fortunately, susceptibility to insect attack is highly variable between eucalypt species and families, however little to no information is available on the relative susceptibility of *E. bosistoana*. To ensure breeding populations are suitably pest tolerant a defoliation trial on *E. bosistoana*

was established to quantify the capacity of this species to tolerate and recover from insect attack (photo shows manually defoliated plant and Gum Emperor caterpillar). Data will be collected for at least one more season and combined results will enable the protection of the resource against pest damage and provide sustainable pest management recommendations to end users.



### Site species mapping

Current site-species mapping of *Eucalyptus* species does not include durable species and the regional mapping scale limits utility for growers. To address these issues, site-species matching has been undertaken, for *E. bosistoana* and *E. globoidea*, informed by micro-site variation. Fine-scale mapping of topography, weather, and soil conditions at two sites in Marlborough have been completed. Photo below shows growth variability within a site.

Production and suitability of alternative species across different sites in New Zealand are able to be predicted using different productivity models. These options were extensively reviewed for *Eucalyptus fastigata*, *E. nitens*, *E. regnans*, *Sequoia sempervirens* (coastal redwood),





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*Pseudotsuga menziesii* (Douglas-fir), *Cupressus lusitanica*, and *C. macrocarpa* in a sites species mapping exercise. The recommendations made will provide a discussion base for the SWP workshop to be held on this topic on 1<sup>st</sup> November to decide priorities for research in this area.



## Reports completed

Report No.	Document Title
SWP-T001	Results of Assessments in FR375, Beaumont Controlled-pollinated 1999 Progeny Trial
SWP-T002	Literature review: measuring growth-strain by IR-spectroscopy
SWP-T003	Breeding Plan for the Development of Douglas-fir
SWP-T004	Alternative Species Site Mapping Review and Analysis
SWP-T005	Selection for solid wood properties in <i>Eucalyptus nitens</i>
SWP-T006	Initial evaluation of genomic selection to improve wood property in <i>Eucalyptus nitens</i> breeding population
SWP-T007	Douglas-fir Optimised Engineered Lumber (OEL) Trial
SWP-T008	Improving drying quality of Eucalyptus Nitens Timber: Results to date
SWP-T011	Scion's core funded experiments on thermal modification of <i>Eucalyptus nitens</i>
SWP-T012	Heartwood formation in young <i>Eucalyptus bosistoana</i>
SWP-T013	Super critical CO <sub>2</sub> chemical extraction - core funding