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## Summary

### Highlights

- A Cypress sawing study was undertaken on 22-year-old unthinned and unpruned *C. x ovensii* and *C. lusitanica* (GH5) clones. For both clones the thermally modified cladding economic scenario had the highest margins.
- A study has shown that the decay resistance (not just extractive content) in durable eucs could be assessed rapidly and efficiently using NIR technology for genetic selection. These results confirm that ongoing NIR assessments in the breeding programme to improve timber durability (a key trait for the species) will be successful. This technique should also allow higher durability to be achieved at younger ages, compared to an unimproved genetic base.
- Douglas-fir CLT tests show that screw connections were able to be repaired following an earthquake. Repair methods had broadly similar behaviour to the original connection. These connection results provide valuable technical information for engineers to design mass timber structures utilising Douglas-fir CLT in the lateral load resisting system to resist seismic loads.
- Douglas-fir strategy work showed that the lowest risk, lowest cost option was log export. Douglas-fir log supply could be smoothed and give more confidence longer term to processors by co-processing with radiata and/or lifting rotation age.

## RESEARCH PROGRESS: Q2 Year 6

### Douglas-fir

Douglas-fir CLT testing continues and a report shows experimental results of high-capacity hold-down connections using self-tapping screws installed with mixed angles (inclined and 90° angle to the timber surface – see example below).

It was found that:

- Fully threaded screws can provide higher stiffness and more load carrying capacity per fastener.
- The ratio of 1:2 (number of withdrawal screws to number of shear screws) was found to be the optimum ratio (compared to 1:1 and 1:1.5).
- Double sided horizontal hold-down tests provided significant displacement capacity performance.
- Tests prove the suitability of mixed angle screw hold-down connections to be able to be repaired following an earthquake. Both repair methods had broadly similar behaviour to the original connection.

These connection results provide valuable technical information for engineers to design mass timber structures utilising Douglas-fir CLT in the lateral load resisting system to resist seismic loads.

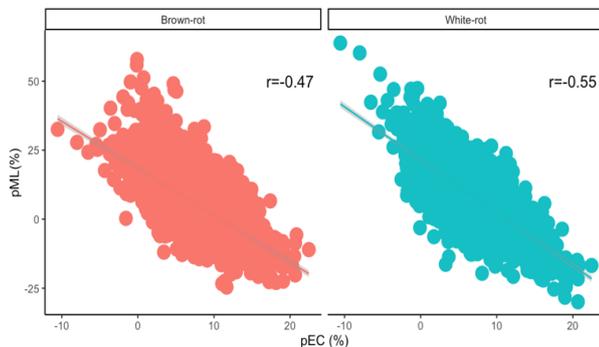




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## Naturally durable eucalypts

A trial was undertaken on *Eucalyptus bosistoana* to examine how well extractive content was related to mass loss under durability testing. The ability of NIR measures to predict the mass loss was then examined. Figure below shows the negative relationship between extractive % and mass loss of samples after exposure to both white and brown rot.



NIR was well correlated to extractive content and mass loss. However, the study indicated a significant site effect on the decay resistance of the *E. bosistoana* heartwood. In summary, this study has shown that the decay resistance could be assessed rapidly and efficiently using NIR technology for genetic selection.

## Cypresses

A growing economic analysis was performed on a short rotation (22 year) no prune and no thin *C. x ovensii* regime using the FGR Cypress Calculator. It appears to be profitable based on a range of site productivities, log prices and starting land values. The analysis was carried out using *C. x ovensii* PSP data from a range of sites supplied by industry.

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A Cypress sawing study was undertaken on 22-year-old unthinned and unpruned *C. x ovensii* and *C. lusitanica* (GH5) clones. Overall volume recoveries were good, with 51% of the volume of logs harvested

converted into graded timber. Grade recoveries were very high with over 90% of boards reaching the top appearance grade (modified Dressing grade, which allows intergrown knots), and almost all boards reaching No. 1 framing grade.



Acoustic stiffness was similar for each species (average 8.7 GPa) with a lot of variation between boards. The basic (oven dry) density of *C. x ovensii* was significantly higher than the GH5 (average 450kg/m<sup>3</sup> and 360 kg/m<sup>3</sup> respectively).

A brief economic analysis was performed to gauge the viability of sawing young unpruned trees. Three scenarios, each with an emphasis on different products, were compared: Thermally modified cladding; Interior panelling; and exterior products from 100% heartwood boards. For both clones the thermally modified cladding scenario had the highest margins (product price minus processing cost). This suggests that producing thermally modified cladding from young unpruned trees could be viable, and that the continued development and testing of thermally modified cypress is a priority.

## Pest management

A wide range of insects can affect Eucalyptus trees in New Zealand. *Paropsis charybdis* and *Paropsisterna cloelia* (EVB – photo below) are the most frequently observed in *Eucalyptus* plantations and cause the most damage. *Eucalyptus* tolerance to insect defoliation is poorly understood but must be quantified across species and families to select appropriate



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breeding lines. It was found that the Crown Damage Index (CDI) is the best technique currently available to assess defoliation. There was substantial range in the defoliation both between and within species and individual outliers with minimal defoliation are candidates for further investigation. Baseline DBH and height measurements were taken to inform future estimates of tolerance after repeated sampling.



## Regional business cases

A strategy workshop for Cypress was held in Wellington on the 29<sup>th</sup> of October. There was a very useful cross-section of perspective and expertise at the meeting and good progress was made. A draft vision was proposed; “Cypress – New Zealand’s No. 1 naturally durable softwood species”. Five theme areas were identified; 1) Producing cypresses: breeding and propagation, 2) Growing cypresses: selection, establishment and silviculture, 3) Harvesting and processing cypresses, 4) Cypress markets and marketing and 5) Communications and collaboration. Goals against each of them were drafted. The meeting has been documented and a short concise draft strategy will be developed which can then be used to develop detailed and prioritised actions by a wider group.

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Two reports around Douglas-fir processing opportunities have been produced. Of the options available for the use of Douglas-fir logs the least-cost/lowest-risk option is that of exporting whole logs. Douglas-fir logs command a premium over radiata logs in the markets they are traded.

Structural sawmilling strategies alone did not appear as attractive options for new investment when D-fir products are marketed directly into niches occupied by radiata. However, market niches that suit D-fir’s strengths, and/or further processing of D-fir into engineered products can generate more value and support better returns to the grower.

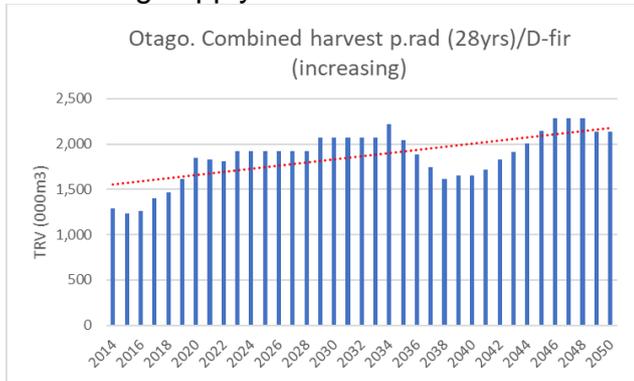


Forest management strategies that may assist or support processing investment include – allowing harvest age to increase (up to 50 years in some regions) to spread spikes in supply and provide longer-term and less erratic supply to those prepared to invest in processing capacity  
– co-processing with radiata in existing and/or new mills to help even the log supply  
– exporting excess logs to global markets  
– a combinations of these.  
The figure below shows what a combined radiata/Douglas-fir harvest (at ages 28 and



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40 respectively) would do to smooth the overall log supply.



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An analysis of the treated wood market for agricultural and horticultural uses estimated that there that the market is most likely in the ~270,000 to 310,000m<sup>3</sup> range. Three different methods were used to derive this number (use per ha, a manufacturer's estimate and a log resource use estimate).

The organic post and pole market is estimated to be in the range of 6,000 and 14,000m<sup>3</sup> which is the logical area where the naturally durable timbers will target first.

It was estimated that there are 6.9 million m<sup>3</sup> of CCA treated timber existing currently in agricultural and horticultural systems which presents a significant disposal liability.

## Reports completed

Report No.	Document Title
SWP-PW05	Using NIR to quantify durability in <i>Eucalyptus bosistoana</i>
SWP-T112	A Strategy for the NZ Cypress Industry - Workshop report and draft action plan
SWP-T113	Douglas fir Processing Opportunities - Part 2.
SWP-T114	Analysis of the treated wood market for Agricultural and Horticultural uses in New Zealand

SWP-T115	Economic modelling of a <i>C. ovensii</i> clonal regimes for a range of growth rates
SWP-T116	Grade recoveries from sawing 20-year-old unpruned cypress clones
SWP-T117	Douglas-fir Regional Processing Strategy - Part 3
SWP-T118	<i>Eucalyptus</i> resistance to paropsine beetles.
SWP-T119	Experimental testing of high-capacity screwed connections in Douglas-fir CLT