SPECIALTY WOOD PRODUCTS PROGRAMME UPDATE

FOREST GROWERS RESEARCH

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Summary

Highlights

Douglas-fir trials were assessed, and the best provenances and families identified for growth, form and branching.

LiDAR scanning can predict defoliation levels due to insect browsing on Eucalypts. The least impacted species for insect browsing were *E. macrorhyncha* and *E. cladocalyx.*

E. globoidea machined very well in evaluation trials. Only the initial sanding results were poorer than radiata, but the process was fine tuned to give a "Grade 1" finish.

A remote sensing project revealed that NEFD tends to underestimate the total area of small-scale alternative species.

RESEARCH PROGRESS: Q2 Year 8

Douglas-fir

Two sets of Douglas-fir trials have been assessed.

Scion's Douglas-fir breeding program is continuing in genetic improvement of traits related to productivity and stem form by establishment of new generation of progeny trial. The latest generation of progeny test was established in 2011 and recently measured for standard traits at age of 10 years on two sites (Kaingaroa and Gowan Hill).

The most productive families at Gowan Hill were from California, Ashly, and Fort Bragg. The unfavourable genetic correlation between DBH and Branching (BRH) will require selection of correlation breakers to select individuals with above-average DBH and below-average BRH. In stem straightness and malformation, the top families were from Washington and Oregon. Best-performing families in Kaingaroa were from California, NZ Ashley, and Fort Bragg. Again, a search for correlation breakers will be required to make genetic improvement in both DBH and BRH simultaneously. Stem straightness was highest in Fort Bragg, Washington, and Oregon, whereas malformation was best in California.

The field experiments for the evaluation of realised genetic gain were established in 2012 and 2013 across New Zealand and measured for productivity and stem-form attributes in 2022.

In stem form traits, the seed sources based on selections from Ashley, Oregon, and Fort Bragg showed superior performance for stem form attributes in the North Island, while the seed sources based on selections from California showed the worst. Even in northern South Island (Blenheim), the seed sources based on Ashley provenance were excellent. Similar to productivity, seed sources based on selections from California provenances were superior in stem form attributes due to the lack of Swiss needle casting. The seed sources from Tyrell SO and Washington seed stands performed the worst in South Island stem form traits.

In terms of acceptability, the seed sources based on selections from Fort Bragg, Oregon, and Ashley provenances had the highest general acceptance on the North Island, while the selections from Tramway and Californian provenances had the lowest. In the South Island, the seed sources based on selections from Ashley, Fort Bragg, and California provenances had the highest acceptability in the north, and the seed sources based on selections from Fort Bragg and Washington provenances had the highest acceptability in the south. The seed sources from Washington Seed Stand and Tyrell SO had the lowest acceptability on the South Island.

Naturally durable eucalypts

Literature reports of *E. quadrangulata* timber featuring collapse were confirmed. Heartwood collapse was under genetic control and could be reduced in a future plantation resource by appropriate selections.

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Three LiDAR scanners were used to collect data from a Eucalyptus trial in the Canterbury region to evaluate the paropsine (insect) defoliation prediction accuracy versus ground-based estimates of defoliation (CDI system shown below).

5% defoliated

12% defoliated

20% defoliated

33% defoliated
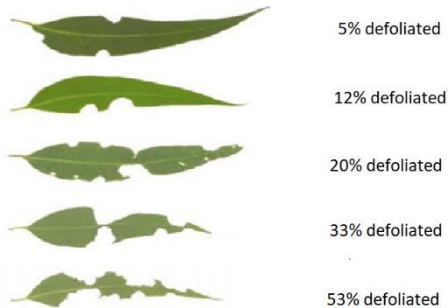
53% defoliated

The results demonstrated showed that LiDAR scanners could predict CDI from the actual CDI observed in the field. All three scanners had comparable predictive abilities, meaning that all could possibly be used for paropsine defoliation assessment.

More testing needs to be undertaken to determine whether LiDAR can differentiate between paropsine beetle defoliation and trees where other stresses have led to small leaves and/or sparse crowns.

Figure below shows the level of insect browsing on 7 species on the Marlborough site. Four species most impacted by insect attack were *E. camaldulensis, E. tricarpa, E. bosistoana* and *E. quadrangulata. E. globoidea* had less browsing than those 4 and the least impacted species were *E. macrorhyncha* and *E. cladocalyx.*

Species from Marlborough site

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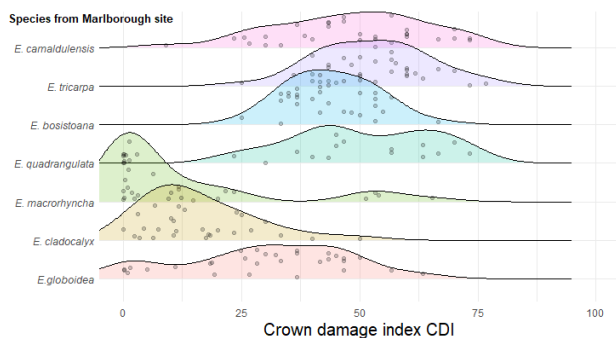
A study was undertaken on the machinability of 28-year-old *E. globoidea* timber sourced from Banks Peninsula and compared the results with the same tests on radiata pine. The radiata pine had an average air-dry density of 460 kg/m^3, compared to the *E. globoidea* which had a density of 723 kg/m^3.

The tests were: planing, sanding, shaping (edging and grooving), boring, mortising and turning. Image of a turning sample below.

Wedge   Convex   Flat   Concave
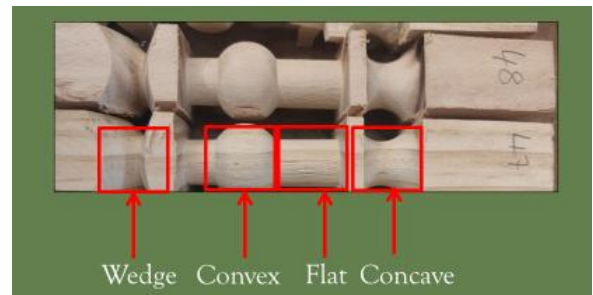
In general, the *E. globoidea* machined very well. Machinability was scored at various points in each operation, with the only low machinability scores occurring at certain points in some tests – for example as the tool exited the wood when grooving, boring and mortising.

The only significant difference in the results between *E. globoidea* and radiata pine was in the sanding operation, where 120 grit sandpaper became gummed up, resulting in the wood surface being burnt. The problem was solved by sanding to 0.5mm depth instead of 1.2 mm, and a 'Grade 1' finish was achieved with the second approach.

Demonstration products (see Kubb game and LVL below), which were produced and displayed at the National Field Days 2022. An outdoor bench was installed prominently at the entrance to the School of Forestry.

Durability

Framing durability trials have been under test for a year now. List below shows the species and timber types under test.

- *E. fastigata*, mixed heartwood\sapwood, untreated and boron treated.
- *E. fastigata*, LVL, untreated and boron treated.
- *E. nitens*, untreated and boron treated.
- *E. regnans*, heartwood, untreated
- *Cupressus macrocarpa*, young and old trees, heartwood, untreated.
- *Cupressus x ovensii*, heartwood, untreated.
- Larch, heartwood, untreated.
- Douglas fir, mixed heartwood\sapwood, untreated.
- Radiata pine, mixed heartwood\sapwood, untreated and H1.2 boron treated.

After one year's exposure in accelerated decay conditions:
• Lightly established decay had developed in untreated *E. fastigata* mixed heartwood\sapwood solid wood, untreated *E. regnans* heartwood, untreated Douglas fir mixed heartwood\sapwood and untreated radiata pine mixed heartwood\sapwood.
• The first stages of decay had developed in untreated *E. fastigata* LVL, untreated *E. nitens*, untreated *C. macrocarpa* from young and old trees, and untreated *Cupressus x ovensii*.
• There was no decay observed in any of the boron treated samples. This includes boron treatment of solid wood of *E. fastigata* and radiata pine along with laminated *E. nitens* and *E. fastigata* LVL.

It is recommended that this test is continued and assessed after two year's exposure in accelerated decay conditions.

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Molecular research has continued this year on cypress canker with an additional gene region sequenced. Analysis grouped the 47 isolates into four different clades, representing two known species, namely *Seiridium cancrinum* and *neocupressi*, and two novel clades. These results could have implications for management and resistance breeding programmes. This information will help us understand which are the more important *Seiridium* species and the threat they pose to cypress in New Zealand.

Pest management

A new ambrosia beetle (image below) known as GAB, *Xylosandrus crassiusculus*, has been introduced into New Zealand in 2019. It is native to East Asia and has been a highly successful invader worldwide. Like most invasive ambrosia beetles, *X. crassiusculus* can attack a wide range of woody plants.

Often the first sign of an attack is the sawdust released by the excavating adult, which takes the form of compacted "noodles" extruding from the tree trunk (see image below). It is hypothesized that Eucalyptus trees (among other hardwoods), but only those under stress (emitting ethanol as a stress response), will be under threat of attack from this pest.

Reports and other outputs completed

Report No.	Document Title
SWP-T151	Forest Protection SSIF research on species other than radiata pine 2021/22
SWP-T152	Genetic variation in collapse and other wood properties of Eucalyptus quadrangulata at mid-rotation age
SWP-T153	Assessing paropsine damage on Eucalyptus trees with remote sensing
SWP-T155	Machinability of 28-year-old *Eucalyptus globoidea* wood
SWP-T159	National forest owner survey and resource inventory of alternative species
SWP-T160	The decay resistance of alternative species in an accelerated framing test Assessment of decay after one year's exposure
SWP-T161	Evaluation of Douglas-fir progeny test FR508/1 and FR508/2
SWP-T162	Evaluation of genetic gain trials in Douglas-fir

Regional strategies

A remote sensing approach to classify alternative species of small-scale plantations in the East Coast wood supply region (i.e., Gisborne District) was trialled. With additional truthing data, the approach achieved 92.9% overall classification accuracy. Douglas-fir and Eucalyptus were the two most accurately classified alternative species categories, with producer's accuracies of 97.2 and 94.0% respectively. The most important input variable selected for the classification was DEM (Digital Elevation Model), suggesting that elevation plays an important role in differentiating plantation species.

When applying the classification to the East Coast region, overall 4,582 ha of small-scale alternative species were mapped and the most common alternative species categories are Douglas-fir and Eucalyptus, accounting for 35% and 30% of the total small-scale alternative species resources. Acacia and poplar are the least common alternative species identified, with 72 ha and 59 ha estimated respectively. When aggregated with the area provided by the large-scale owners, in total 5,353 ha of alternative species were estimated in the East Coast region. This is 780 ha (17%) more than the NEFD-reported area. The area of cypress, other softwoods and hardwoods are similar to the NEFD area. However, Douglas-fir was 245 ha (12%) less than the NEFD area and the estimated Eucalyptus area was three times more than the NEFD area. Overall, it appears that NEFD underestimates the total area of small-scale alternative species.