Minimising growth-strain to improve processing

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Growth-strain

• Distortion and splitting of logs

• Low recovery

• Plantation eucalyptus only grown for low value chip market
Peeling trial
10 trees (26 logs) 30-year old *E. globoidea*

- Some logs yielded quality veneer
- Veneer from other logs showed splitting
Cause of veneer splitting

- Peeling quality correlated to growth-strain **not** acoustic velocity (MoE)
Reducing growth-strain

Breeding
- Will solve/reduce problem permanently
- Only for the future resource

Segregation
- Segregating (low growth strain) logs suitable for solid wood processing from the chip resource
- For existing resource and potentially to identify problem logs in future resource
- Technology does not currently exist (non-destructive, fast and robust)

Processing
Reducing processing by heat, microwave or other treatment
→ ongoing cost, never made work economically
Obstacle

Measurement
- Releasing surface strains & assessing with strain-gauges
- 30 min per tree
- Destructive

Breeding
- Need to assess 10,000s of trees
- **Fast**, cheap

Segregation
- Non-destructive, fast
Breeding

SFF ‘Minimising growth-strain to improve processing’

Partners throughout the wood chain
- seed producers, nurseries, small & large growers, processors, end-users, state, university

Screening NZDFI breeding population for growth-strain
- *E. bosistoana*; *E. argophloia*; *E. tricarpa*; *E. quadrangulata*
- >300 families / ~20,000 trees

Establish improved breeding population via rooting of cuttings
- Possible early deployment of improved material
Splitting test

- Developed over the last 6 years
- Rapid test of growth-strain
- Direct assessment of the problem not indirectly a cause (i.e. surface growth-strain)
- Works in a breeding programme
Process
## Heritability

81 families; 4032 trees

<table>
<thead>
<tr>
<th></th>
<th>Strain</th>
<th>Diameter</th>
<th>Density</th>
<th>Stiffness</th>
<th>Vol. shrinkage</th>
<th>Height</th>
<th>Ac. vel.</th>
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<tbody>
<tr>
<td>Growth-strain</td>
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<tr>
<td>Diameter</td>
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## Correlations

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<td>-0.09</td>
<td><strong>0.40</strong></td>
<td>-0.06</td>
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<td>Vol. shrinkage</td>
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</tbody>
</table>
# Expected gain

New breeding population:
- Top 25% - keeping broad genetic base (within-family selection)
- Selected mainly for growth-strain and diameter

<table>
<thead>
<tr>
<th></th>
<th>New breeding population multivariate</th>
<th>Top 1% univariate</th>
<th>Mean</th>
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<tbody>
<tr>
<td>Growth-strain (μs)</td>
<td>-108</td>
<td>-912</td>
<td>2072</td>
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<tr>
<td>Diameter (mm)</td>
<td>3.1</td>
<td>13.6</td>
<td>36</td>
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<tr>
<td>Density (kg/m³)</td>
<td>-6.6</td>
<td>-88.5</td>
<td>815</td>
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<td>Stiffness (GPa)</td>
<td>-0.42</td>
<td>2.6</td>
<td>11.2</td>
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<tr>
<td>Vol. shrinkage (%)</td>
<td>-0.2</td>
<td>-4</td>
<td>20</td>
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<td>Height (mm)</td>
<td>231</td>
<td>944</td>
<td>2,388</td>
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<td>Ac. vel. (km/s)</td>
<td>-0.06</td>
<td>0.44</td>
<td>3.69</td>
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Segregation

Identifying low growth-strain trees in the existing/future resource

- In mill/in forest screening
- Better value recovery

Requirements
- Non-destructive
- Fast
- Work in an industrial setting
Molecular strain

- Macroscopic strain is reflected in molecular strain
Effect of strain on NIR spectra

- Band shifts at 6465 cm\(^{-1}\) and 6286 cm\(^{-1}\)
Accuracy of NIR

dry wood – lab conditions

- Linear relationships between peak positions and strain levels
- Mean slope: $1.04 \times 10^{-3} \text{ cm}^{-1}/\mu\varepsilon$
- Accuracy of measurement: $\sim 0.3 \text{ cm}^{-1}$
- Expected band shift due to growth-stress: $\sim 5 \text{ cm}^{-1}$