# Veneer and LVL from New Zealand grown *Eucalyptus globoidea*

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# Background

*A 350 m timber skyscraper proposed by Sumitomo Forestry*

*53 m tall timber building Vancouver, Canada*

# Potential of NZDFI eucalyptus

- *High stiffness*
- Durability: Preservative-free

| Species | Air-dry density at 12% MC (kg/m3) | MoE (GPa) | MoR (MPa) |
|---|---|---|---|
| *E. nitens* | 700 | 13 | 99 |
| ***E. boisistoana*** | 1100 | **21** | 163 |
| ***E. quadrangulata*** | 1030 | **18** | 163 |
| ***E. globoidea*** | 880 | **17** | 133 |
| *P. radiata* | 480 | 9.1 | 76 |

Note: Data from Australian old-growth trees (*Bootle, 2005).*

# Growth-stress

Heart Checks

Veneer Checks

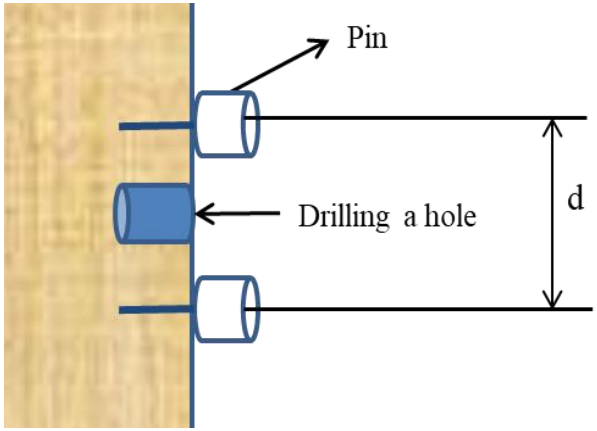

End Splitting

- Growth-stresses are also related to internal checking during drying, board distortion during sawing etc.

# Methods

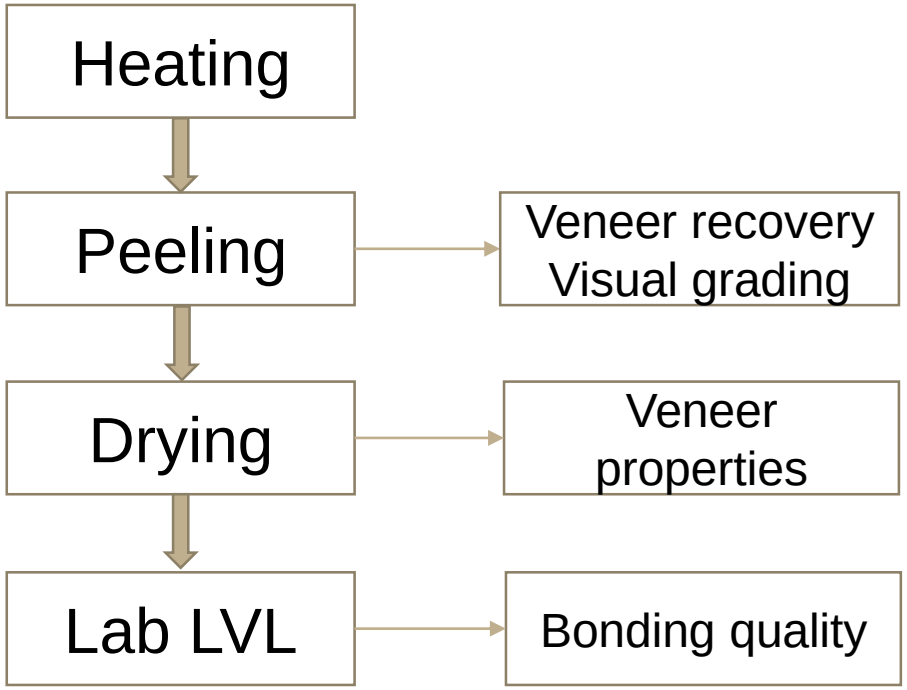
- Nine trees (30-year-old)
- 26 logs (2.7 m long)

- Growth-strain measurement
  - *CIRAD method*
  - *4 positions per log*



# Rotary peeling and veneer evaluation

- *Nelson Pine Industries (NPI)*
- $\textit{Veneer recovery} = \frac{\textit{veneer volume}}{\textit{log volume}} \times 100\%$




1) 100% eucalypt; 2) 50% eucalypt + 50% pine

# Methods

- Veneer properties
  - *Splitting length*
  - *Dried density and MC*
  - *Shrinkage*
  - *Dynamic MoE*
- Bonding quality
  - *AS/NZS 2269.0*
  - *Mean ≥5, Min≥2*

*Gluelines with bond quality of 4 (top) and 0 (bottom)*

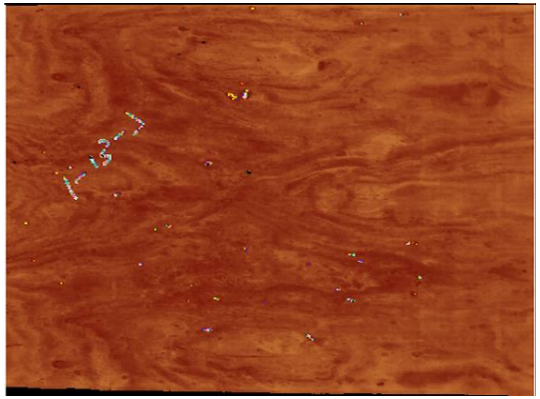
# Results

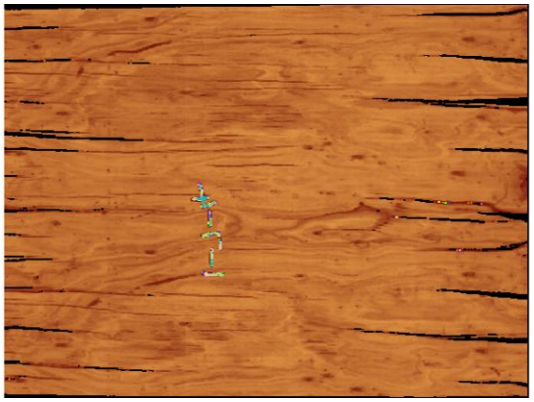
- Veneer recovery and splitting

| | Recovery (%) | Useable veneer (%) | Strain (με) | Splitting length per veneer (m) |
|---|---|---|---|---|
| Mean | 54.5 | 33.4 | 839.4 | 3.01 |
| SD | 14.2 | 23.7 | 181.7 | 2.57 |
| Minimum | 23.6 | 0.0 | 553.9 | 0.15 |
| Maximum | 74.5 | 74.5 | 1136.8 | 8.66 |

Note 1: Average recovery of radiata pine: ~70%. Eucalypt had greater peeler core and clipper wastes.
Note 2: Veneers were graded to face, core, composer and waste classes; Face and core classes were considered as usable veneers.

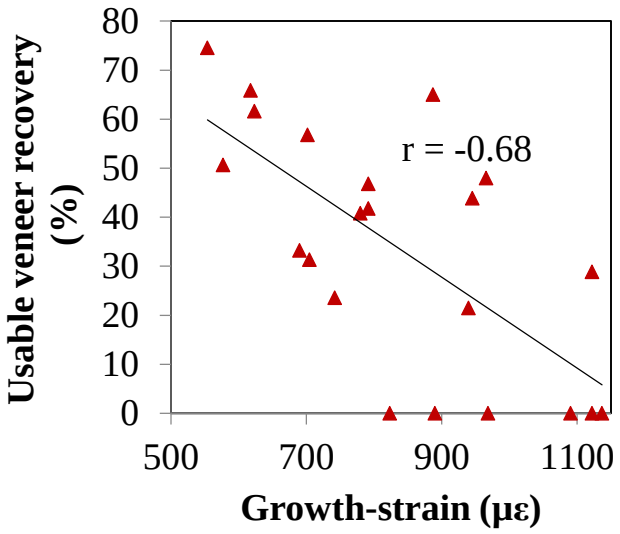
# Veneer recovery and splitting

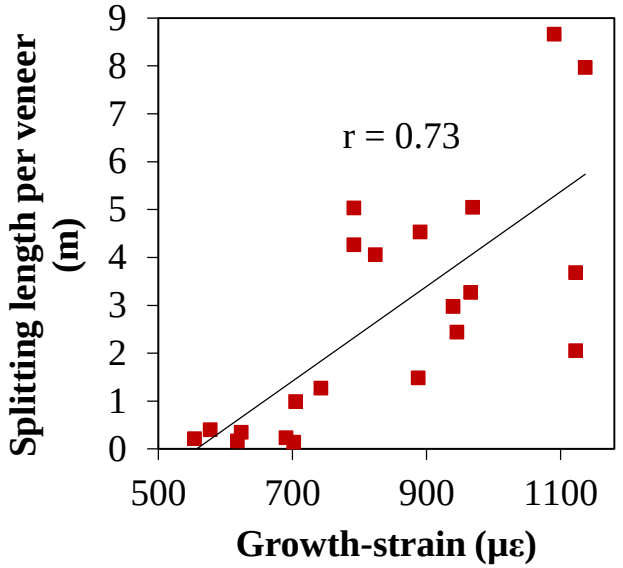




Face grade veneer with no splitting (left) and composer grade veneer with severe splitting (right)

# Veneer recovery and splitting




*Dependence of veneer recovery and splitting length on growth-strain*

# Properties of *E. globoidea* veneer

| | Dried density ($kg/m^3$) | Moisture content (%) | Shrinkage (%) | Dynamic MoE (GPa) |
|---|---|---|---|---|
| Mean | 688.13 | 7.31 | 9.85 | 15.14* |
| SD | 68.55 | 1.09 | 0.77 | 2.05 |
| Minimum | 557.41 | 5.51 | 8.46 | 11.04 |
| Maximum | 824.00 | 9.32 | 11.31 | 19.51 |

Note: *Estimated static MoE: ~13 Gpa;
Shrinkage for *P. radiata*: 4.4% ~ 6.4%.

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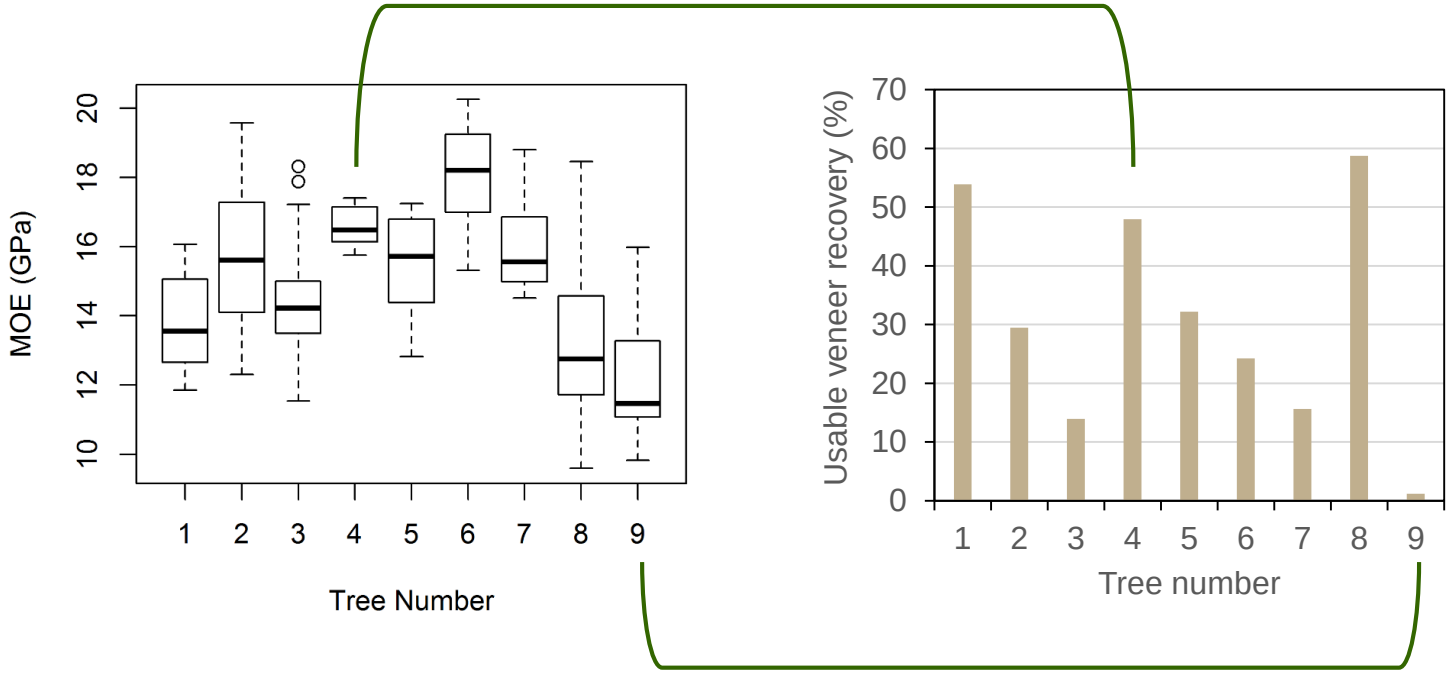
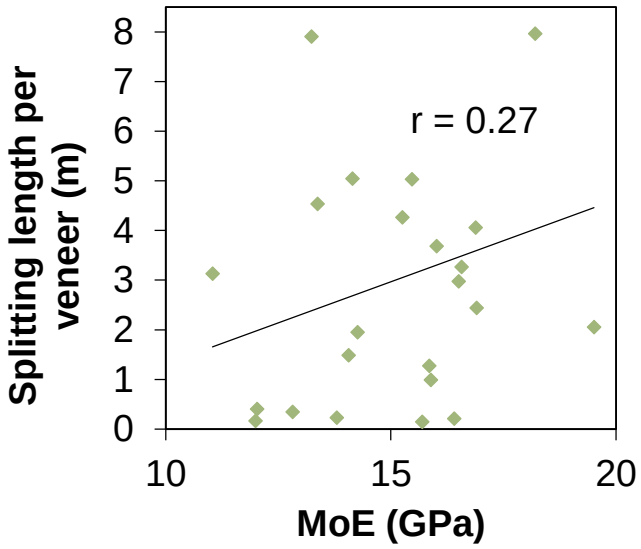
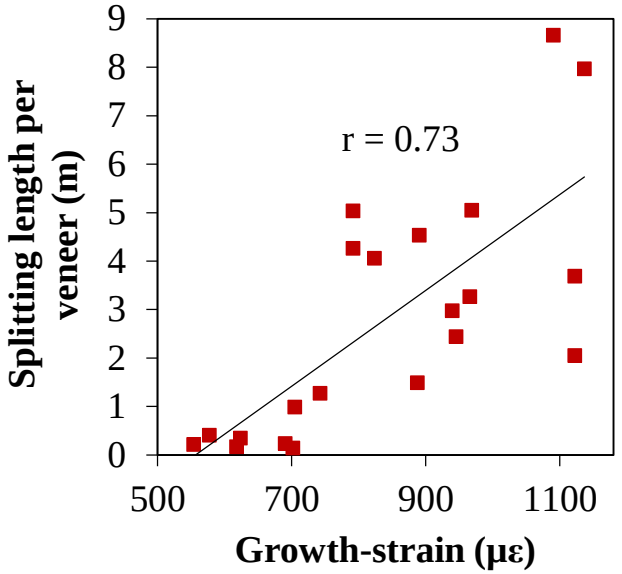



Note: Significant differences ($P < 0.001$) between trees.

# Properties of *E. globoidea* veneer




*Association between veneer splitting and MoE as well as growth-strain*

# Bond quality

Bond tests of LVL made from *E. globoidea* veneers

| Veneer | Grade | Density | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 | 8-9 | 9-10 | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Euca | 12GPa | 640.51 | 5 | 1 | 4 | 1 | 2 | 2 | 3 | 0 | 1 | 2 |
| | 16GPa | 696.92 | 9 | 4 | 5 | 7 | 7 | 6 | 6 | 1 | 5 | 6 |
| | 16GPa | 702.52 | 8 | 3 | 7 | 8 | 8 | 9 | 7 | 2 | 8 | 7 |
| | 16GPa | 806.83 | 3 | 0 | 5 | 2 | 1 | 2 | 1 | 1 | 1 | 2 |
| | 14GPa | 809.22 | 3 | 2 | 4 | 3 | 1 | 1 | 1 | 0 | 3 | 2 |
| | 17.5GPa | 860.05 | 7 | 0 | 1 | 1 | 5 | 7 | 5 | 0 | 2 | 3 |

Bond tests of LVL made from *E. globoidea and P. radiata* veneers

| Veneer | 1-2 E-R | 2-3 R-E | 3-4 E-R | **4-5 R-R** | 5-6 R-E | 6-7 E-R | 7-8 R-E | 8-9 E-R | 9-10 R-E | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| G4 Rad + Euc A | 8 | 5 | 1 | **9** | 8 | 6 | 8 | 6 | 9 | 7 |
| G4 Rad + Euc B | 6 | 4 | 2 | **8** | 8 | 6 | 7 | 0 | 9 | 6 |
| G2 Rad + Euc A | 4 | 3 | 3 | **9** | 7 | 5 | 8 | 9 | 9 | 6 |
| G2 Rad + Euc B | 5 | 2 | 1 | **9** | 7 | 7 | 8 | 3 | 8 | 6 |

Note: Bond quality range from 0 to 10, with 0 is the worst and 10 the best.

# Conclusions

- *Usable veneers for structural products could be obtained from E. globoidea at yields up to 74.5%, but variation was large.*
- *A technical solution for gluing E. globoidea needs to be developed.*
- *Growth-strain reduced veneer recovery by splitting, largely independent of stiffness. A breeding program could potentially address this problem by selecting families with low growth-strain levels.*

# Acknowledgement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