Eucalyptus globoidea peeling/LVL trial

Part of the SFF project "Minimising growth-strain in eucalypts to transform processing" is a peeling/LVL trial to test the suitability of NZDFI eucalypts for LVL production. These eucalypts have a higher stiffness and density than radiata pine. They are also naturally durable. But these eucalypts are more challenging to process. Logs often split making peeling into veneers difficult. Splitting is thought to be associated with internal growth-strain in the trees. The SFF project aims to reduce growth-strain in the trees through a breeding programme to a level at which processing is viable.

Material and methods

Ten *E. globoidea* trees were felled from a 30 year old stand located in the lower North Island on the 31st May 2016 (Figure 1). Immediately after felling the stems were manually debarked (Figure 2). The acoustic velocity was measured with the Hitman tool. From the ten stems 26 suitable logs for peeling of 2.7 m length could be recovered. The small end (SED) and large end diameters (LED) were measured for each log enabling the calculation of log volume.

Figure 1: 30 year old *E. globoidea* stand

Figure 2: Debarked *E. globoidea* logs

For each log the amount of growth-strain was determined with the CIRAD method (Figure 3). First two pins were punched into the log using a template. The template ensured that the pins were placed a set distance apart in axial direction. Then the growth-strain was released by drilling a ~2 cm deep hole centered between the two pins. The change in the distance between the pins was monitored with a dial gauge placed in a frame. The measured change in distance between the pins represents the magnitude of growth-strain in the log at the assessed position. Growth-strain is variable on the surface of a stem. Therefore growth-strain was measured on four positions at ~1.35 m spaced by ~90^0 around the circumference of each 2.7 m log. The four assessments for each log were averaged. Measuring points were chosen in straight-grained areas in close proximity to the above described positions.

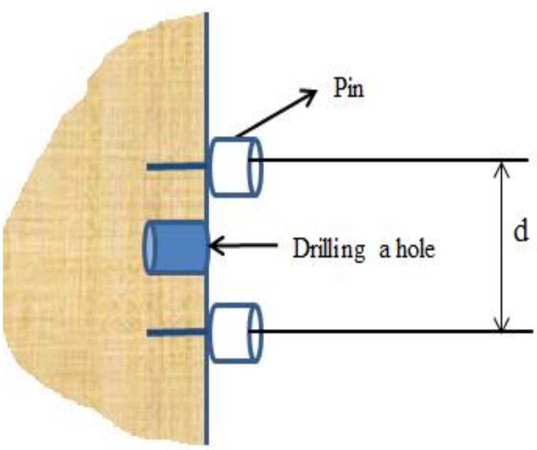

Figure 3: Growth-strain measurement with the CIRAD device

The trees were transported to Nelson Pine Industries Ltd, Richmond for processing. The logs were heated for 24 h in a water bath before peeling on the 8th of June (Figure 4). During the peeling process gross recovery, green recovery, and different waste (core, round up, spur, clipper defects) volumes were recorded for each log. After clipping 296 veneer sheets were obtained. The green veneer sheets were visually graded to 4 classes (face, core, composer, waste) and sampled to determine moisture content and tangential shrinkage (Figure 5). Usable veneer was defined as face and core grades, ignoring composer and waste grades. From the dryer line ultrasonic veneer velocity and width data were made available for each veneer sheet. The individual veneer sheets could be tracked back to the individual logs.

Peeling quality (1 very good - 4 very bad) of the stems was assessed visually by the amount of splitting in the logs/veneer sourced from each stem.

Figure 4: Rotary peeling of *E. globoidea* (left) and produced veneer sheets (right)

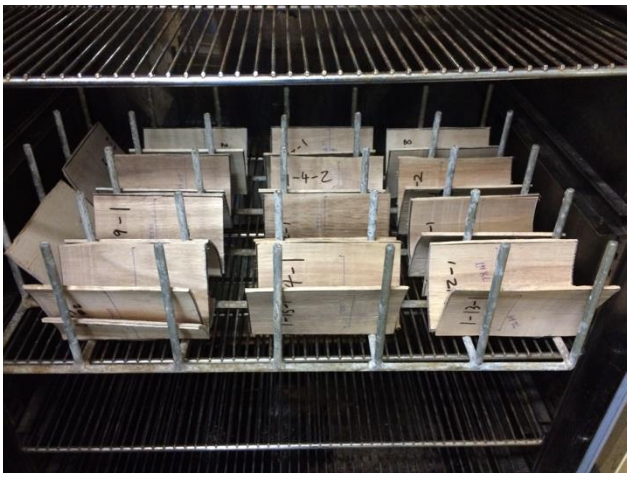

Figure 5: Veneer samples for measuring moisture content and shrinkage

Results

The summary statistics of the *E. globoidea* logs are given in Table 1. A good spread of low and high growth-strain as well as acoustic velocity was represented in the sample.

Table 1: Descriptive statistics of debarked 30 year old *E. globoidea* logs

	Growth-strain (µdef)	LED (cm)	SED (cm)	AV (km/s)
Mean	0.839	38.9	34.4	3.32
SD	0.195	6.3	4.3	0.36
Minimum	0.464	28.5	26.0	2.47
Maximum	1.137	51.0	41.8	3.76

LED: large end diameter; SED: small end diameter; AV: acoustic velocity (resonance). Strain, LED and SMD were measured on 26 logs of 2.7 m, while AV was measured on 15 logs of 5.5 m or 2.7 m.

In a preliminary test a spare *E. globoidea* log was chosen and peeled cold. This was unsuccessful and therefore preheating to soften the wood was deemed necessary. The descriptive statistics of the recovered veneer from the *E. globoidea* logs is given in Table 2. Green veneer recovery was highly variable ranging between 23.6% and 74.5%. The average recovery for the *E. globoidea* logs was less compared to radiata but slightly higher for the best logs. This was due to poorer stem form of the supplied *E. globoidea* logs and the larger clipper losses caused by end splitting. Improving growth-strain and form are the objective of this SFF programme. A wide range in tangential shrinkage of the veneers was observed. The samples with high shrinkage tended to curl up. Tangential shrinkage was neither correlated to growth-strain or acoustic velocity of the logs.

Table 2: Descriptive statistics of the recovered veneer

	Green veneer recovery (%)	Moisture content (%)	Ultrasound velocity (km/s)	Tangential shrinkage (%)
Mean	53.5	103.3	4.66	13.4
SD	2.8	3.5	0.016	0. 7
Minimum	23.6	67.1	3.88	8.2
Maximum	74.5	143.2	5.36	21.4

Peeling quality was related to growth-strain (R^2 = 0.75) rather than acoustic velocity (R^2 = 0.23) (Figure 6). This indicates that high stiffness logs (resulting in higher grade LVL) which are easy to process can be found. The two trees with the lowest growth-strain yielded high quality veneer (Figure 7 left).

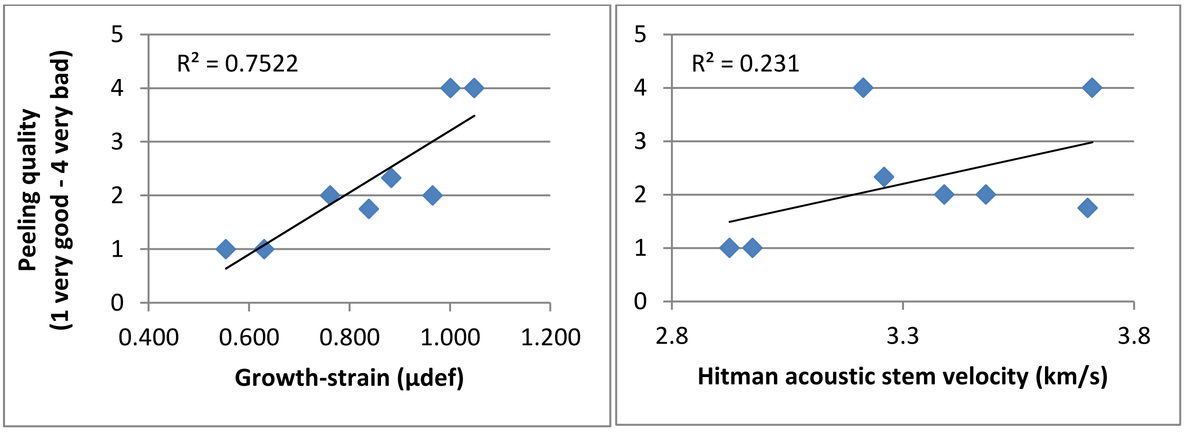

Figure 6: Correlation between peeling quality and growth-strain (left) as well as acoustic velocity (right) for *E. globoidea* stems

Figure 7: High (left) and low (end-splits / differentiating tissue) (right) quality *E. globoidea* veneers

A similar result was observed on the log level. Growth-strain was related stronger to the conversion of log volume into usable veneer volume (face and core grade) than to ultrasound velocity of the veneers (Figure 8)**Error! Reference source not found.**.

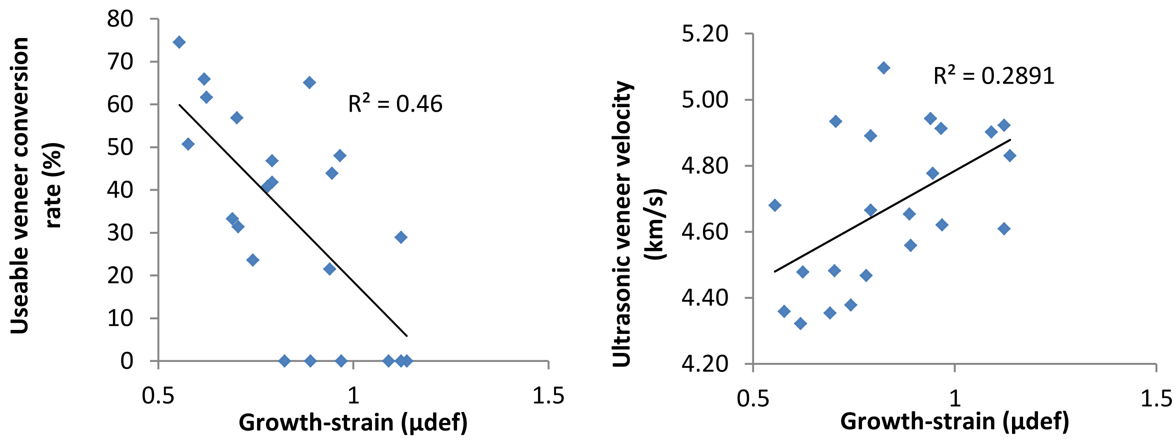

Figure 8: Dependence of usable veneer conversions (left) and ultrasonic veneer velocity (right) on growth-strain for the individual *E. globoidea* logs

Not all *E. globoidea* logs showed the typical radial pattern of increasing wood stiffness as indicated by ultrasonic veneer velocity (Figure 9). Logs yielding veneers of consistently high ultrasonic velocity were observed.

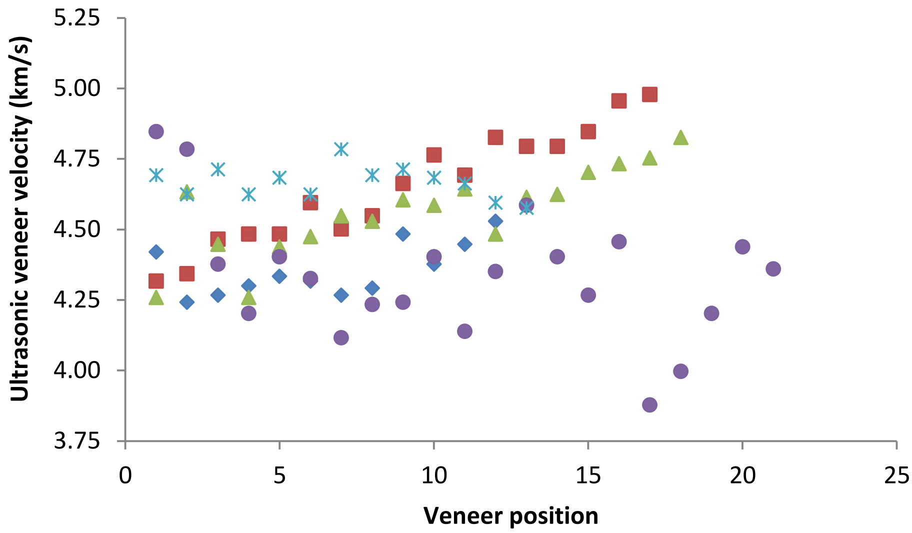

Figure 9: Ultrasonic veneer velocity dependent of radial veneer position in the log

Conclusion

The study indicated that

a) High quality veneers can be obtained from *E. globoidea*
b) Veneer quality / yield is highly variable for this wild/unimproved resource
c) High conversion and veneer quality was associated stronger with low growth-strain (not low acoustic velocity) logs. This is important as high acoustic velocity is desired.

The study suggested that the top 25% (growth-strain) of the stems of this wild unimproved resource could be processed into quality veneers with a reasonable yield. The SFF project “Minimising growth-strain in eucalypts to transform processing” should result be able to deliver a eucalyptus resource suitable for LVL production.

Upcoming work

LVL will be produced from the graded veneer sheets. Properties of the LVL will be assessed.